Reports on consumers' food behaviours and on dietary diversity and associated factors

D2.4

Short Description
This Deliverable compiles the work of multiple partners across the FoodLAND project who have prepared research papers, at a cross country and country specific level, to investigate dietary requirements, behavioural profiles, and food purchasing habits of urban and rural consumers. D2.4 also details the data collection process for rural consumer undertaken in 5 Food Hubs across 5 African countries (Kenya, Morocco, Tanzania, Tunisia, and Uganda), its research objectives, as well as preliminary comparative assessments across countries and cities.

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1. Introduction

1.1 Rationale and Objectives of Tasks 2.2, 2.3 and Deliverable D2.4

The main objective of FoodLAND WP2 is providing background knowledge of African **consumer food preferences and behaviours and of their socioeconomic drivers** and measuring the current level of **dietary diversity** of consumers in both rural and urban settings. T2.2 combines ethnographic (observations, focus groups, in-depth surveys), bio-metric experiments (eye-tracking, GSR), and structured behavioural economic experiments to get insights for new market opportunities for novel food products. T2.3, aims at assessing the dietary diversity of women and children in rural settings and identify the individual and situational factors associated with it.

This Deliverable builds on D2.3 to provide **advanced analyses at both country and cross-country level on the dietary requirements, behavioural profiles, and food purchasing habits of urban and rural consumers in five African countries** (Kenya, Morocco, Tanzania, Tunisia, and Uganda). D2.4 also details the data collection process for rural consumer undertaken in 5 food hubs its research objectives, as well as preliminary comparative assessments across countries and cities.

This assessment of the main individual and situational determinants of nutritional imbalances, as well as of consumers' behaviours and profiles will enhance the understanding of the unhealthy dietary conditions in the studied settings and orient the technological research activities (T4.1, T4.5) and the development of tailored nutritional recommendations (D2.5).

1.2 Scope of the document

The scope of Deliverable D2.4 is to report advanced findings derived from the urban and rural consumer research, which can form the basis of a series of scientific publications. These findings are derived from different datasets on both urban and rural consumers, including:

1. A **survey with rural consumers in 5 Food Hubs (pairs women-child).** The surveys include the gender perspective, devote special attention to maternal and child diets and health, and collect data on consumers' socio-economic conditions, socio-demographic (e.g., migration) characteristics, food provisioning and preparation habits, diets, food prices, and community conditions and services. The survey and the research procedures are presented in Chapter 2.

2. A **baseline, gender-sensitive survey** with randomized samples of **urban consumers** measuring **the consumers' socio-economic conditions, socio-demographic** (e.g., migration), **food provisioning habits, diets, food prices, and contextual conditions and services** (presented in D2.3; Marini Govigli et al., 2022).

3. **Structured and incentivized behavioural economic experiments** to identify behavioural factors influencing consumers' decision-making, as well as getting insights for new market opportunities for novel food products (presented in D2.3; Marini Govigli et al., 2022).

4. **Biometric testing** (e.g., eye-tracking) and **experimental auctions** to map how product labels and other product elements influence consumers' food choices and their willingness to pay (presented in D2.3; Marini Govigli et al., 2022)

The main research questions answered by this research and forming the basis of scientific publications are (but not limited to):

Food Security and food behaviours (Chapter 2)

- Are the rural consumers food secure?
- What are the main food provisioning methods employed by rural consumers and do they influence the rural consumers' food security and women's diet quality?
- How the two dimensions of migration (i.e., immigration to cities and emigration from cities of some member of the household) can affect the dietary patterns and food security of urban and rural population?

Consumer behaviours and food choices (addressed in Chapters 2, 4, and 6)

- What are the determinants of the rural consumers' food purchasing habits, diet quality and women's empowerment?
- What is the impact of product labelling and provision of information on the urban consumers' willingness to pay?
- What are the main consumers' conscious and non-conscious determinants that influence the consumers' willingness to pay?
- Do urban consumers share similar diets and behavioural profiles? How these profile influence the urban consumers' propensity to adopt nutritional dietary innovations?

Dietary diversity (addressed in Chapters 2 and 3)

- Which is the level of maternal and child dietary diversity of rural consumers from five African countries?
- What are the main determinants of the maternal and child dietary diversity (e.g., socioeconomic and demographic determinants, food provision and purchasing choices, etc.)?
- What are the determinants of the rural consumers' food purchasing habits, diet quality and women's empowerment?
- What are the diet quality and food security characteristics of urban consumers? To what extent are associated with contextual, household and individual characteristics?

Women empowerment (addressed in Chapter 2)

- What is the women's empowerment in rural settings of five African countries?
- What are the main determinants of the women's empowerment (e.g., socio-economic, gender norms and demographic variables)?
- Does an association exist between women's agency and nutritional status?

Innovation propensity (addressed in Chapter 2)

- Does cognitive and relational social capital influence the propensity of urban consumers to include a new local food product in their diet?
- Do consumers' trust influence the urban consumers' propensity to introduce a new nutrient-dense food product in the household diet?

1.3 Structure of the document

This document is structured in seven main sections covering both the rural and the urban consumer research:

1. An introduction to the scope of the document (Section 0);
2. An overview of the **rural consumer research**: analysis of socio-economic conditions, nutritional status, and women's empowerment (Section 2). This section is articulated in nine elements:
    a. Rural consumer research methodology and procedures (2.1)
    b. Cross-country descriptive analysis of rural consumers' socio-economic conditions and food provisioning habits (2.2)
    c. Cross-country analysis of women and children's diet quality in rural populations (2.3)
    d. Cross-country analysis of rural women empowerment (2.4)
    e. Analysis of rural consumers in Kenya, Kitui Food Hub (2.5, 2.6, 2.7)
    f. Analysis of rural consumers in Morocco, Beni Mellal Food Hub (2.8)
    g. Analysis of rural consumers in Tanzania, Mvomero / Morogoro Food Hub (2.9, 2.10)
    h. Analysis of rural consumers in Tunisia, Fernana Food Hub (2.11)
    i. Analysis of rural consumers in Uganda, Kamuli Food Hub (2.12).
3. Cross-country analysis of diet quality and food security among **urban consumers** (Section 3)
4. Dietary and behavioural profiles of urban consumers (Section 4)
5. Urban consumers' propensity for innovation (Section 5). This section is articulated in two chapters:
    a. The influence of social capital on the urban consumers' propensity to include new local food products in their diet (5.1).
    b. Urban consumers' propensity to purchase new nutrient-dense food products (5.2)
6. (Section 6). This section is articulated in three chapters: Results from the experimental auction and biometric tests
    a. Integrating experimental economics and biometric methods to improve understanding of consumers' decision making (6.1).
    b. How does health-related information impact willingness to pay for olive oil? (6.2)
    c. Biometric testing of the relationship between taste, origin, and consumers' willingness to pay (WTP) for olive oil in Morocco and Tunisia (6.3).
7. A concluding chapter highlighting the main recommendations stemming from this research and future steps on results' exploitation (Section 7).

2. Rural consumer research: analysis of socio-economic conditions, nutritional status, and women's empowerment

2.1 Methodology & research procedures

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2.1.1 Research questions and survey instrument

A series of surveys with randomized samples of rural consumers in 5 Food Hubs (one for each of the FoodLAND country) were run from October 2022 until March 2023. The aim of this activity was to sample **500 pairs of women of reproductive age** (one woman per household between 15-49 years old) **and child** (between 6 to 23 months of age) **in each Food Hub** to inform about the **rural consumers' socio-economic conditions, socio-demographic (e.g., migration), food provisioning and preparation habits, food consumption and diet quality, food expenditures, and community conditions and services, while paying attention to the gender perspective and women empowerment**.

The research procedures and survey instruments (fully anonymized questionnaire and ad hoc survey app) were developed mirroring the methodology and approach used for FoodLAND urban consumer research (Marini Govigli et al., D2.3; Appendix 2: Urban consumers' survey instrument) and focused on four main research axes (23 questions in total):

1. Food purchasing and gathering characteristics (information on the type of food purchased, produced, or gathered in the wild).
2. Food consumption and Individual Diet Quality Questionnaire (DQQ) measurements for both women in reproductive age and their child.
3. Characteristics of the community and socio-economic and socio-demographic consumers' information (e.g., women's role in the household, household structure and size, employment, income, , etc).
4. Women's role in the household (e.g., household domestic work burden) and women's power over food purchasing habits and community decision making structures.

The research procedures and the complete survey tool in English are provided in Deliverable 2.3.

Research axis 1. Food security and behaviours.

The aim of this set of questions (Q1 to Q3 and Q9-10) was to understand the rural consumers' food provisioning habits (gathering in the wild, self-production, or purchasing from local shops) and food security levels (i.e., the share of household income spent on purchasing food products; household capability of meeting food needs). These questions will allow responding to the following RQs: are the rural consumers food secure? What are the main food provisioning methods employed by rural consumers and do they influence the rural consumers' food security and women's diet quality?

Research axis 2. Food consumption and Individual Diet Quality Questionnaire (DQQ)

Q4 to Q8 aimed at identifying a series of dietary quality (DQQ) indicators for both women in reproductive age and their children. These questions (mirroring the approach used for urban consumers; D2.3) follow the guidelines for measuring the minimum dietary diversity for women indicators developed by the FAO (FAO, 2021) and assessing infant and young child feeding practices (WHO & UNICEF, 2021). The methodology used is based in food groups listing, and food items included in each food group are the "sentinel foods" or the most frequently consumed items within a food group in a given population. The DQQ tool includes 29 food groups. From this information a series of indicators can be computed as: food groups dietary diversity score (FGDs), minimum dietary diversity for women (MDD-W), All-5 score, NCD-Protect score, NCD-Risk score, and Global Dietary Recommendations score (GDR). The main research questions are: Which is the level of maternal and child dietary diversity of rural consumers from five African countries? What are the main determinants of the maternal and child dietary diversity (e.g., socioeconomic and demographic determinants, food provision and purchasing choices, etc.)?

Research axis 3. Community and socio-economic and socio-demographic consumers' information

Q11 to Q18 are questions which collect data on the rural consumer household's socioeconomic and socio-demographic structure. The information they provide includes rural consumer's age, number of children and education level, women's role in the household, household structure and size, employment (both for the household head and women in reproductive age), destination of the household food production, household income level, perceived worries towards the future (e.g., environmental, health, economic, etc.). These questions will be used in combination with the other research axes to explore the determinants of the rural consumers' food purchasing habits, diet quality and women's empowerment.

Research axis 4. Women's empowerment

The aim of questions Q19 to Q23 was to collect information on women's empowerment in rural areas. They aimed at assessing the women's ability in controlling and benefitting from local resources, assets, income, decision making processes as well as estimating the women's satisfaction with their current role and responsibilities in the household and local society. Women's empowerment was evaluated through to the following questions:

- Women's role in decision making within the household (e.g., regarding the use and production of resources, food, income, health issues, education, and mobility).
- Level of satisfaction with their current responsibilities within the household.
- Women's ties with the local community, estimated through a self-evaluation of the number of different group meetings they attend (e.g., women's associations, microfinance groups, health associations, etc.).
- Community perception on the role of women (self-estimated by the interviewed respondents).
- Time spent on work and/or unpaid domestic chores and care work within the household.

The main research questions are: What is the current level of women's empowerment in the rural settings of five African countries? What are the main determinants of the women's empowerment (e.g., socio-economic, gender norms and demographic variables)? Does an association exist between women's agency and nutritional status?

2.1.2 Data collection procedures, study areas, and final sample size

A first version of the rural consumer (pairs of woman and child) survey was developed by UNIBO from June 2022 to August 2022 with regular feedback sought from local partners' teams to adjust the content of the questionnaire to the local contexts. To overcome data collection and data entry problems, the survey was integrated with virtual survey software developed by ENAM, to be used by local enumerators to collect data in the field (in these rural settings where internet connection allowed it) and to systematize the data collection entry process. Local teams pretested the survey instrument from August 2022 onwards to ensure a smooth implementation of the protocol and reported back any issue they encountered while performing the data collection in the field. The survey was translated by all local teams in local languages and inputted directly into the survey's app interface. Specifically, local teams also adapted the questions on breastfeeding habits, according to the local contexts (e.g., Question 6.03)

Detailed research procedures were also shared with all local teams, with additional information on sample stratification, as well as tips on participant's recruitments. The research procedures are provided as Appendix to D2.3. Finally, a standardised ethics form was provided to all local teams and translated to their local languages. This was read and signed by the participant women covering the voluntary participation and personal data protection.

The rural consumer research was undertaken in five study areas (Food Hubs) one for each of the FoodLAND countries and was completed by April 2023 (Table 1).

Table 1. An overview of the 5 food Hubs where the rural consumer research was undertaken.

Food Hub	Country	Inhabitants (year)	Targeted sample size	Final sample size	Dataset on survey results	Project month
Kitui	Kenya	759,164 (2019)	500	558	January 2023	M29
Beni Mellal	Morocco	2,613,137 (2020)	500	512	December 2022 – January 2023	M28-29
Mvomero / Morogoro	Tanzania	312,109 (2012)	500	518	November 2022 – December 2022	M27-28
Jendouba	Tunisia	404,853 (2022)	500	300[1]	March 2023 – April 2023	M31-32
Kamuli	Uganda	558,500 (2020)	500	503	January 2023 – February 2023	M29-30

Between January 2023 and April 2023, several iterations of validation checks, followed by verifications by local partners, were implemented to fill missing data and entry errors (e.g., values outside admitted range). In line with data management best practice, the initial raw data was archived, all edits made to the data during the validation checks were recorded using logs, and the final clean and homogenised datasets were shared with local partners and compiled in an anonymised dataset at project level (D2.1).

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[1] The full sample for Tunisia of 500 observations is expected for the end of April, after the end of the Ramadan.

The final sample collected through the rural consumer research activities is presented in Table 2 along with some initial descriptive statistics of the sample (section 2.2).

Table 2. Sample by Food Hub of the rural consumer research

Food Hub	Country	Final sample size	Average age of the respondent	Average number of children	Average household size
Kitui	Kenya	558	28	2.2	5.5
Beni Mellal	Morocco	512	31	2.4	5.5
Mvomero / Morogoro	Tanzania	518	26	2.8	5.2
Jendouba	Tunisia	300[1]	32	2.4	5.2
Kamuli	Uganda	503	27	3.5	6.7
Total		**2,391**	**29**	**2.7**	**5.7**

2.2 Cross-country descriptive analysis of rural consumers' socio-economic conditions and food provisioning habits

Authors: Fabrizio Alboni, Valentino Marini Govigli, Marco Setti (UNIBO)

2.2.1 Introduction

In the following section, we present the **first comparative results on rural consumers' socio-economic conditions and food provisioning habits**. These analyses were based on a final sample of **2,391 valid observations**. Data was gathered in 5 food hubs located in five countries (Kenya, Morocco, Tanzania, Tunisia, and Uganda). The survey was standardized across all cities (survey available in Appendix 2), with few adaptations to the dietary questions to mothers and their children. The results from this section complement the descriptive and cross-country results provided in Chapter 2.3 on women empowerment and Chapter 2.4 on women and children's diet quality in rural populations.

2.2.2 Results
2.2.2.1 Respondents' socio-economic conditions

Age household size, and educational level

The average age of the mothers involved in the survey is just under 29 years (Table 3 and Figure 1) and half of them have at most two children (Table 4. Women from the Moroccan and Tunisian Food Hubs are older than the global project average (more than 52% are over 30 years old) while, on the contrary, in Tanzania and Uganda most interviewees are under 25 years old (Figure 1). Regarding the number of children, fewer differences are observed between countries. The UG food hub is the only one which has a higher median value (half of the mothers have at least three children, Table 4).

Table 3. Age of respondents - summary statistics

country	n	%	Mean	st.Dev	min	Q1	Median	Q3	max
KE	558	23.34	27.78	6.42	16	23.00	27	32	48
MO	512	21.41	31.62	6.72	17	26.75	31	37	49
TN	300	12.55	31.64	6.07	19	27.00	32	37	45
TZ	518	21.66	26.36	7.27	16	20.00	25	31	49
UG	503	21.04	26.77	6.68	16	22.00	25	31	49
Total	**2,391**	**100.00**	**28.57**	**7.05**	**16**	**23.00**	**28**	**34**	**49**
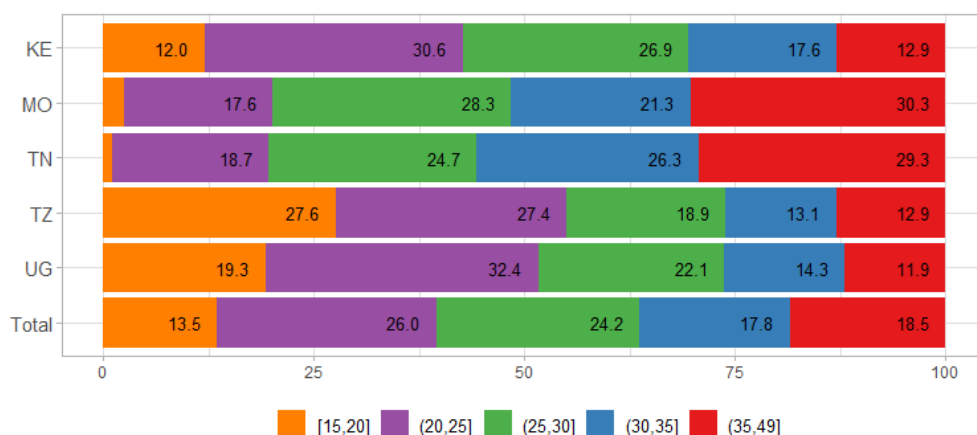
Figure 1. Age of respondents - distribution by country

Table 4. Number of children - summary statistics

country	n	%	Mean	st.Dev	min	Q1	Median	Q3	max
KE	558	23.34	2.22	1.34	1	1	2	3	10
MO	512	21.41	2.37	1.10	1	2	2	3	9
TN	300	12.55	2.43	1.15	1	2	2	3	6
TZ	518	21.66	2.79	1.88	1	1	2	4	11
UG	503	21.04	3.53	2.29	1	2	3	5	12
Total	2,391	100.00	2.68	1.71	1	1	2	3	12

The analysis of the respondents' education level reveals heterogeneous results (Figure 2). 30% of the sampled women emerge as being illiterate or without a qualification, 36% as having a primary qualification, while 33% as having a secondary or higher qualification. At the country level, Uganda, Tanzania, and Morocco are the countries showing the lowest levels of education (with over 40% illiterate or without a qualification). Tunisia and Kenya on the contrary have the highest recorded educational levels, with 55 % of the sampled women having a secondary or higher education qualification.
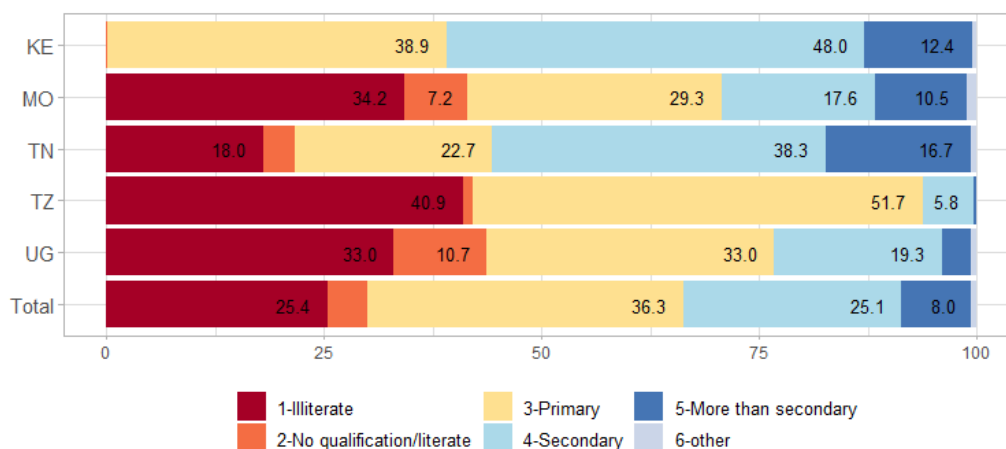
Figure 2. Respondents by education level

More than 88% of the interviewed women are either wives or daughters of the household head (Figure 3). Mothers who are also household heads are therefore a small share of the sample, ranging from 4% in Kenya to 11% in Morocco. When women are heads of households, they tend to have significantly more children than women in other roles (Figure 4).
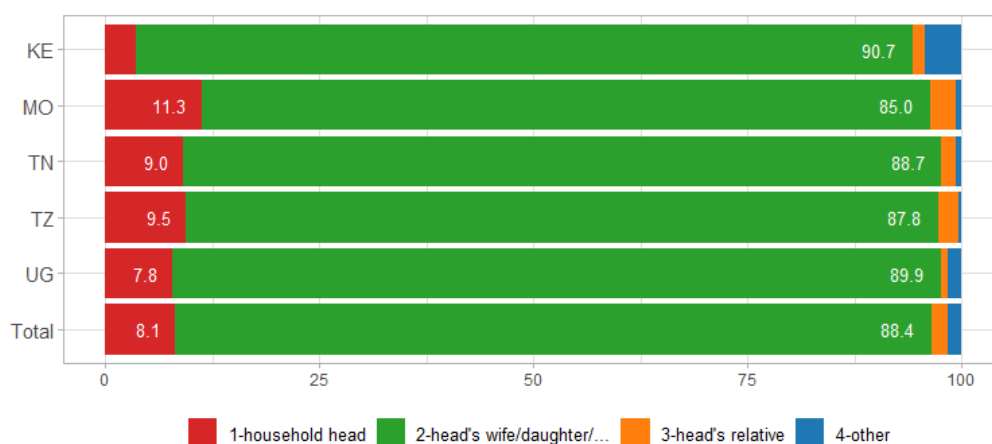
Figure 3 Respondents by role in the household.
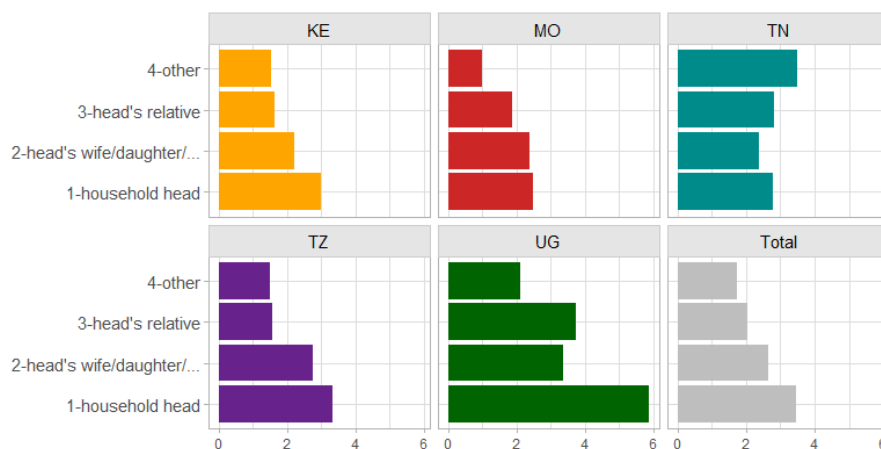
Figure 4. Number of children by role in the household and country - average value

The average household size of the surveyed mothers is 5.6 members. Only Uganda, with 6.7, shows a significantly different value from the other countries (Table 5). Concerning the type of members, the differences between the countries are not substantial. The UG Food Hub is the one showing the highest number of children between 3 and 13 years old, with an average of 2.5 versus an overall average of 1.6 children per household (Figure 5).

Table 5. Household members by country - summary statistics

country	Mean	st.Dev	min	Q1	Median	Q3	max
KE	5.51	2.76	2	4	5	7	21
MO	5.52	2.28	2	4	5	6	22
TN	5.20	1.73	3	4	5	6	11
TZ	5.22	2.23	2	3	5	6	21
UG	6.70	3.24	2	4	6	8	22
Total	5.66	2.62	2	4	5	7	22
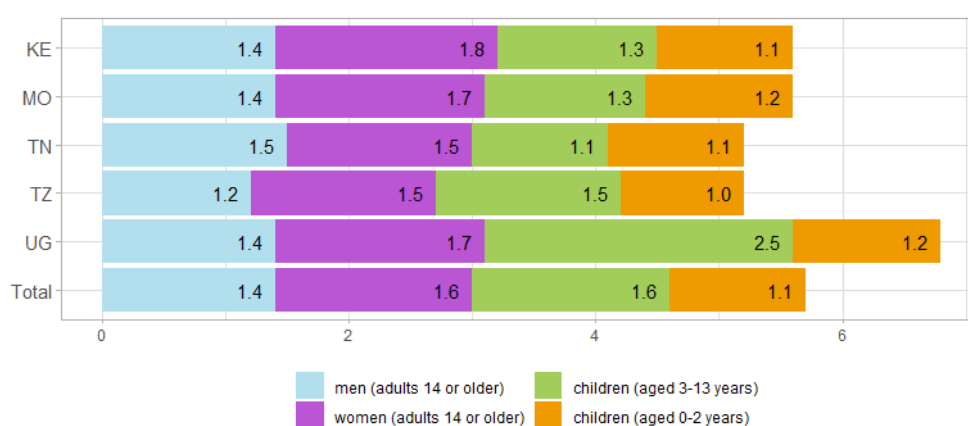
Figure 5. Household members, average values.

Income and employment

More than two-thirds of respondents (67.4%) own a mobile phone, varying from the highest level recorded in Kenya (89%), to the lowest one in Tanzania (34%). Illiterate and youngest /15-20 years old) women are those who show the lowest share of mobile phone ownership (Figure 6)
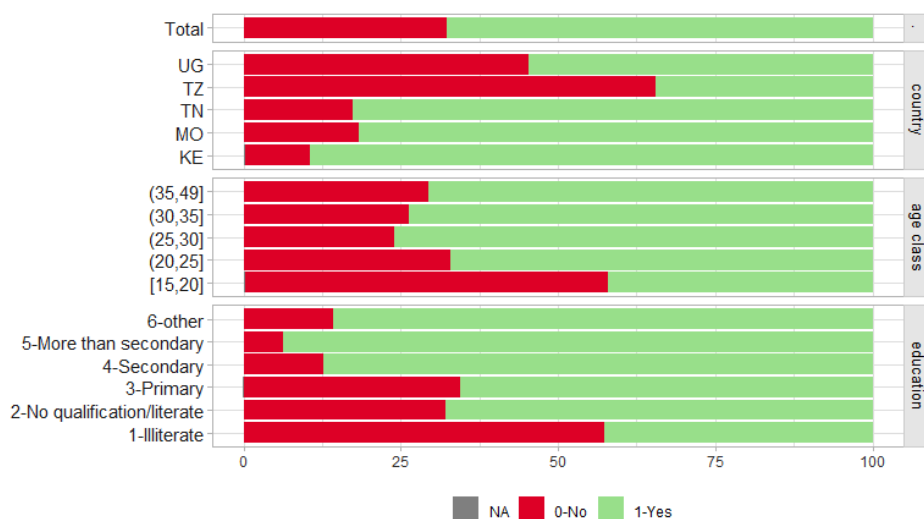
Figure 6. Possession of a mobile phone

In terms of the women's employment, most of them are dedicated to farming activities (48%; Figure 7), with strong differences amongst countries. In Tanzania and Kenya women are mostly farmers (91% and 70% respectively). On the other hand, in Morocco and Tunisia most of them reported "Other", which, while looking into the qualitative information provided, mainly means that they are either housewives or currently unemployed (Table 6).
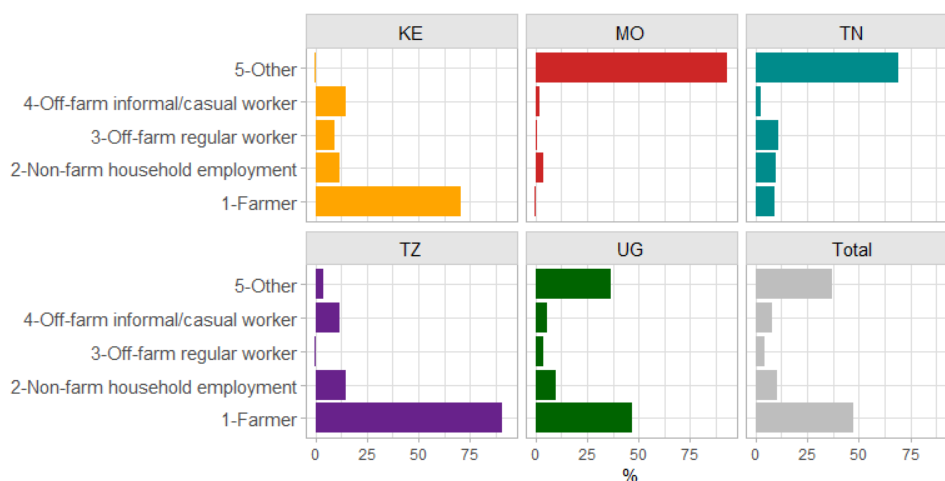
Figure 7. Main forms of employment.

Table 6. Main forms of employment - % on respondents

	KE	MO	TN	TZ	UG	Total
1-Farmer	70.3	0.4	9.0	90.7	46.9	47.1

2-Non-farm household employment	12.0	4.1	9.7	15.1	10.1	10.3
3-Off-farm regular worker	9.3	0.6	11.3	0.4	3.8	4.6
4-Off-farm informal/casual worker	14.7	2.3	2.3	12.0	5.4	7.9
5-Other	0.5	93.0	69.3	3.7	36.8	37.3

The intended destination of household food production is mainly for household use, with 36% using it entirely and 24% mainly in the household (Figure 8). However, it should be noted that in some countries a large proportion of respondents mention that they do not produce (72% in Morocco and 41% in Tunisia). In other countries substantial shares are destined for household use: 82% in Kenya, 70% in Tanzania and 64% in Uganda.
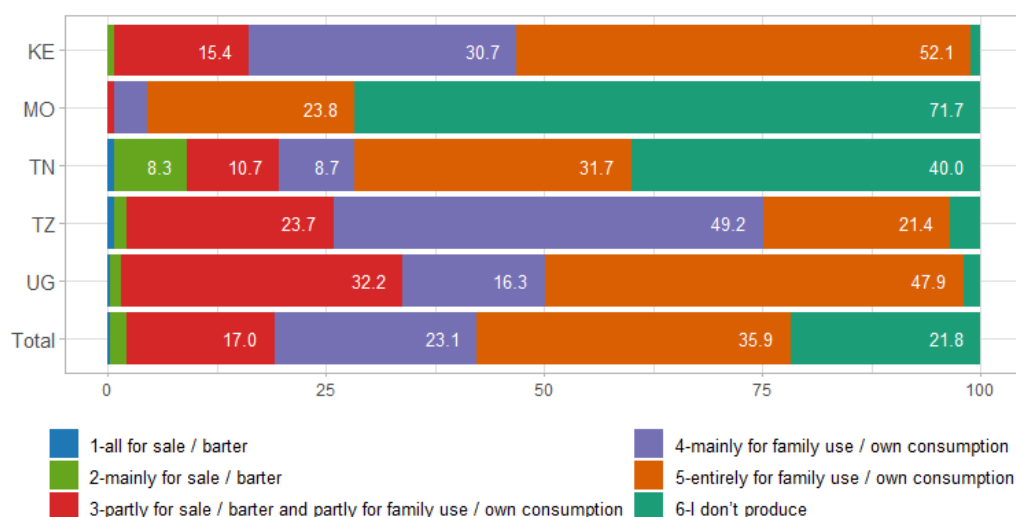
Figure 8. Intended destination/use of household production.

The activity mainly carried out by the head of the household, when this is not the mother respondent, is farming (32% of cases). Almost 40% of the sampled households carry out off-farm activities (regular or informal) (Figure 9).

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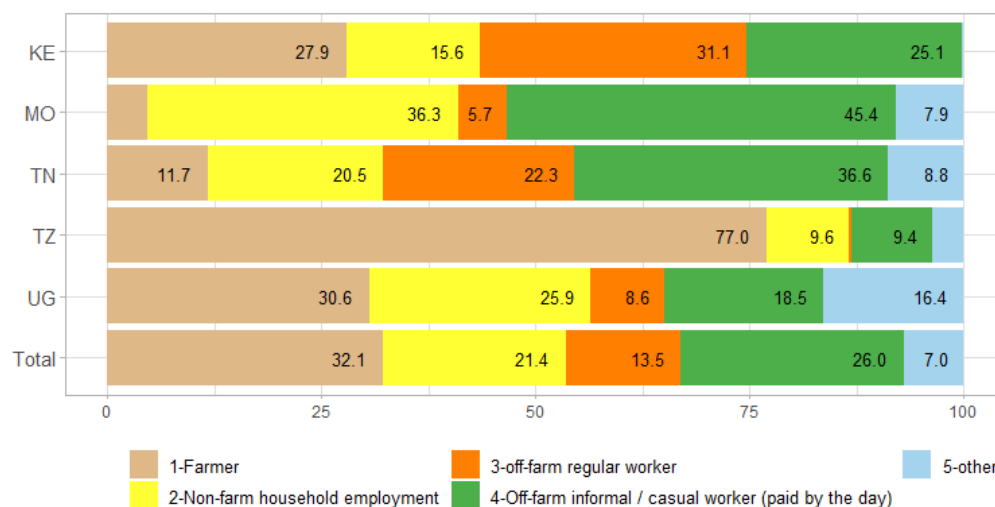
Figure 9. Household head's main employment

Figure 10 shows the distribution by country food hub, of households with both the respondent and the household head (when different) actively engaged in farming activities. Results show that 53% of the households overall have at least one of the two members as farmers. Consistent differences can be observed amongst countries: in the Moroccan food hub more than 95% of the sampled households are not involved in farming activities, while in Tanzania in almost 67% of the households both the respondent and the household head are farmers.
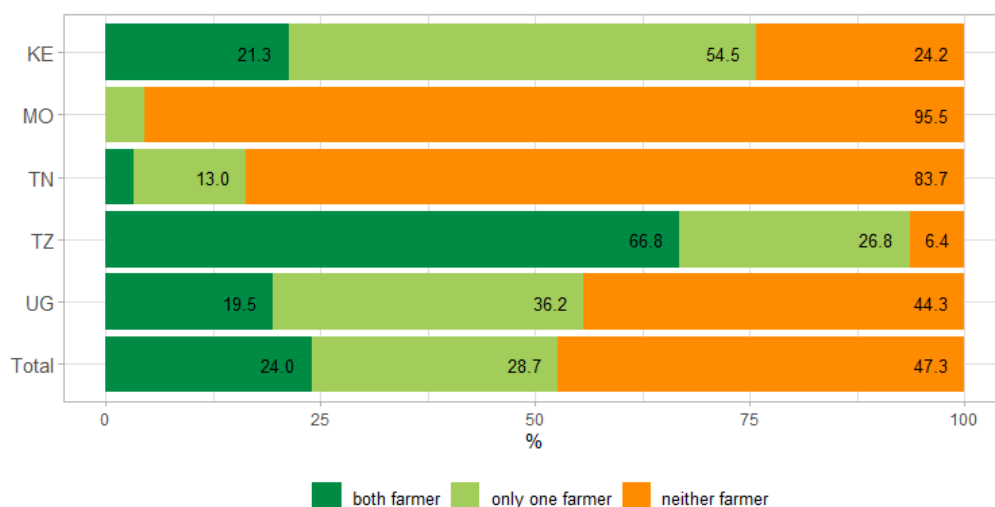
Figure 10. Employment as farmer of the respondent and head of household

The average monthly household income is 113€ (Table 7) but is characterized by a strong variability between and even within countries (Figure 11). It ranges from €45 per month in

Tanzania to €463 per month in Tunisia, with an additional within-country variability from €54 to €1500 per month.[2]

Table 7. Average monthly household income in Euro, excluding outliers - summary statistics.

country	Mean	st.Dev	min	Q1	Median	Q3	max
KE	67.01	73.14	0.77	20.02	46.20	88.55	423.50
MO	158.49	170.94	27.30	43.22	79.62	228.64	455.00
TN	463.63	327.47	54.00	180.00	360.00	717.00	1500.00
TZ	45.36	47.57	1.23	12.30	28.70	61.50	287.00
UG	85.77	98.38	1.25	25.00	60.00	105.00	762.50
Total	113.15	185.43	0.77	20.50	52.70	110.00	1500.00
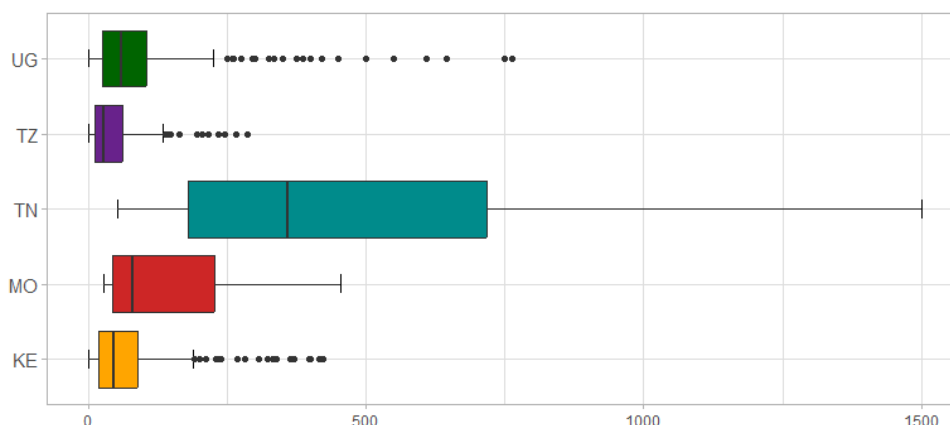
Figure 11. Average monthly household income in Euro, excluding outliers

The main source of income is non-farm activities (46%), while only a third of the household income comes from farm production (Figure 11). Income sources show significant differences amongst countries: in Tanzania 61% of the household income is generated by agricultural activities while in Tunisia it is 17% and in Kenya less than 12%. The differences are also related to the extent to which, in the different countries, the respondent and/or the head of the household are employed in agricultural activities (Figure 12). When both individuals are farmers, the share of farm income is prevalent (85% in Uganda and 71% and above in Tunisia and Tanzania). A special case is the one of the Food Hub in Kenya, where remittances play a key role, accounting for well over half of the income (56%), and in particular where both respondent and head of household are farmers remittances still account for 64% of the household income.

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[2] Household income level was an optional question, so there are differences in the number of responses available per country. In Morocco, the non-response rate is almost 99%, in Tunisia it is around 33%, while in the other countries it is much lower (10% in Kenya, 3% in Tanzania and nil in Uganda).

Figure 12. Monthly household income - % composition by source (outliers excluded from analysis)
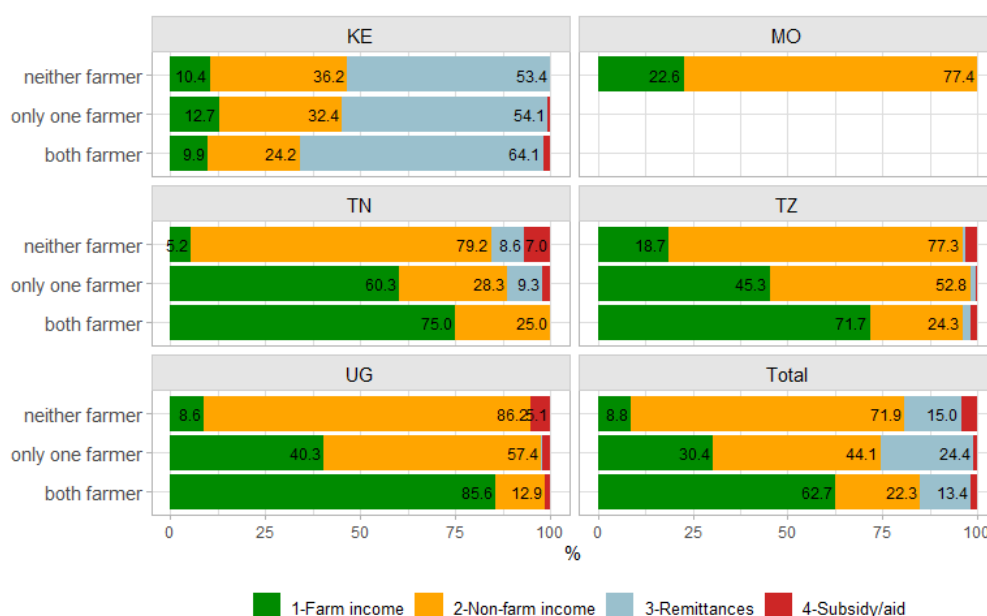
Figure 13. Income sources by type of employment and country.

Perceived worries towards the future

The most frequently reported worry for the women participants are **economic problems, in particular the increase of food prices and related income reduction**, linked with worries related to **food shortage** (Figure 14; Table 8). While these are the most strongly perceived problems, their ranking differs. A significant correlation was found only between the worries reported in the Moroccan and Tunisian Food Hubs, and between those reported in the Tanzanian and Ugandan Food Hubs (Table 9). In the former two, water shortage and health also play an important role while in the latter, cost increase and infestation are also mentioned. The Moroccan Food Hub as a general higher overall average of worry's perceptions than all the other countries.
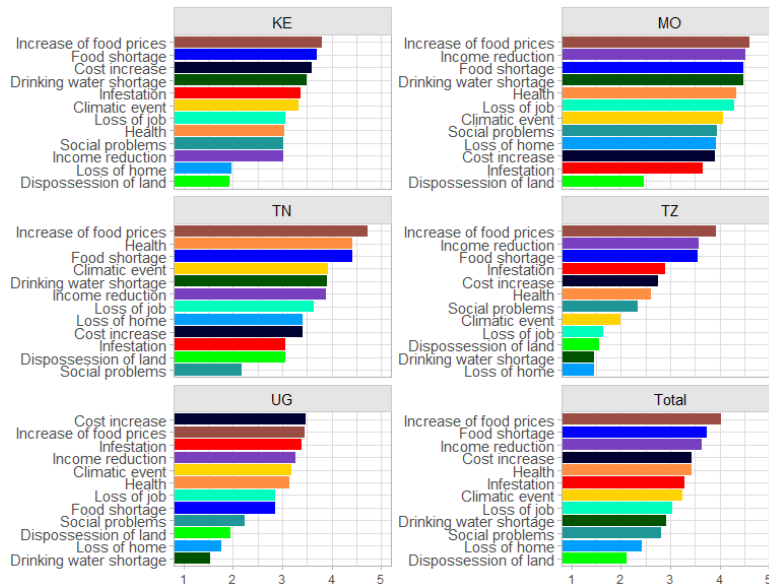
Figure 14. Worries for the near future sorted by importance; average values on a scale from 1: Not at all important to 5: Very important.

Table 8. Worries for the near future

variable	KE	MO	TN	TZ	UG	Total
Food shortage/starvation	3.71	4.49	4.42	3.56	2.85	3.75
Infestation (insects,boars)/pest/fish disease	3.38	3.65	3.07	2.89	3.39	3.30
Dispossession of land	1.93	2.46	3.07	1.56	1.96	2.11
Cost increase (price of seed,fertilizer,feed)	3.60	3.91	3.42	2.76	3.48	3.44
Health (human disease)	3.05	4.34	4.43	2.61	3.15	3.43
Drinking water shortage	3.50	4.49	3.90	1.47	1.54	2.91
Climatic event (flood,drought,storm)	3.34	4.08	3.92	1.99	3.19	3.25
Loss of home	1.98	3.92	3.42	1.46	1.76	2.42
Increase of food prices	3.80	4.61	4.72	3.92	3.46	4.04
Loss of job	3.06	4.30	3.63	1.65	2.85	3.05
Income reduction	3.03	4.52	3.89	3.58	3.27	3.63
Social problems (theft,violence,or crime)	3.03	3.94	2.19	2.34	2.25	2.81

Table 9. Spearman correlation between worries in different countries

country	KE	MO	TN	TZ	UG
KE					
MO	0.435				
TN	0.545 .	0.794 **			
TZ	0.529 .	0.455	0.368		
UG	0.498 .	0.107	0.228	0.792 **	

2.2.2.2 Food provisioning habits

Overall, **the main sources of food supply are local shops or producers located in the village** (70% of the respondents), **followed by family production** (25%), and purchase from shops located in another village/city (15) (Figure 15). When looking at the individual Food Hubs, it can be observed that in Uganda some products (cereals, vegetables, legumes and fruit) are almost completely produced in the household; Morocco, on the other hand, is the country where purchases made in other towns or cities carry the greatest weight (Table 10).
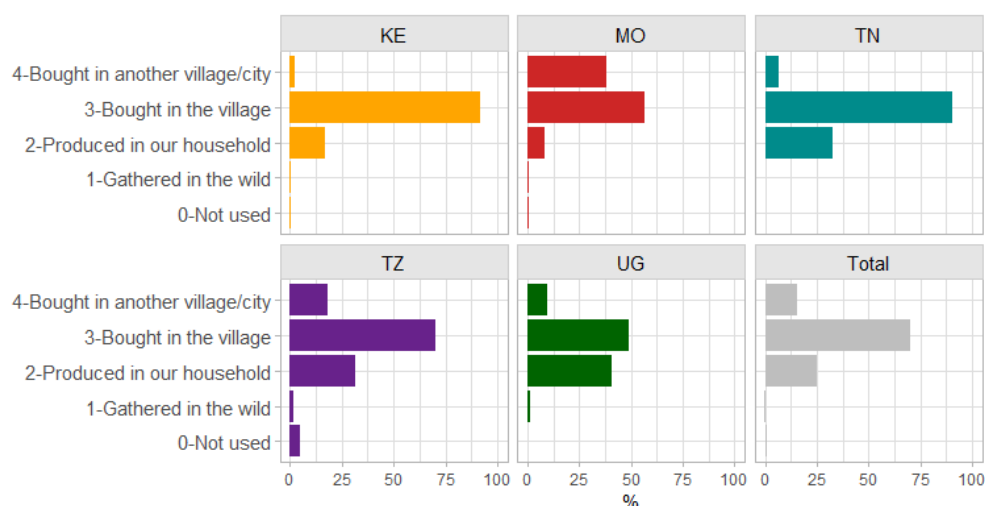
Figure 15. Where the household obtained/bought food products - overall food products (multiple response question)

Table 10. Where the household obtained/bought food products - overall food products (% values on respondents)

where	KE	MO	TN	TZ	UG	Total
0-Not used	0.7	0.5	0.3	5.0	0.2	1.2
1-Gathered in the wild	0.7	0.5		1.7	1.5	0.5
2-Produced in our household	17.1	8.4	32.7	31.3	40.7	25.2
3-Bought in the village	91.8	56.5	90.3	70.0	48.7	70.3
4-Bought in another village/city	2.1	38.2	6.4	18.4	9.7	15.5

Figure 16. Where the household obtained/bought food products by food products.

These results are confirmed by the answers to the question on the proportion of food consumed that comes from household production or obtained for free (Figure 17). **For 52.7% of the respondents less than half of the food consumed is self-produced or obtained for free, while for less than a third (31.6%) more than half of the food consumed is self-produced.** Results at country level show that in Uganda household production plays an important role (for almost 70% of respondents self-production accounts for more than half of the food consumed) while in North African countries it accounts for a much smaller share (in Tunisia only for 10% of households does self-production account for more than half of the food consumed).
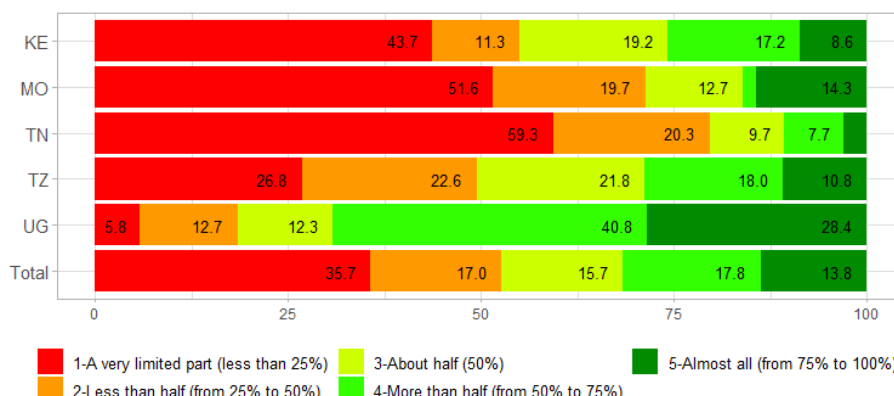
Figure 17. Share of the food consumed that is produced by the household, gathered in the wild or provided to you for free.

The share of household income spent on food purchases is heterogeneous, on the one hand 40% of households spend less than half their income, on the other hand 37% spend more than half (Figure 18). However, it is noteworthy that in the Ugandan food hub 63% of the households spend less than half of their income on food while in the Kenyan food hub 67% spend a large share.
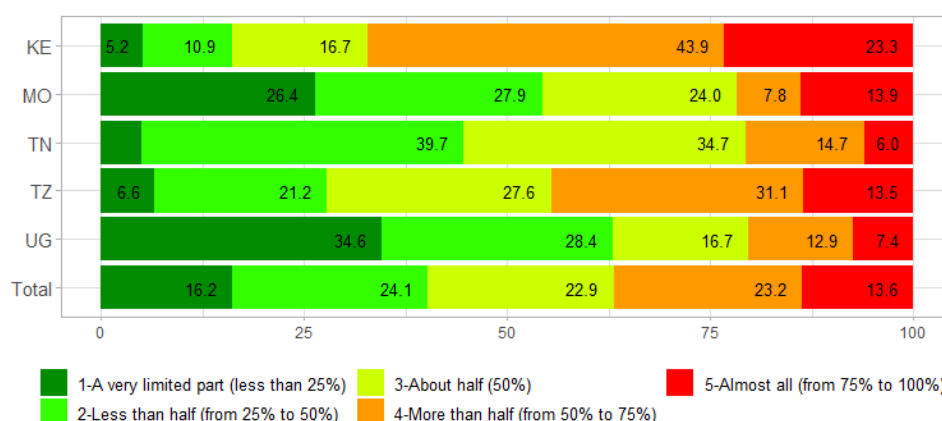
Figure 18. Share of household income spent on purchased food

Concerning the **ability to satisfy the household's food needs**, it should be pointed out that **31% of the sample mentions serious problems with food shortages**, which, considering the difficulties in satisfying these needs, reaches almost 70% of the households involved in the survey. Kenya is the country where the most problematic situation is recorded (65% have had serious problems), but also in Morocco there is widespread difficulty in meeting food needs. Tunisia and Uganda, on the other hand, present a greater heterogeneity, with almost a third of the households having problems or difficulties, and over 40% having no problems at all (Figure 19).
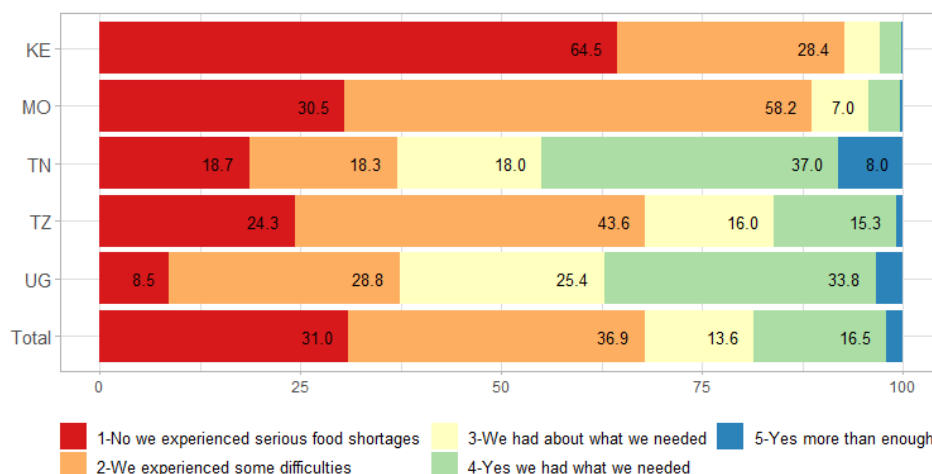
Figure 19. Meeting the household's dietary needs

At the project level, it should be noted that the **household ability in meeting dietary needs tends to increase with the age of the interviewees**. The situation is more diversified with respect to educational level. in fact, Results show that as the educational qualification increases, households facing serious problems in food security as well as households with no problems in food security tend to increase. When looking at the relation between income and household food needs, **results show that the higher the household income share destined to food purchasing is, the higher the food shortages faced by the household are** (Figure 20).
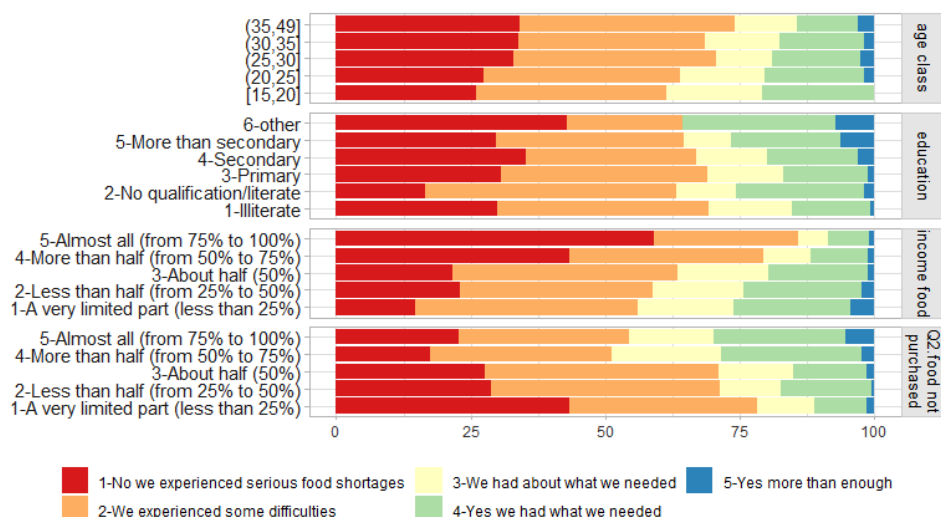
Figure 20. Meeting the household's food needs

The foods having the most predominantly perceived shortages are meat and fish products (77% of the participants experienced shortages of these products). When excluding these two products, the rankings amongst countries differ. Cereal products were in shortages in the Moroccan, Kenyan, and Ugandan Food Hubs. On the contrary, this is not an issue for the Tunisian Food Hub, where a shortage of fruits is present in addition to meat and fish products. It should also be highlighted that in Kenya, for all products, over 83% declare that they have had a shortage, compared with the situation in Tunisia where only meat and fish are considered scarce for just over 50% of the interviewees (Figure 21).
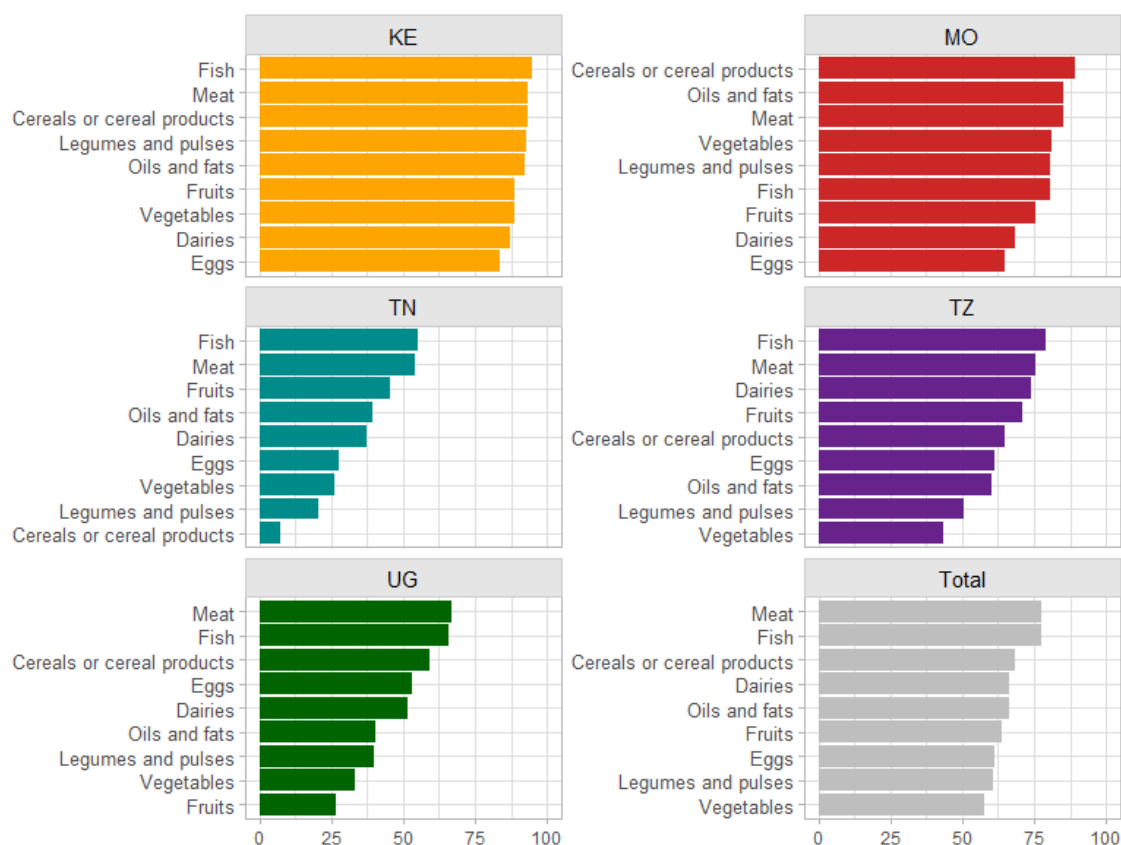
Figure 21. Food shortages by food products and country.

Multiple Correspondence Analysis

Figure 22 shows the results of a Multiple Correspondence Analysis synthesizing occurring associations amongst (i) the variables concerning the origin of the food consumed, (ii) the share of income used to purchase food, (iii) the ability to satisfy food needs, (iv) the destination of production and, (v) the interviewee's participation in agricultural activity. Countries and the main source of income (not used as an active variable because it has a high non-response rate, especially in some countries) were then projected onto this plan as supplementary variables (which therefore do not influence the definition of the axes of the plan).

The results of this analysis show that the first axis is characterized by the destination of production (Q15) and respondent's participation in agricultural activities (Q14.16), as well as the share of food consumed that is produced by the household (Q2). Specifically, on the left-hand side, we

have **households with low agricultural 'intensity'**, i.e. those that do not produce, neither the respondent nor the household head are farmers and for whom the share of food consumed coming from their activity is minimal (less than 25%). The suppletive variables projected in this area include observations from Morocco and those who did not provide information on income. The **positive values of this axis are instead characterized by households whose production is mainly, or partially, for sale, by households in which both the respondent and the household head** are farmers, or at least one is, and by the fact that part of the food consumed is self-produced. Households with predominantly agricultural incomes are in this area, and these are characteristics that seem to distinguish Tanzanian households. The second factorial axis is mainly described by variables covering the extent to which food needs are met (Q9) and the share of income spent on food (Q3). **In the negative part of the axis we find those who have no problems meeting their food needs**, those who spend a minimal part of their income on food and those for whom almost all the food consumed comes from their own production. In the positive part we have, on the contrary, **those who have experienced severe food shortages and who spend a large part of their income on food**. The negative part is characterized by Ugandan units, while the positive part By Kenyan observations and households where remittances are the main source of income.
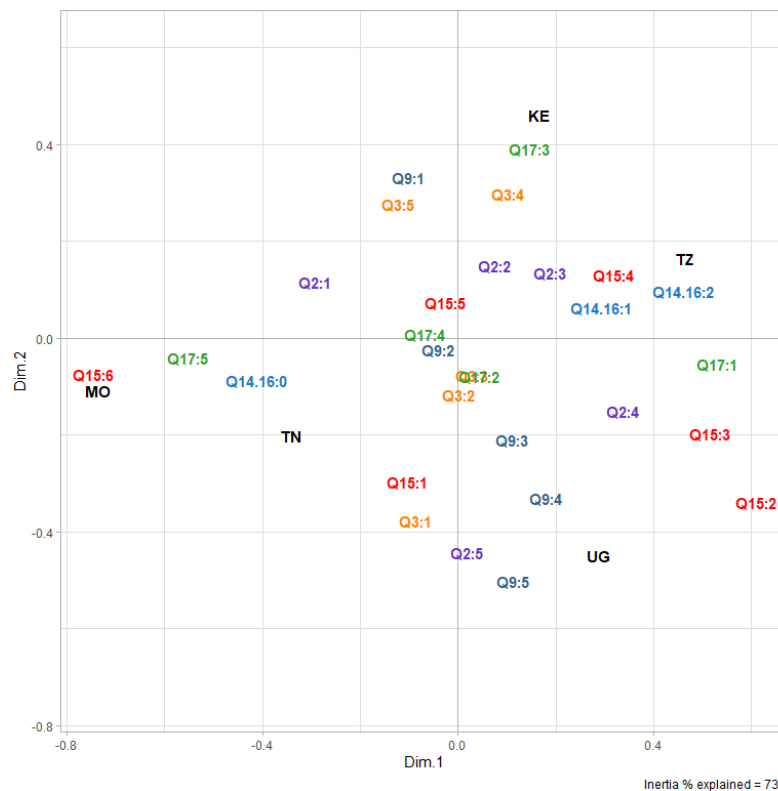
Figure 22. Multiple correspondence analysis: Q2: What share of the food consumed during a year is produced by your household, gathered in the wild or provided to you for free? 1-A very limited part (less than 25%), 2-Less than half (from 25% to 50%), 3-About half (50%), 4-More than half (from 50% to 75%), 5-Almost all (from 75% to 100%); Q3: What share of your household income is spent each year on purchased food? 1-A very limited part (less than 25%), 2-Less than half (from 25% to 50%), 3-About half (50%), 4-More than half (from 50% to 75%), 5-Almost all (from 75% to 100%); Q9: Were you and your household able to meet your food needs during the last year? 1-No we experienced serious food shortages, 2-We experienced some difficulties, 3-We had about what we needed, 4-Yes we had what we

2.2.3 Conclusions

2.2.3.1 Conclusions on the Research question

Results indicate that over one third of the sampled rural women is illiterate. Illiterate women appear to be less independent on the responsibilities taken over food purchasing and employment choices, and most of them (along with the youngest women sampled) have a limited share of mobile phone ownership. In general women tend to have limited decision-making power over the household, as only a small fraction of them is household heads.

Additionally, we also found that **most of the women in the rural food hubs are engaged in farming activities**. This is typical for rural economies where the primary sector is the sector providing most economic opportunities for all rural dwellers. Exceptions are to be found in Morocco and Tunisia, where most of the women do not have an employment or are involved in unpaid housework. Interestingly, **the main source of income at household level is not related to farming activities (46%).** This indicates that households probably diversify their income streams to achieve economic sustainability, engaging in other activities than farming.

As expected, **the intended destination of household food production is mainly for household use**. This indicates that these zones are still highly characterized by subsistence economies. For 52.7% of the respondents less than half of the food consumed is self-produced or obtained for free, while for about one third (31.6%) more than half of the food consumed is self-produced. This also shows that **rural households in the studied regions are dependent on the market for the purchase of food**. When looking at purchasing habits, we see that generally the main sources of food supply are local shops or producers located in the village. This links with the main concerns perceived by the women, which includes increase of food prices and related income reduction and food shortage, and **thus an expected incapacity of rural women to secure the dietary requirements of the households if prices rise**.

Around one third of the sample has **experienced serious food shortages, and difficulties in satisfying basic food needs and dietary requirements**. Food security appears to be tightly linked to the women's age as well as the household income share destined to food purchasing. Foods that are generally lacking from their diets are mainly protein-rich foods as meat and fish products.

2.2.3.2 Policy recommendations

- Enhancing education and literacy for rural women can support their empowerment in local and rural communities.
- Monitoring price increases in rural areas in period of crisis can support policymakers in detecting exacerbation of food security.
- Innovative protein-rich meat and fish products can be produced and commercialized in rural areas, to improve the dietary intake of women and their households.

2.2.3.3 Recommendations for the project FoodLAND

- Ad hoc training for rural women on food production activities to enhance women' empowerment and increase the diet diversification.
Production and commercialization of innovative product lines deployed by the project targeting specifically the dietary requirement of women in reproductive age and their children.

2.3 Women and children's diet quality in rural populations of five African countries: results from the FoodLAND project

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2.3.1 Introduction

Maternal micronutrient deficiencies constitute a widespread nutrition challenge faced by women living in resource-poor settings, the consequences of which affect not only the health and survival of women but also their children, notably through intrauterine growth retardation (Allen, 2005). One of the main factors of this type of malnutrition is the poor quality of women's diets, notably their lack of diversity. There is ample evidence from developed countries that dietary diversity is indeed strongly associated with nutrient adequacy (Ruel M, n.d.) and growing evidence from developing countries also supports this association (Arimond et al., 2010).

In resource-poor environments across the globe, low quality monotonous diets are the norm. When grain or tuber-based staple foods dominate and diets lack vegetables, fruits and animal-source foods, the risk for a range of micronutrient deficiencies is high. Women of reproductive age (15-49 years old) are particularly vulnerable because of their higher micronutrient needs (Torheim et al., 2010). Adequate nutrition during infancy and early childhood is fundamental to the development of each child's full human potential. Poor infant feeding practices, coupled with high rates of infectious diseases, are the principal proximate causes of malnutrition during the first two years of life. In turn, this period of life is a "critical window" for the promotion of optimal growth, health, and behavioural development (Dewey & Adu-Afarwuah, 2008).

As one of the objectives of the FoodLAND project is to improve the diet quality of women and children we **assessed the baseline situation in the food hubs of the five countries participating in the project, and the association with key variables such as age, sex and food security at household level**. The objective of this contribution is to **assess and compare the diet quality of women and children in the food hubs of the five different African countries that have collected the data for this purpose, and explore their association with household and individual characteristics**.

2.3.2 Methodology

2.3.2.1 Study population

The surveys on rural consumers were conducted in rural populations located in the five countries as described in Section 2.1 and summarised below:

- In Kenya, in Kitui county that is located in the north-central part of the country and has an estimated population of 759 000 inhabitants.
- In Uganda, in the Kamuli district, in the eastern part of Uganda with a registered population of 558 500 people.
- In Tanzania, in the Mvomero district, in the eastern part of the country and with 312 000 inhabitants registered.

- In Morocco rural populations located in the Beni Mellal food Hub, with an estimated population of 2,613,137 (2020) inhabitants.
- In Tunisia, rural populations located in the Jendouba district with 404,853 estimated inhabitants in 2022.

2.3.2.2 Data collection procedures and tools

Please refer to Section 2.1 for further details on the research procedures for the rural consumer data collection.

2.3.2.3 Variables

The survey questionnaire included socioeconomic, food security, and consumption behavior variables as well as standardized questions to compute the diet quality indicators, as described of women of reproductive age and children below 2 years. The latter variables are hereby described:

- **The global diet quality questionnaire** (Uyar et al., 2023), that is a standardized questionnaire adapted at country level to collect diet data (available at https://www.dietquality.org). This dietary data allows for the computation of multiple diet quality indicators, including:
  - <u>Minimum Dietary Diversity for Women</u> indicator for women of reproductive age reflecting the likelihood of having the micronutrients needs covered for women 15 to 49 years of age
  - <u>Global Dietary</u> Recommendations (GDR) Score that proxies the adherence to global dietary recommendations. It ranges from 0 to 18 and the higher the GDR score, the more recommendations are likely to be met. Its computation is based on the NCD-Protect and the NCD-Risk scores.
  - <u>Other diet quality indicators</u> that reflect the consumption of specific food groups or items like vegetable and fruit, animal source foods, sweet foods, and others.

- The **WHO and UNICEF Indicators** (World Health Organization and the United Nations Children's Fund (UNICEF), 2021) for assessing infant and young child feeding practices that include:
  - Breastfeeding rate
  - Early initiation of breastfeeding
  - Exclusive breastfeeding for the first two days
  - Bottle feeding rate

In the following analyses, we used the share of income allocated to food as a proxy of food insecurity. Our rationale is that the highest the share of income allocated to food is the highest the likelihood of the household being insecure is.

2.3.2.4 Statistical analysis

Different methodologies were used in statistical analyses, according to the type of analysis and the type of variables involved. For bivariate analyses, the chi-square test was used to verify the presence of a significant relationship between the qualitative variables, while non-parametric tests (Kruskal-Wallis or Wilcoxon) were used when comparing qualitative and quantitative variables.

The use of non-parametric tests was dictated by the presence of quantitative variables whose distributions did not meet the assumption of normality.

Generalized linear models were used to interpret any relationships occurring between the diet indicators and socio-economic determinants (e.g., gender, education, income, etc.). These included logit regressions to analyze dependent variables which are dichotomous, while Poisson models for dependent count variables.

2.3.3 Results

2.3.3.1 Descriptive statistics

The mean age of women interviewed in Tanzania is 26 years old, in Kenya and Uganda is 28 years old, and in Morocco and Tunisia 32 years old, Women older than 35 years of age represent a 30% of the sample in Morocco and Tunisia and a 13% in the other three countries.

In relation to education, between 55 and 60% of the women in Kenya and Tunisia have secondary education or higher, whereas in Uganda and Morocco the proportion is 23% and 28% respectively and in Tanzania only 6.2% have secondary or higher education.

The share of income dedicated to food varies greatly from country to country. Morocco is the country that shows the greatest proportion of households (14%) dedicating more than 75% of their income to food, followed by Tanzania (11%), Kenya (9%) and Tunisia (3%). But at the same time Morocco is also one of the countries showing a higher proportion of households (52%) dedicating the smallest share of their income to food (less than 25%), along with Tunisia (59%) and followed by Kenya (44%), Tanzania (27%) and Uganda (6%).

2.3.3.2 Women's diet quality

Minimum Dietary Diversity for Women

Women in Tunisia show the highest dietary diversity with an MDDW of 77.4%, followed by Kenya with 65%, Morocco with 57%, Uganda with 56% and Tanzania with 33% (Figure 23).

The age of the women was not significantly associated with MDDW in any of the countries analyzed, **whereas education of the mother was associated with it in all countries** except for Tanzania. In all the countries women having a higher level of education had a higher likelihood of achieving the minimum dietary diversity.

In relation to the share of income spent on food and its association with the MDDW, only Tunisia and Tanzania showed a significant association with higher MDDW among women living in households spending most of their income in food. Thus, MDDW was higher in food insecure households classified by this indicator.

In relation to other diet quality indicators as consuming the five food groups or All-5 indicator Kenya (47%) and Tunisia (45%) also show the highest values, although Uganda (28%) is in the third place followed by Morocco (12.6%) and Tanzania (12.5%).

Figure 23. Distribution of the Minimum Dietary Diversity (Yes) for Women score by country and selected variables (women's age, women's education and share of income allocated to food)

Global Dietary Recommendation

The Global Dietary Recommendation (GDR) score is constructed with two other indicators: the non-communicable diseases (NCD) protect score and the NCD-risk score. Both are measured on a scale of 0 to 9.

The mean NCD-protect scores were below 4 for all countries except for Uganda that was 4.18, but the NCD-risk scores were very low for all of them, with means below 1 for Morocco, Tanzania and Uganda, and a mean value of 1.14 for Kenya and 1.4 for Tunisia. As a result, **the Global Dietary Recommendation adherence score was above 11 for all the countries** and highest for Uganda with a mean value of 12.34.

Among the **food groups considered risky** for NCD, those more frequently consumed were **sweet foods** (with Tunisia and Kenya showing the highest levels 55% and 26% of consumption respectively) and **salty or fried snacks** that were mostly consumed in Uganda and Tanzania with 33% of women reporting consumption. The consumption of sugar sweetened soft drinks was scarce overall, but Tunisia showed the highest value (13%) followed by Kenya with a 9%. The consumption of processed meat was also highest in Tunisia with a 4.7% of consumption among the women surveyed.

Among the NCD protect food groups pulses was the most frequently reported, with values ranging 67% in Kenya to 18% in Morocco, followed by whole grains that were consumed by 78% of women in Uganda followed by Tunisia with a 34% and ranging to 17% in Morocco. Nuts and seeds were consumed by 45% of the women in Uganda but by less than 15% of the women surveyed in an of the other countries.

The Global Dietary Recommendation score was not significantly associated with the women's education in any of the five countries. In Morocco, Tunisia and Uganda the share of income spent on food was positively associated with the GDR score.

2.3.3.3 Children´s diet quality

The diet of infants and young children, below 2 years of age, is mainly composed of breastmilk and complementary feeding. Thus, the indicators of the quality of the diet of these children relate to either breastfeeding practices or the quality of the complementary foods they receive.

Breast-feeding

The rate of children that have been breastfed is above 99% for all countries except Morocco that shows a rate of 89%. Age of the mother or education was not associated with this variable and in relation to the variable share of income allocated to food an association was observed only in Morocco, with the highest ever breastfeeding rate among women living in households where more than 75% of income was dedicated to food purchase.

The WHO Global Strategy for Infant and Young Child Feeding (World Health Organization and the United Nations Children's Fund (UNICEF), 2003) recommends that infants should be breastfed within one hour of birth. In the populations we surveyed within the FoodLAND food hubs, the proportion of children that were put to breast within the first hour of birth varied from country to country. The highest prevalence is found in Uganda with a prevalence of early initiation of breastfeeding of 66%, followed by Kenya with 62,2%, Tanzania with 54%, Morocco with 43% and Tunisia with 32%. The factors associated with it was mother education only in Kenya and in an inverse direction, that is, women with higher education had initiated breastfeeding later than women with lower or no education whatsoever. In addition, the share of income allocated to food was also positively associated with the likelihood of early initiating breastfeeding.

The WHO recommends avoiding the use of feeding bottles because they are difficult to keep clean and represent a particularly important route for the transmission of pathogens (Dewey, 2005). In the countries studied the use of bottle feeding was highest for Morocco (51% followed by Tunisia (46%), Kenya (28%), Tanzania (26%) and Uganda (9%).

Complementary feeding

WHO indicates that low vegetable and fruit consumption is associated with an increased risk of noncommunicable diseases. For infants and young children over six months of age, consumption of zero vegetables or fruits on the previous day represents an unhealthy practice.

In Kenya, only 9% of children surveyed had zero fruit and vegetables consumption, while in Morocco and Uganda it raised to 16-17%, in Tanzania 21% and in Tunisia one out of three children had zero fruit or vegetable serving the day before (33%). The only variable associated with this indicator was age in Tunisia, where younger mothers were less likely to feed fruit and vegetables to their children.

The WHO guiding principles also state that animal source foods or "meat, poultry, fish or eggs should be eaten daily or as often as possible". Therefore, no consumption of animal source food (ASF) is considered an inadequate practice. In the food hubs surveyed in Tanzania 65% of the children did not have any ASF the day before, followed by Uganda with 50%, Tunisia 32% and Morocco and Kenya with 24 and 23% respectively (Figure 24).

Figure 24. Distribution of the Animal Source Foods consumption score by country and selected variables, for children 6 to 23 months

The consumption of ASF by infants and young children was positively associated with the education of the mother in Kenya, Tunisia and Uganda (the higher the education, the higher the likelihood of the child having consumed ASF the day before. The share of income allocated to food was also associated with the children's consumption of ASF but with no straightforward direction for interpretation.

Finally, the WHO guiding principles for complementary feeding advise against giving sweet drinks to children, such as soft drinks as they contribute no nutrients other than energy and may displace more nutritious foods (Dewey, 2005).

More than 50% of the children surveyed in the food hubs of Kenya, Morocco and Uganda had consumed sweet beverages the day before, as compared to 36% in Tanzania and 22% in Tunisia. Among those, the highest consumption in soft drinks was found in Kenya with 7% consumption among children 6 to 23 months of age and in Uganda with 6%. Tanzania showed a 2% consumption of these type of drinks among children surveyed and Morocco and Tunisia only 1%.

2.3.4   Conclusions

2.3.4.1 Conclusions on the Research question

The minimum dietary diversity of women living in the FoodLAND food hubs is similar to the national estimates. The Global Diet Quality project estimated MDDW for the 2021-2022 period for Kenya, Uganda, and Tanzania at 69%, 59% and 36% respectively while in the FoodLAND food hubs was 65%, 56% and 33% respectively. For Morocco the national estimate at 76% is significantly higher than the one obtained in our results (57%), and for Tunisia we do not have

national estimates to compare with. **The similarities between results obtained in the rural populations surveyed in our project and national estimates may be related to how representative of the whole country are the populations surveyed.** In Kenya, Tanzania and Uganda the majority of the population is of rural origin while in Morocco 64% of the population is urban (Global Alliance for Improved Nutrition (GAIN)Johns Hopkins University, 2020). As shown in the results of urban populations surveyed by the FoodLAND project (Section 3), the MDDW among women living in the cities in Morocco is much higher (83%). The positive association between MDDW and women's education observed in most of the countries is consistent with results from other contexts (Custodio et al., 2020).

The NCD protect scores are lower than the national estimates by the Global Diet Quality Project. However**,** the NCD risk scores are also significantly lower resulting in Global Recommendations scores for the five countries above the urban or national estimates.

In relation to children's feeding practices the estimates regarding breastfeeding and complementary feeding are better than those provided at national level (Global Alliance for Improved Nutrition (GAIN)Johns Hopkins University, 2020) probably reflecting the better situation of rural populations in relation to children's feeding practices as compared to urban. Only the food hub in Morocco showed a lower value of children ever breastfed (89%) as compared to the national estimate (97%), although the indicators of early initiation of breastfeeding and exclusive breastfeeding for the first two days were higher than estimates at national level.

2.3.4.2 Policy recommendations

Although the dietary diversity of women seems to be higher than national estimates, the consumption of the **5 recommended groups is low among women of reproductive age, thus policies to improve this indicator is encouraged**. In addition, policies targeting the food groups considered protective for NCD should be considered at a country-by-country basis.

The consumption of unhealthy foods results varies from country to country. **Policies targeting the consumption of sweet foods should be put in place in Kenya and Tunisia whereas reducing the consumption of salty snacks should be priority in Uganda and Tanzania**.

In relation to children feeding practices, the rates of breastfeeding are high, but the **early initiation of breastfeeding is low and should be considered a priority** as in some of the countries is inversely associated with mothers' education, that is, more educated women start breastfeeding their babies later than less educated mothers.

2.3.4.3 Recommendations for the project FoodLAND

The results from this work can be compared with the results on the dietary patterns of urban populations (Section 3) to get new insights of the differences between dietary practices in rural and urban areas. In addition, these results can contribute to the design of interventions and policy recommendations aiming to improve the diet quality and nutritional status of women and children in the selected areas.

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2.4 Cross-country descriptive analysis on rural women empowerment

Authors: Naiara Arri and Lur Etxeberria (ELHUYAR)

2.4.1 Introduction

The aim of this study is to **review and compare information on women's empowerment in rural areas**, assessing the women's ability in controlling and benefitting from local resources, assets, income, decision making processes as well as estimating the women's satisfaction with their current role and responsibilities in the household and local society.

This study seeks to respond to the following research questions: What is the current level of women's empowerment in the rural settings of five African countries? What are the main determinants of the women's empowerment (e.g., socio-economic, gender norms and demographic variables)?

2.4.2 Methodology

In this chapter, we present the results of a descriptive and comparative analysis of the information on women empowerment in rural areas collected during the rural consumer research (Q19 to 23 of the Rural consumer survey tool; Refer to Section 2 and D2.3 for further information on the data collection procedures, study areas, and final sample size).

2.4.3 Results

2.4.3.1 Women's role in household decision-making

Results show that **rural women participate in most of decisions, and most decisions are taken jointly by them and other household members** (Figure 25). **What the household eats" is the item that is mostly decided (47,42 %) by women** who responded the survey on their own, while "Q19.5 Whether the household should take a loan" is the type of decision where women are less involved (7,21 %).

Q19-Empowerment: Role in household decision-making
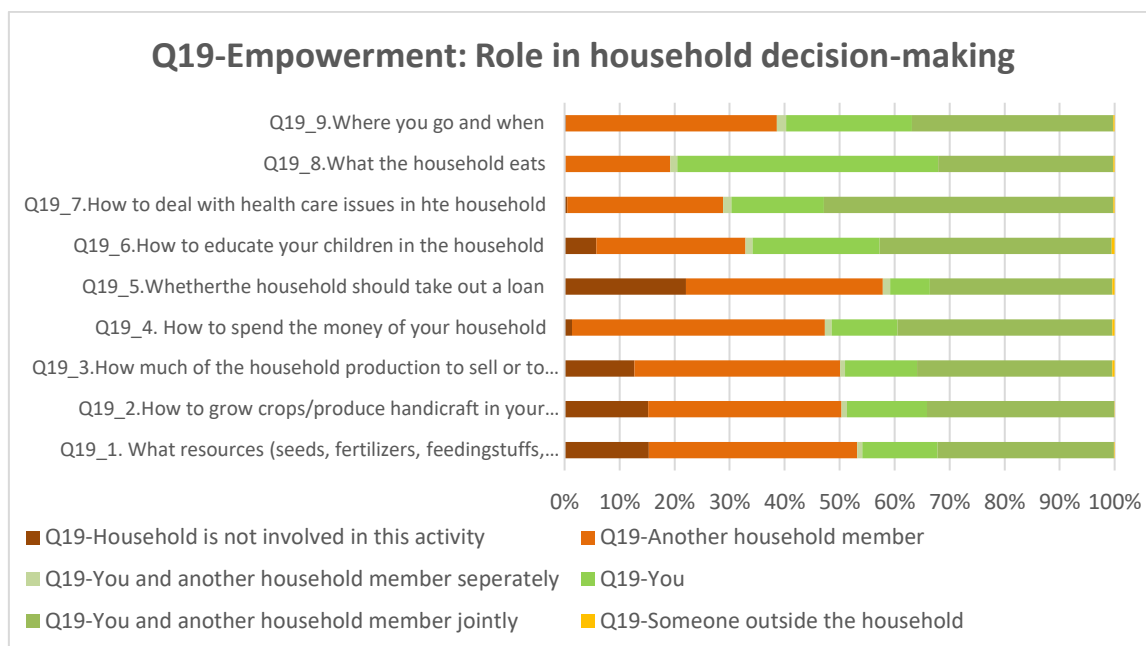
Figure 25. Women's role in household decision making.

When comparing the survey results across the 5 Food Hubs (Figure 26 to Figure 30), we can identify a clear difference between the first five statements presented (*what resources to buy, how to grow crops, how much of the household production to sell or consume, how to spend the money of the household and whether to take out a loan*) which are directly related to the farm as an economic activity; and the last four statements (*how to educate your children, how to deal with health care issues, what the household eats and where you go and when*) which are directly linked to the women's home, the essential caring activities developed in each household, and the women's freedom of movement.

In Kenya results show that **decisions are most predominantly taken by the female consumers interviewed and another household member jointly.** Interviewed women participate at a 60 % rate in all types of decisions (either on their own, or in cooperation with other members of the household). There are **two major decisions taken mostly by women** on their own: what the household eats and where the woman goes and when. In these two cases, joint decisions are still predominant, yet with a substantial number of women who decides this on their own (34,64 % where they go and when; and 33,75 % what the household eats; Figure 26). The **two issues more prominently decided by other members of the household** are: what resources to buy (36,98%) and how to grow crops/produce handicraft in their household (36,09%).
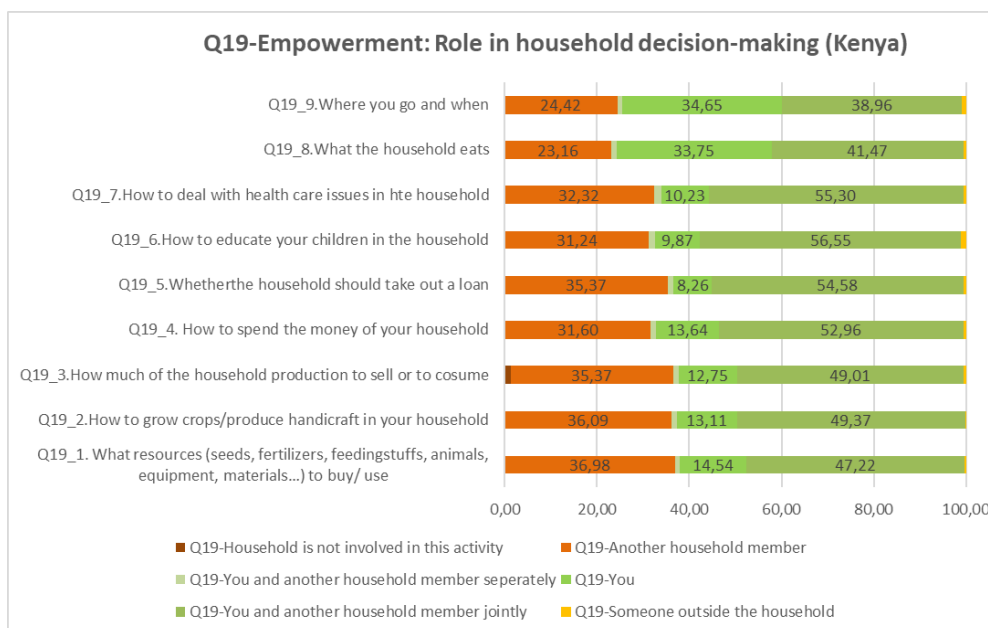
Figure 26. Women's role in household decision making (Kenya – Kitui Food Hub).

In Morocco, most households have women who are not involved in decisions about what resources to buy, and how to grow crops/produce handicraft in their household (respectively 55% and 66%;Figure 27). **Farming related decisions, are mostly decided by other household members**, including:

(i)   how much of the household production to sell or to consume (40,82 %),
(ii)   how to spend the money of the household (57 %),
(iii) whether the household should take out a loan (44,53 %),
(iv)   and where they go and when (40,63 %).

Women participate in care-related decisions. Decisions on how to educate their children in the household (51,56 %) and what the household eats (50,39 %) are taken by women on their own, and other care related issues are taken either by them or jointly with other household members. For example, how to deal with healthcare issues in the household is predominantly dealt jointly (50,20 %).

Q19-Empowerment: Role in household decision-making (Morocco)
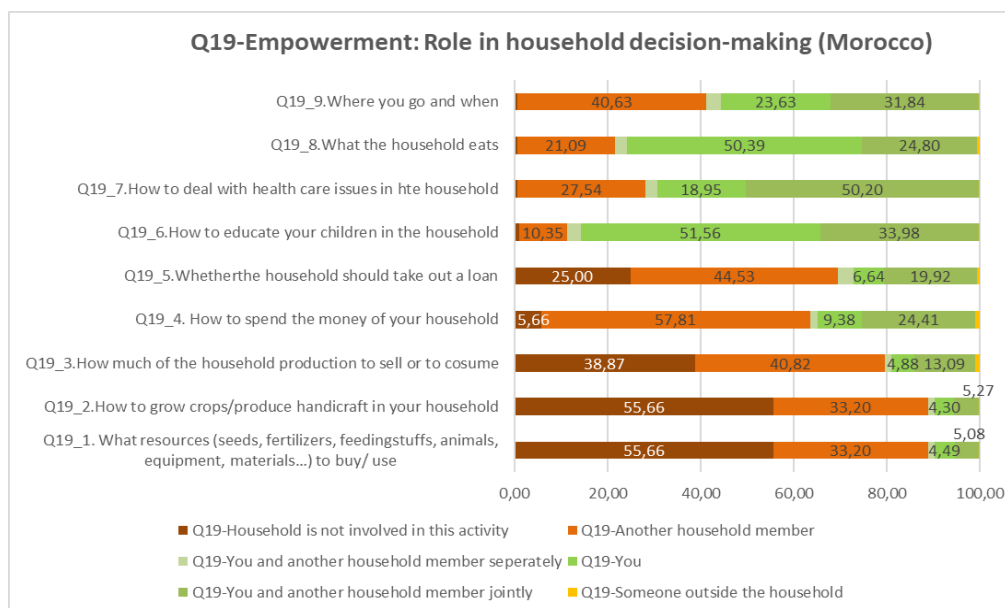
Figure 27. Women's role in household decision making (Morocco – Ait Ouallal Bittit / Ait Yazem Food Hub).

In Tunisia, we can see a very clear gendered segregation between care related decisions and farming related decisions (Figure 28). **Women are mostly in charge (over 80 %) of care related decisions**[3]. For example, women participate (either on their own or jointly) in almost all the decisions on how to educate their children (99 %), and very similarly on how to deal with healthcare issues (93 %) and deciding what is eaten at the household (97 %). **Finance related household decisions,** such as whether to take a loan (39,60 %) or on how to spend money in the household (49.50 %) **are mainly taken by another household member, even if women still participate at significant rates**: 37 % in the case of taking a loan, and over 50 % in the case of how to spend money in the household.

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[3] 101 observations from Tunisia were evaluated in this analysis, as the data collection process was still running in the TN food hub.
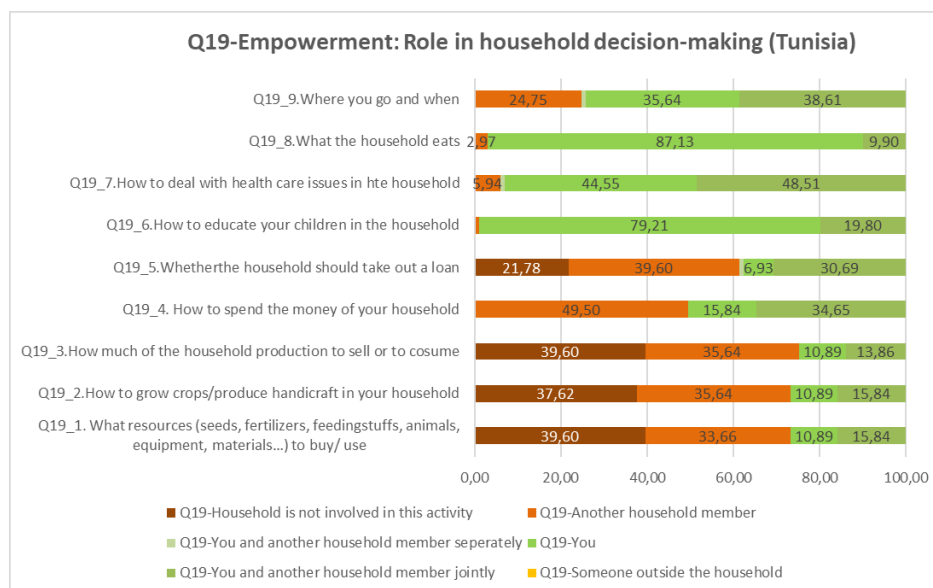
Figure 28. Women's role in household decision making (Tunisia – Jendouba Food Hub).

In Tanzania, decisions are most predominantly taken by the female consumers interviewed and another household member jointly at every level (Figure 29). There are two major exceptions: what the household eats and where you go and when. In these two cases, joint decisions are still predominant, but there is a prominent number of women who decide on their own (34,64 % where they go and when; and 33,75 % what the household eats). The two issues more prominently decided by other members of the household are: what resources to buy (36,98 %) and how to grow crops/produce handicraft in their household (36,09 %).
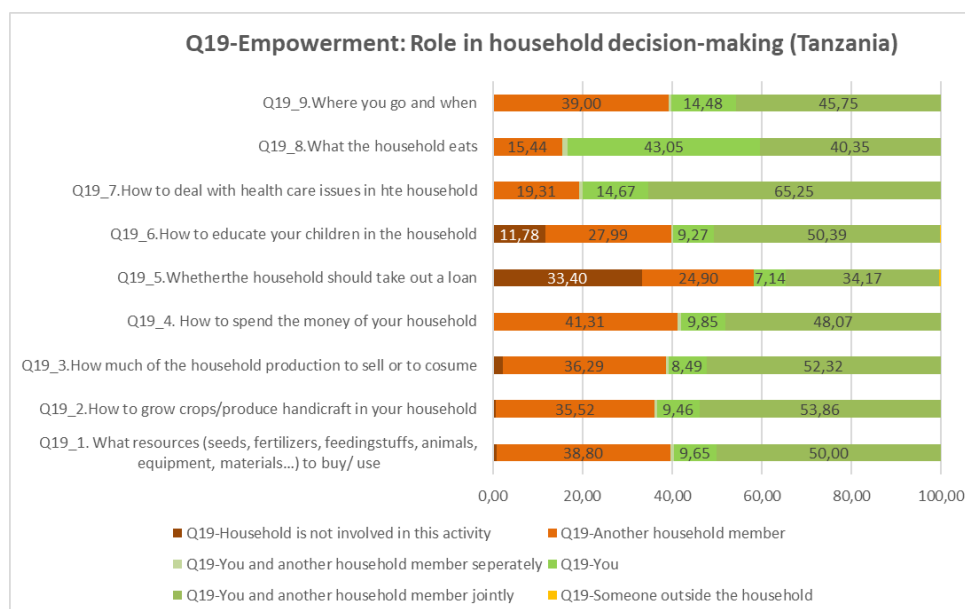
Figure 29. Women's role in household decision making (Tanzania – Mvomero / Morogoro Food Hub).

Finally, **in Uganda, we can identify some gendered segregations** depending on the type of decisions taken. **Women are involved at a higher or lower rate in all types of decisions, at around 50 % rate. They most predominantly decide (on their own) about what the household eat (56 %).** However, **finance related issues such as whether to take a loan, or how to spend the money in the household are decisions where they participate less.** The way the money in the household is spent is mostly decided by another household member (53,88 %), and regarding whether the household should take a loan, is not involving the household in 31,81 % of cases, and is a decision taken by another member of the household in almost 38 % of the cases.
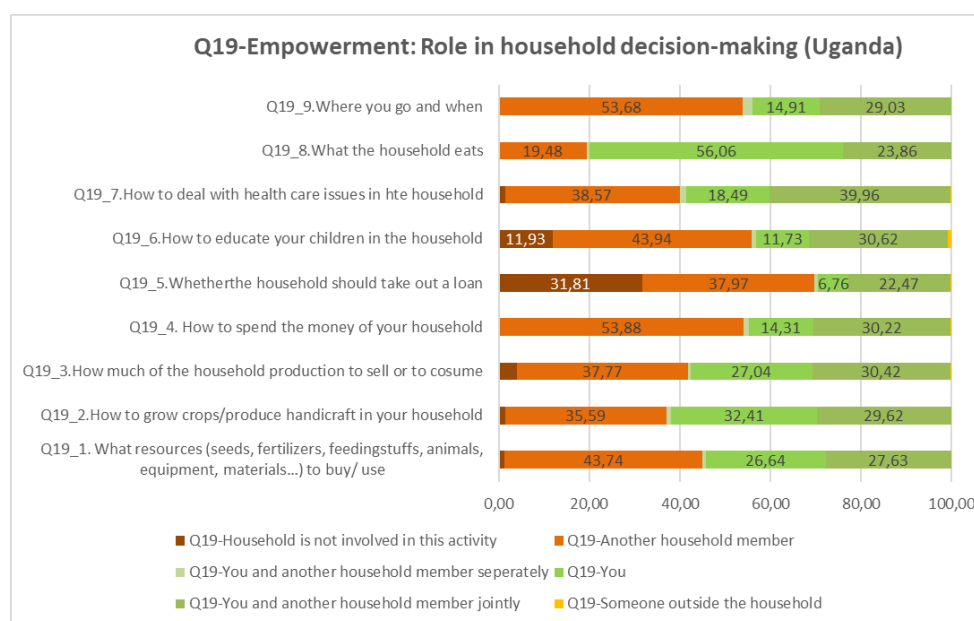
Figure 30. Women's role in household decision making (Uganda – Kamuli Food Hub).

2.4.3.2 Women's level of satisfaction about their responsibilities

In the survey female rural consumers were also asked about the level of satisfaction with their role at decisions taken at their households. In general, we can say that **rural female consumer's responding to the survey seem to be happy or extremely happy (over 70%) about their role in decision-making in all the countries** (Figure 31).

The Kenyan Food Hub is the study area with the highest satisfaction. Over 50 % (51,17 %) of the sample reported that is extremely happy, and 40,75 % said they were happy about their role at household decisions. On the other hand, the Tunisian Food Hub reported that there are 30 % who feel either unhappy or extremely unhappy about their role in decision-making. It would be interesting to complete this question with an open question to understand better in which way they are not satisfied. In the same way, almost 30 % of the women in Morocco they did not position towards one side or the other, and stated they are neither happy nor unhappy. It could seem they just accept the situation, without a need to value their happiness.
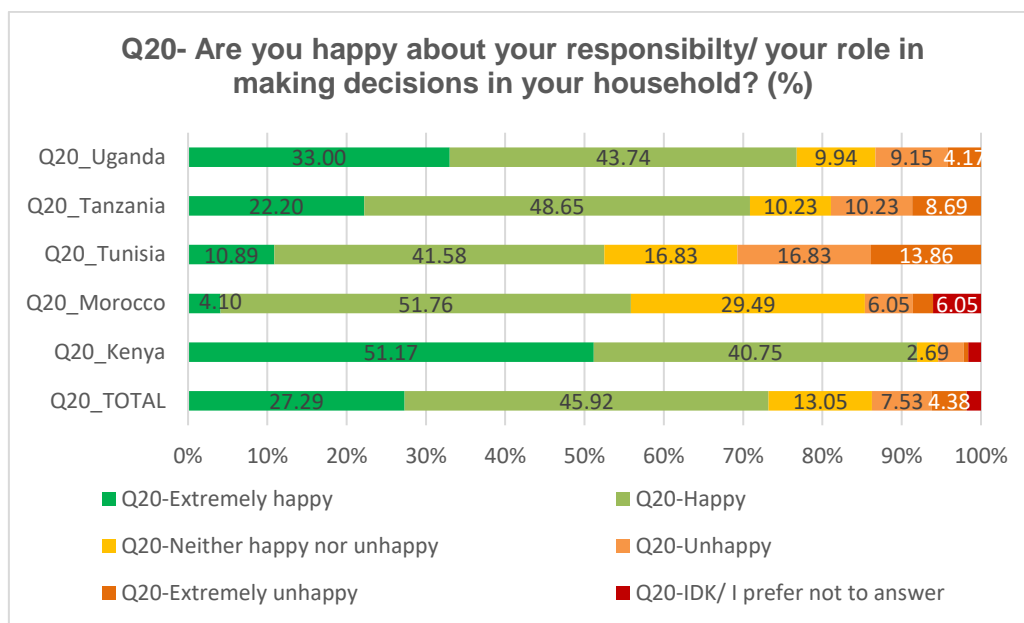
Figure 31. Women's level of satisfaction about their responsibilities in the households across the five country food hubs.

2.4.3.3. Women's participation in local groups

Results highlight several differences across countries regarding the women's participation at different local community groups (Figure 32). **Women from the Kenyan rural food hub participate at a much higher rate in all different type of groups, but specially women cooperatives (49,64 %), groups with members of the community (46,42 %) and mutual/self-help groups (46,77%).** On the opposite side, **women from the Moroccan rural food hub participate at the lowest rate, around 1% of the women who replied to the interview** participate in some kind of local community group.

Women's participation in the food hubs located in Tunisia, Tanzania, and Uganda is similar. Women from these three countries participate at around 20 % rate. In Tunisia, participation is less than 10 %, with exception of credit or microfinance groups that reach 20 %. Women from Tanzania participate at very low rates of less than 10%. In Uganda, 18,27% of the sampled women participate at women groups or cooperatives, 19,88 % at credit or microfinance group and 21,87 % at mutual or self-help groups.
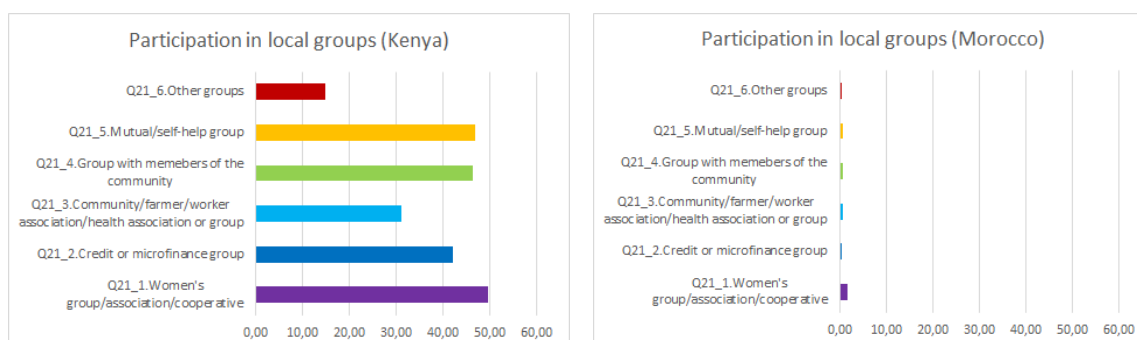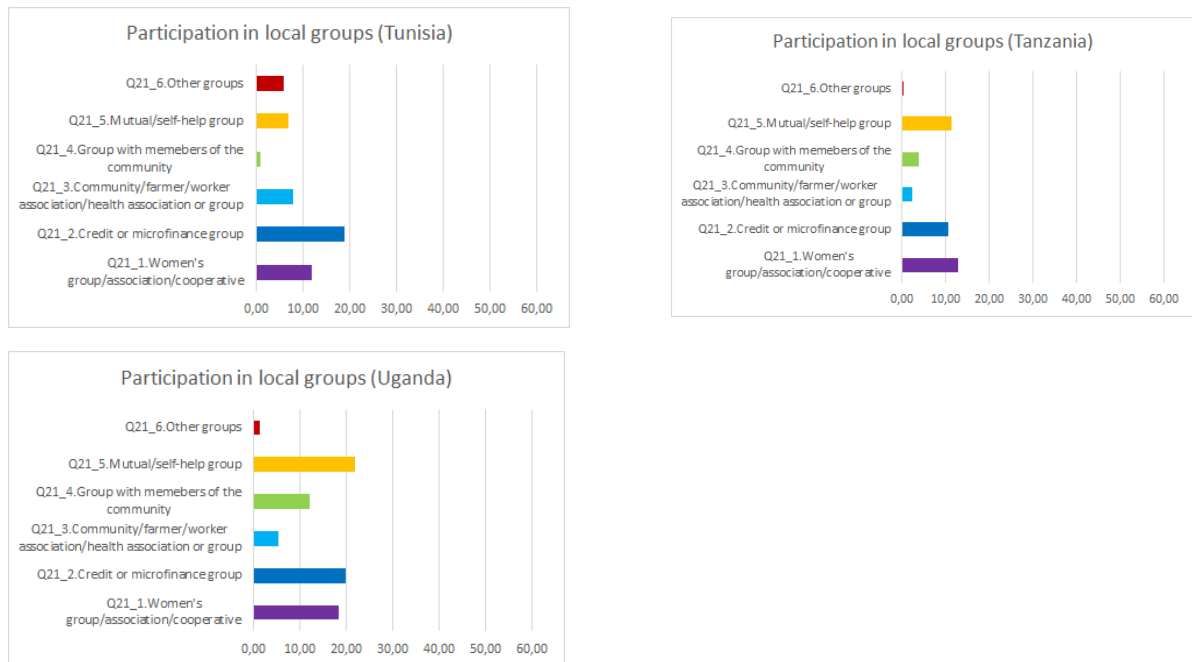
Figure 32. Women's participation in local community groups across the five country food hubs.

2.4.3.4 Gender-awareness within their communities

The survey included three statements to value on a 0-5 scale the gender-awareness of their communities, including a statement that indicated the opposite view to the other two. Generally, in all countries most women (over 50 %) agreed with the three statements; and there was an slight difference in the number of women who strongly agree with the second statement. To fully account the accountability of the responses, as they are contradictory statements, further statistical tests need to be run.

Different results are found in Tunisia, where almost 80 % of the women agreed to the first and third statements, which were gender-aware, almost 60% disagreed or strongly disagreed to the second statement and 17 % neither agreed nor disagreed. To be clearer 80 % women agreed with the statement "women can be as good leaders as well as men", 60 % disagreed or strongly disagreed with the statement "A man's job is to earn money; a woman´s job is to look after home and family" and 70 % agreed with the statement "women are just as capable as men of contributing to household income".

Probably, there was tendency to be politically correct and agree, no matter what it was stated, but we could conclude that it would be interesting to offer some basic gender-awareness workshops or trainings to the respondents and see if we could find any changes in the responses after the completion of the training.

Figure 33. Gender-awareness questions across the five country food hubs.

2.4.3.5 Time spent on paid work and unpaid chores.

This question assesses how women used their daily time in paid and unpaid work and activities. Responses have been very heterogeneous with values ranging from 1 hour to 14 hours. Table 11 presents the results by food hubs reporting the average value out of all the responses received by country, and the maximum and minimum values.

In Kenya, women seem to spend more time on paid work in and out of the household (an average of 6,42 hours) than on unpaid domestic chores and care work (4.57 hours per day). We observe **the same tendency in Tanzania**, even though the average amount of hours spent in both type of activities is lower (5.19 hours on average in paid work in and out of the household, and 3.91 hours on average on unpaid domestic chores and care work). **In Morocco and Uganda there seems to be an opposite tendency, as women seem to spend more time on unpaid domestic**

chores and care work than on paid work in and out of the household (they spend 7.39 hours on unpaid domestic chores and care work in Morocco and 6.52 hours in Uganda). In Tunisia no difference was found between the time spent on paid and unpaid work. The amount of time spent in both type of activities is one of the highest recorded, therefore in Tunisia women seem to have a bigger burden of work (both paid and unpaid work) which reaches almost 15 hours per day.

The credibility of these responses needs to be further assessed, as answering this question requires a strong sense of one's own use of time. When comparing the data collected to previous surveys assessing the use of time at country level (e.g., ILO-2019) significant difference can be found, which can rely on the methodology used to collect information on time spent.

Table 11. Answers by country to the question Q23-How many hours do you spend daily?

	Row Labels	Average	Max. Value	Min. Value
KE	Q23_1 on work in and out of the household?	**6.42**	16	1
	Q23_2 on unpaid domestic chores and care work	4.57	12	1
MO	Q23_1 on work in and out of the household?	4.86	12	1
	Q23_2 on unpaid domestic chores and care work	**7.39**	12	1
TN	Q23_1 on work in and out of the household?	**7.62**	14	1
	Q23_2 on unpaid domestic chores and care work	**7.04**	14	1
TZ	Q23_1 on work in and out of the household?	5.19	13	1
	Q23_2 on unpaid domestic chores and care work	3.91	12	1

UG	Q23_1 on work in and out of the household?	4.06	15	0
	Q23_2 on unpaid domestic chores and care work	**6.52**	15	1

2.4.4 Conclusions

2.4.4.1 Conclusions on the Research question

- Women participate in most of decisions, and most decisions are taken jointly by them and other household members. "Q19.8 What the household eats" is the item that is mostly decided (47,42 %) by women who responded the survey on their own, whiles whether "Q19.5 Whether the household should take a loan" is the type of decision at which women were less involved (7,21 %).
- Rural female consumer's responding to the survey, seem to be happy or extremely happy (over 70%) about their role in decision-making in all the countries.
- In general, women's participation in local groups is very low, and most interviewed women (around 80% do not participate in any type of local groups or cooperatives) with a clear exception being women from Kenyan rural Food Hubs, where almost 50% of women who replied the survey participated in women cooperatives (49,64 %), groups with members of the community (46,42 %) and mutual/self-help groups (46,77%).
- Rural communities in the Food Hubs could benefit from capacity building, and general training on gender issues, and how it affects their everyday life. There seems to be a stronger sense on gender awareness in Tunisia, but it is difficult to get concluding statements on the other four countries.
- The data collected is extremely heterogenous when analysed at cross-country level. In Morocco and Uganda unpaid domestic chores and care work seem to take most of women's work burden, whiles in Kenya and Tanzania women seem to spend more time on paid work in and out of the household. Women in Tunisia seem to have the biggest workload (paid and unpaid) with almost 15 hours by day spent on both paid and unpaid chores.

2.4.4.2 Policy recommendations

- Promoting rural women´s participation in local groups and cooperatives. This could be done by offering specific operational trainings that rural women would find useful on the first sight.
- Country level Time Use Surveys could be a strong tool with a double aim, on the one hand they are a way of becoming aware of how we use our time, and on the other they could lead to very interesting data that could be the base for specific gender policies.

2.4.4.3 Recommendations for the project FoodLAND

- Using diary to collect data on the social uses of time at more accurately, would allow to get a better sense on how women and men in Food Hub communities uses their own daily time.

- Offering gender equality training in each of the Food Hubs would support greatly rural women empowerment. These workshops/training actions, adapted to the local context, could also serve as an event to attract, especially women, to participate in community groups and cooperatives.

2.4.5 References

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2.5 Households food production and procurement behaviour among mother-child (6-23 months) pairs in Kitui County, Kenya

Authors: Wambui Kogi-Makau, Dasel Wambua Mulwa Kaindi, Sophia Ngala, Jeff Wamiti, Linet Thuku, and Evans Chimoita (UoN)

2.5.1 Introduction

Kitui County is one of the 29 counties in Kenya categorized as arid and semi-arid lands in the country. It has also been classified as one of the thirteen (13) counties categorized as high risk for starvation in 2023. It has an aridity of 30-84% as classified by the State Directorate for Development of the ASALS. The county experiences a temperature range of 14^0C and 32^0C (Kitui County Intergrated plan 2018-2022, 2018).

Like Kenya, agriculture is the backbone of the county's economy. The residents practice both crop and livestock farming in varying scales. The main livestock types kept include cattle (beef and dairy), sheep and poultry (exotic and indigenous). However, the milk production declined by 23% in a similar period in Jan-March 2022 to 1.0 Liter of milk per household, on the other hand the long term milk harvesting average is 1.3 Liters. Even though average daily milk consumption is 0.8 Liters it can also reduce to 0.6 liters (NDMA 2023). The types of crops grown in the county are dependent on the climate of the area. The main crops grown include maize, sorghum, millets, green grams, cowpeas, and pigeon peas. The level of food self-sufficiency in the county is 51%; however, 10% of the entire population is absolutely food insecure (Kitui County Integrated plan 2018-2022, 2018). Nutrition status of the population in the county remains poor with about 6.3% of the children being at risk of malnutrition (NDMA 2023). This was highly attributed to the frequent droughts experienced resulting to food insecurity. The rates of wasting, stunting and underweight are 4.6%, 38.2% and 20.7%, respectively (Kitui County Integrated plan 2018-2022, 2018).

A study conducted in Kitui County, that targeted children less than five years reported that more than three quarters (99%), consumed cereals, while none of the children consumed meat or fish while only 5.3% and 2% consume meat and eggs consecutively (Kariuki, 2011). Even though a mean dietary diversity score of 4.9 was reported (Kariuki 2011), other life cycles groups had poor diversity scores especially children aged 9-12 months who had the DDS mean of 2.7 while those of 6-8 months had mean of 2.1 (Kimiywe & Chege, 2015). The most consumed food group was grains, roots and tubers (94.4%) while the least consumed were proteins of animal source, eggs (4.6%), dairy (32.1%) and flesh foods (13.0%). The study also noted that the children's diet is low in fruits and vegetables(Kimiywe & Chege, 2015). The paper seeks to answer the two-research question; i) what are the household food production and procurement behaviors in Kitui County? and ii) what is the mother's level of empowerment in decision making at household level?

2.5.2 Methodology
2.5.2.1 Study area and population

Kitui County is one of the counties that is home to the Akamba community in Kenya. According to the 2019 Census report, Kitui has 1,136,154 persons with 549,003 and 587,151 being male and female, respectively. The county has 247 county villages that were established through the Kitui County Villages Act 2015 and are headed by a village administrator who is responsible for overseeing the county affairs at the village level. (Kitui County Integrated plan 2018-2022, 2018).

The county, situated in the eastern part of the country, comprises of eight Sub-Counties; Kitui West, Kitui Central, Kitui Rural, Kitui South, Kitui East, Mwingi North, Mwingi West and Mwingi Central. The study was conducted in three of the sub-counties where Kitui Enterprise Promotion Company Ltd (KEPC) sources its agricultural foods supplies for processing. The sub-counties are Kitui Central, Mwingi West, and Kitui East. KEPC is host to the Kitui foodLAND hub.

2.5.2.2 Research design

A cross-sectional study design was adopted for this study. The afore mentioned design involved collecting and describing data from the study population at one point in time (January 2023) (Kumar & Ranjit, 2011).

2.5.2.3 Study population

The target population was households with children aged 6-23 months and their mothers aged 15-49 years in the three (3) sub-counties in Kitui County. The mothers were the respondents for the study. A total of 558 rural mother and child dyads were selected for the study.

The sample size has been calculated using the Fisher et al. (1991) formula, using Kitui County's prevalence of stunting (38.2%):

$$\frac{Z^2 PQ \ x \ DEFF}{d^2}$$

Where:
- N = Desired sample size
- Z= Level of significance of 95%
- P= prevalence rate of stunting (38.2%)
- Q= 1-p
- D= Level of accuracy – used 5% standard error.
- DEFF = Design effect (in this case DEFF =1.5).

In the case study under evaluation the formula equates to:

$$\frac{1.96^2 \ x \ 0.382 \ x \ 0.618 \ x \ 1.5}{0.05^2} = 544 \, households$$

2.5.2.4 Sampling procedure

A Sub-county is divided into locations, which are further sub-divided into sub-locations, villages and clusters of "Nyumba Kumi" or community units. Simple random sampling technique was used to select the study clusters which are the villages. According to the Kitui Village Act 2015, the wards are further divided into villages that range between five to seven per ward. A list of all villages within a sub-location was developed to suffice as the sampling frames. Random sampling was used to select three (3) villages per ward and subsequently households with children aged 6-23 months per village to participate in the study.

Households with the target respondents – (mother 15-49 years of age with a child aged 0-23 months) was selected through snowballing and random walk techniques. In the event a household has more than one child falling in the category of interest, the older younger child was included in the study.

The first household was identified by locating a starting point within the village of interest, and then followed by the spinning of a pen/bottle. Enumerator moved in the direction and the first house that meets the mother-child pair criteria was recruited for the study. The next household was identified by snowballing technique. Snowballing entailed already interviewed mother's giving directions to the next appropriate household while random walk entailed groups spinning a pen/bottle to mark the direction the teams will follow as they identify household with mother-child pairs for the study.

2.5.2.5 Data collection tools and procedures

An online semi-structured questionnaire which was administered via face-to-face interviews was used in data collection. The questionnaire was translated into the local language (Kikamba) and to enhance clarity a Kiswahili language version was availed. The questionnaire captured data on socio-demographic and socio-economic characteristics, household food production and purchasing behavior, and mothers' level of empowerment. The first section of the questionnaire captured data on: the age and gender of child, age of mother, mother's level of education, household size, the respondent's role in the household, level of income, forms of employment, and the use of farm produce. The second section targeted to find out the household food production and purchasing behavior, and asked about the source of selected food products, percentage of food consumed in the household that was non-purchased, and percentage of the household income used in purchasing food. A set of five (5) questions, that focused on role of the mother in decision making at household level, her participation in community groups, and how she used her time were used to assess the respondent's level of empowerment.

2.5.2.6 Ethical considerations

The research ethical clearance was obtained from KNH-UoN ERC (Kenyatta National Hospital-University of Nairobi Ethical Research Committee). Additionally, a research permit was obtained from National Commission for Science, Technology, and Innovation (NACOSTI). The Deputy Sub County officer (DSCO) was requested to give consent on behalf of the County. The researchers ensured that participants understood the scope, objective, and the procedure of data collection. The information given to the study participants included: objectives, purpose and duration of the research, identity of the researchers, risks and benefits, information on data protection, privacy and data retention, the right not to take part, the right to withdraw, and contact details for questions.

2.5.2.7 Data Analysis

Using R for stats software, the data was first analyzed and summarized as frequencies and percentages. The Continuous variables were analyzed and presented as ranges, maximum, minimum and means with their respective standard deviation. Kruskal- wallis test was performed to test if the selected variables were significantly related or not. All reported p-values were considered statistically significant at a level of $p < 0.05$.

2.5.3 Results

The results included aggregated and disaggregated data from 558 mother-child dyads in Kitui County collected in January 2023.

2.5.3.1 Demographic characteristics of the study participants and households in Kitui County

Twelve percent of the mothers were 20 years and below while the mothers aged 21 to 35 years were 75.1%. Mothers aged above 35 to 49 years were 12.9%. The mothers' mean age (±Standard deviation [sd]) was 27.78 (±6.42), with a minimum and maximum age of 16 and 48 year of age, respectively.

The mean number of children in the study population is 2.22±1.34 and it ranges between one (Minimum) and ten children (maximum). Slightly over a third (36.4%) of the households have one child, while 29.2% and 20.4% households have two and three children, respectively.

Nearly half (48%) of the respondents had attained secondary school education, whereas only 12.4% had studied beyond secondary school level. Less than half of the respondents (38.9%) had acquired primary school education as their highest level of education. None of the respondents were illiterate. There is a significant relationship between level of education and age-group, with most of the women aged between 25 and 30yrs old attaining secondary school level of education ($X2 = 60.07$, P-value < 0.001).

Most of the respondents (90.7%) are either a wife or a daughter of the household head, but only 3.6% of the women consider themselves as the household heads.

The number of men aged fourteen years and above ranged between one (1) and seven (7) whereas that of women of the same age ranged between one (1) and ten (10). The mean was higher among the women than the men, 1.76±1.22 vs. 1.38 ±1.08. The mean of the children aged 3-23 years was higher than that of the children aged 0-2 years, 1.31±1.24 vs. 1.05±0.24. The mean of the total number of the household members stood at 5.51±2.76, with the household with the least members having two (2) members and the one with the most had twenty-one (21) members. The mean number of adults with salary/ revenue, 1.22 ±1.26, was higher than the mean number of women with salary/ revenue, 0.42±0.80.

Nearly all respondent women (89.4%) owned a mobile phone. Slightly less than three quarters (70.3%) of the respondents were predominantly farmers. Very few of the respondents were either Off-farm informal/casual workers or non-farm household employment or Off-farm regular workers.

The four main sources of income for the households are farm income, non-farm income, remittances, and subsidies/aids. The mean total income for the households was KES 9700±12531. Remittances yielded the highest mean income (KES 5658±10,674) and maximum income. Non-farm income (KES 2803±6533) and farm income (KES 1183±3339) were also important sources for the household welfare.

Most (91.4%) of households earning a mean income of less than KES 10,000 or a median of between KES 5000 and KES 8000 experienced food shortage when compared to households earning higher incomes (Kruskal-Wallis 22.51, p-value: <0.001).). Education level higher than primary school level were significantly associated with higher incomes (Kruskal-Wallis 30.23, p-value: <0.001).

2.5.3.2 Household food procurement

As clearly shown in Figure 34, **household production and the market (purchased) were the main sources of foods** with the market taking the upper edge and with availability being within the community (village). Most of the respondents purchased food products in the village, except for fish products. Other than buying the food products in the village, self-production was the second most common source for many households. Of all the nine types of food products of interest to this study, **meat (99.3%) oils and fats (98.2%) and dairy products (94.3%) were the most commonly purchased** within the village whereas eggs (81.0%) were the least commonly purchased. Fish, Oils, and fats were the least produced food products within the household, 0.4% and 1.4%, respectively. Of the nine food products, eggs (33.5%) and fruits (30.5%) were the most produced foods within the household. Gathering of foods in the wild emerged as being an uncommon practice, nevertheless, some of the food products such as vegetables (0.5%), fruits (1.3%), meat (0.2%) and eggs (0.9%) were sourced from the wild (Figure 34).
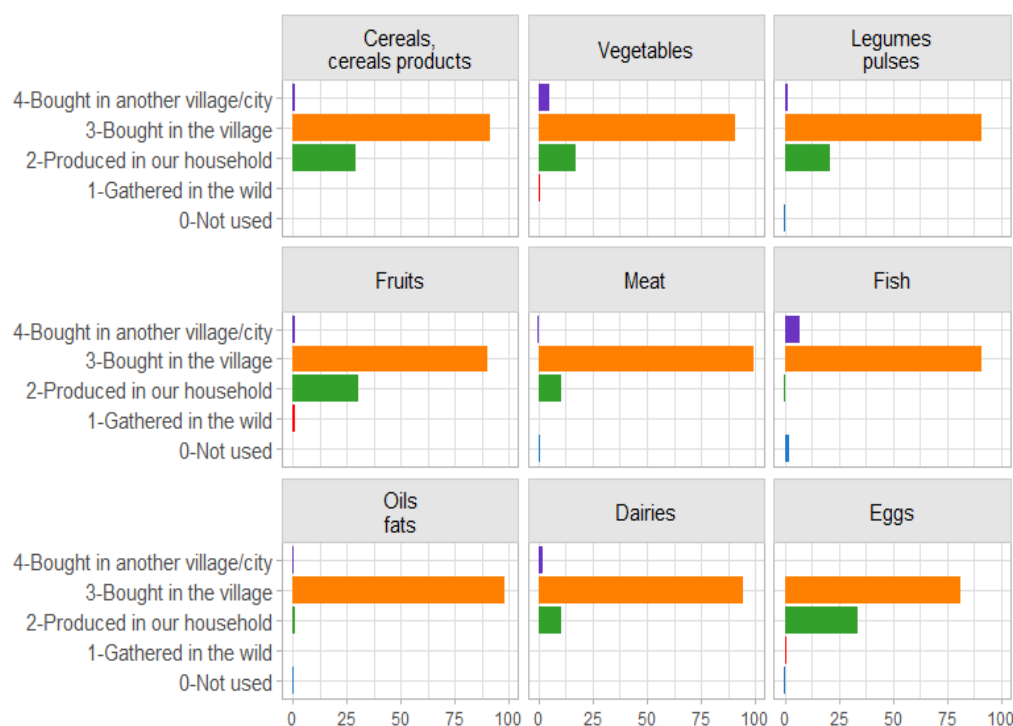
Figure 34 Household food production and purchasing choices (%).

The largest percentage of the respondents (43.7%), reported that less than a quarter of the food consumed in the household was either produced by the household, gathered in the wild or given to the respondents for free. Less than a tenth (8.6%) of the respondents reported that almost all the food consumed in the household is produced by the household, gathered in the wild or provided to them for free. The remaining 47.7% of the respondents expressed that of the food consumed in the household, 25% -75% of it was either produced by the household, gathered in the wild or provided to them for free (Figure 35).
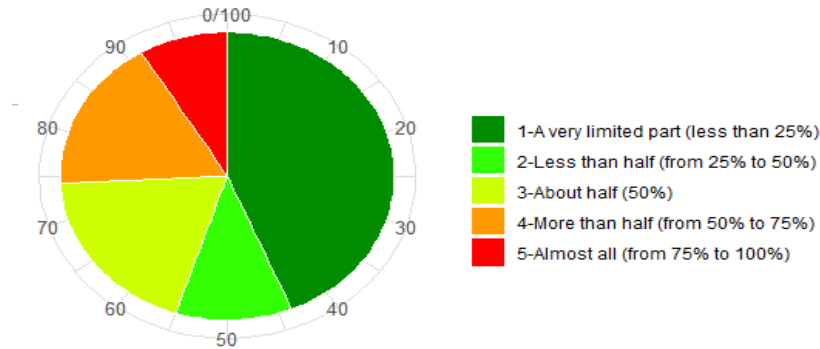
Figure 35. Share of the food consumed that is produced by the household, gathered in the wild or provided to the household for free.

Spending above 75% of one's income on food implies very high vulnerability to food insecurity, while expenditures of 65-75% and 50-65%, imply high and medium food insecurity respectively. Slightly less than half of the respondents (43.9%) and 23.3%, respectively, spent more than half of the household income and almost all the household income on purchased food. For 32.8% of the respondents, the share of the household income spent on purchased food ranged between 25% to about 50% (**Error! Reference source not found.**). A significant relationship was found between the share of household income spent on non-purchased food (p=1.6e-21) and food needs (*p*= 0.0011). The results also show that no relationship was found between the age and education level of the respondents.

Table 12 Relationship between the share of household income categories spent on purchased food by Share of food consumed not purchased (Q2), age and education level.

variable	levels	1-A very limited part (less than 25%)	2-Less than half (from 25% to 50%)	3-About half (50%)	4-More than half (from 50% to 75%)	5-Almost all (from 75% to 100%)	P-value
Total	Total	5.2	11.0	16.7	44.0	23.2	
Q2.food not purchased	1-A very limited part (less than 25%)	4.1	7.0	7.8	51.2	29.9	1.6e-21***
	2-Less than half (from 25% to 50%)	9.5	14.3	15.9	46.0	14.3	
	3-About half (50%)	1.9	22.4	38.3	26.2	11.2	
	4-More than half (from 50% to 75%)	9.5	9.5	18.9	54.7	7.4	
	5-Almost all (from 75% to 100%)	4.2	4.2	10.4	22.9	58.3	
age	[15,20]	7.5	1.5	13.4	53.7	23.9	0.1090
	(20,25]	3.5	11.2	21.2	44.1	20.0	
	(25,30]	7.3	13.3	12.7	46.7	20.0	
	(30,35]	2.0	13.3	16.3	39.8	28.6	
	(35,49]	6.9	11.1	18.1	34.7	29.2	

variable	levels	1-A very limited part (less than 25%)	2-Less than half (from 25% to 50%)	3-About half (50%)	4-More than half (from 50% to 75%)	5-Almost all (from 75% to 100%)	P-value
education	2-No qualification/literate	0.0	100.0	0.0	0.0	0.0	0.5976
	3-Primary	4.2	9.3	16.7	45.8	24.1	
	4-Secondary	5.2	12.7	16.4	43.3	22.4	
	5-More than secondary	8.7	8.7	18.8	40.6	23.2	
	6-other	0.0	0.0	0.0	66.7	33.3	
food needs	1-No we experienced serious food shortages	4.7	12.8	12.3	46.0	24.2	0.0011**
	2-We experienced some difficulties	3.8	8.2	24.1	42.4	21.5	
	3-We had about what we needed	8.3	4.2	29.2	45.8	12.5	
	4-Yes we had what we needed	26.7	6.7	26.7	13.3	26.7	
	5-Yes more than enough	0.0	0.0	0.0	0.0	100.0	

2.5.3.3 Women empowerment

Among the households, a large proportion of the decisions were made by the respondent and another household member separately with a range of 39.0% - 56.6% while the respondent alone was very little involved in decision making (0.0% - 1.3%) (Figure 36).

Figure 36. In your household, who normally makes most of the decisions about the activities listed below?

More than half of the respondents (51.1%) preferred not to answer questions on their satisfaction about their responsibility/role in decision making at the household level. Out of 271 of the respondents who answered this question, 83.4 % were extremely happy. Only 1.1 % were unhappy about their role in decision making while 3.3% were extremely unhappy.

Among the 20 – 25 years old age group, 30.3 % of mothers were happy with their role in making decisions while only 11.1% of those between the ages of 35 – 49 years were happy with their role. Figure 37 also shows that almost half (49.1%) of mothers who attained secondary education were happy with their role in decision making while 0.7% of mothers who had other forms of education were happy. Most (88.2%) of mothers whose role in the household was the head's wife / head's daughter / niece / granddaughter were happy with their role in decision making. However only 1.8% of the head's relative (mother/sister/cousin) were happy with their role. Most mothers from households that experienced serious food shortages (68.3%) were happy with their decision-making role while 0.4% of mothers from households that had what their needed to meet their food needs were happy with their role. There was no significant difference (p > 0.05) between the proportion of respondents who were happy with their role in decision making and their; age, level of education, role in the household, share of income spent on food as well as their food needs.
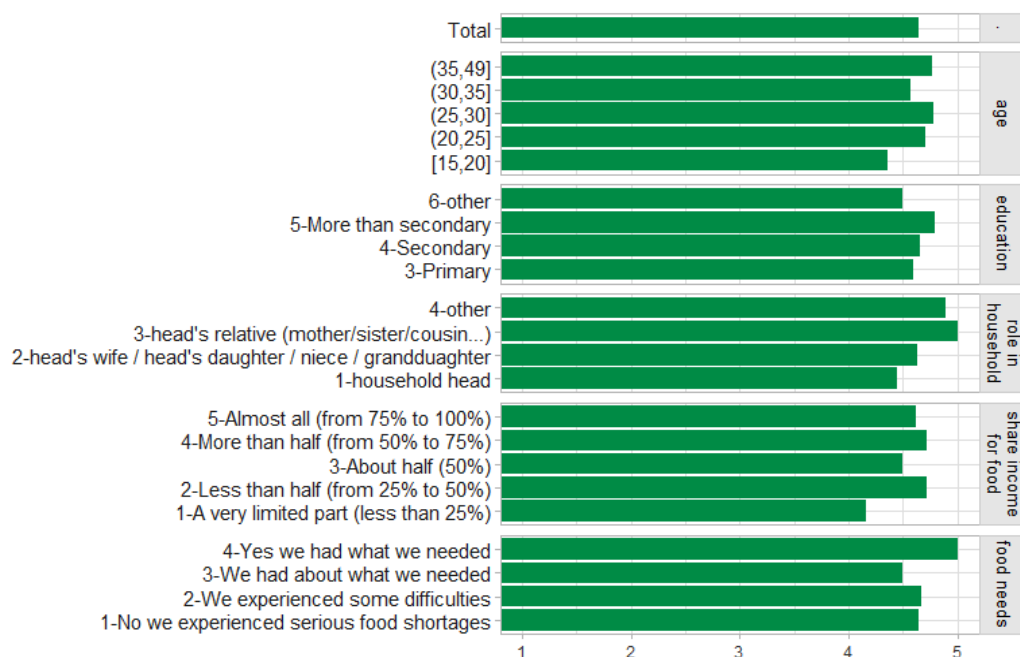
Figure 37. Level of satisfaction of the women' responsibility / role in making decisions in household; average values on a scale from 1: Extremely unhappy to 5: Extremely happy

2.5.3.4 Hours spent in paid work and unpaid domestic chores/ care work by women

All respondents spent a greater proportion of their time at paid work (mean =6.42) compared to performing domestic chores/care (mean = 4.57). Hours spent daily on unpaid domestic chores and care work by the respondents were significantly related to the households' food needs (p=0.0328). On the other hand, education level was significantly (p < 0.001) associated with hours spent on paid work (Table 13).

Table 13. The relationship between the mean hours spent daily (during the last month) on unpaid domestic chores or care work and paid work

variable	levels	Unpaid domestic chores/care		Paid work	
		Mean hours	p-value	Mean hours	p-value
Total	.	4.57		6.42	
age	[15,20]	4.12	0.3554	6.33	0.0065
	(20,25]	4.76		5.99	
	(25,30]	4.63		6.75	
	(30,35]	4.64		6.73	
	(35,49]	4.29		6.39	
education	2-No qualification/literate	3.00	0.8119	6.00	6.2e-04***
	3-Primary	4.67		6.01	
	4-Secondary	4.51		6.51	
	5-More than secondary	4.48		7.39	
	6-other	4.67		4.67	
	1-A very limited part (less than 25%)	4.07	0.0740	7.07	0.0999
	2-Less than half (from 25% to 50%)	4.51		6.07	

variable	levels	Unpaid domestic chores/care		Paid work	
		Mean hours	p-value	Mean hours	p-value
share income for food	3-About half (50%)	5.11		6.32	
	4-More than half (from 50% to 75%)	4.65		6.27	
	5-Almost all (from 75% to 100%)	4.16		6.79	
food needs	1-No we experienced serious food shortages	4.70	0.0328*	6.35	0.5056
	2-We experienced some difficulties	4.52		6.45	
	3-We had about what we needed	3.42		6.83	
	4-Yes we had what we needed	3.87		7.13	
	5-Yes more than enough	4.00		4.00	

2.5.3.5 Nature of worries experienced by women in the study area

The 12 categories used to reflect respondents' worries for the near future are presented in Figure 38. Respondents gave a score level on a scale that ranged between 1 and 5; 1- not at all important and 5- very important. Increase in food prices was the worry scoring the highest among the 12 categories. It was closely followed by food shortage/starvation with a mean of 3.71 and increase in the cost of production (3.60) in form of price of seeds, fertilizer and seeds. Loss of home and dispossession of land, with a mean score of 1.98 and 1.93, respectively, were of least importance (Figure 38).
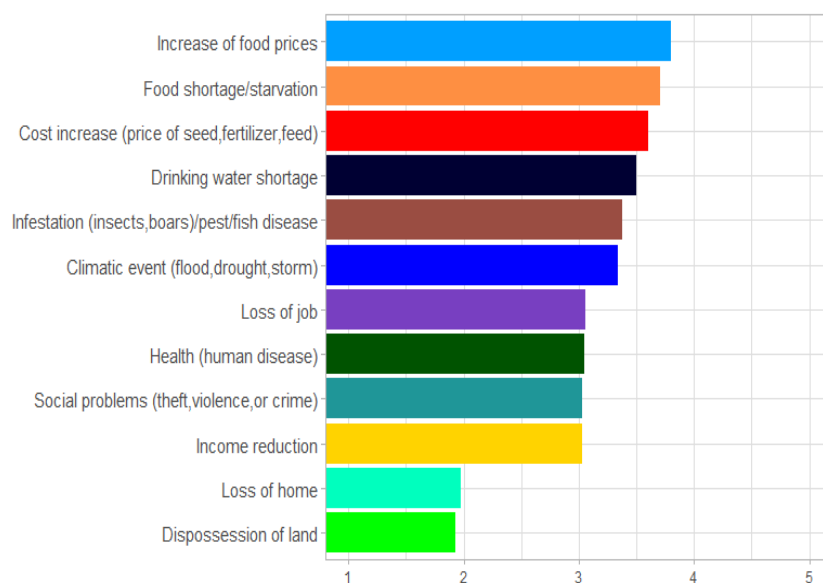
Figure 38. Perceived worries for the near future sorted by importance; average values on a scale from 1: Not at all important to 5: Very important.

2.5.4 Conclusions
2.5.4.1 Conclusions on the Research question

- Despite the households being rural, they are highly dependent on the market for acquisition of food.

- Unexpectedly, most households purchase cereals, legumes, fruits, vegetables, and eggs from the market, and yet, there is high potential for household level production
- In the backdrop of this, education level and amount of income were key influencers on food purchasing behaviours of rural women consumers.

2.5.4.2 Policy recommendations

- Reduce reliance on food purchases through the promotion and facilitation of increased production of nutrient dense foods.

2.5.4.3 Recommendations for the project FoodLAND

- Increase local capacity to produce and utilize nutrient dense foods such as quinoa-enriched novel food products.

2.5.5 References

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2.6 Dietary habits of mothers with children 6-23 months in rural areas of Kitui County, Kenya

Authors: Dasel Wambua Mulwa Kaindi, Wambui Kogi-Makau, Linet Thuku, Sophia Ngala, Jeff Wamiti, and Evans Chimoita (UoN)

2.6.1 Introduction

Women and children are considered as part of the vulnerable groups in the society, and as such a lot of effort has been put to improve their nutrition status. The well-being and nutrition statuses of children and women are linked (Castro et al., 2015). Dietary intake is one of the factors that determine the child and maternal nutritional status (UNICEF, 1990). In many different countries in the world, women's diet consists of limited fruits and vegetables and animal source foods such as meat, dairy and milk (UNICEF, n.d.). Food choices of women are influenced by factors that could either be intrinsic or extrinsic in nature (Turner et al., 2018). Globally, the diets of women are influenced by numerous factors that include access to food, affordability and socio-cultural factors that affect their ability to decide on matters related to their nutrition and care (UNICEF, n.d.)

Kitui County is one of the 29 counties in Kenya categorized as arid and semi-arid lands in the country. It has also been classified as one of the thirteen (13) counties categorized as high risk for starvation in 2023. It has an aridity of 30-84% as classified by the State Directorate for Development of the ASALS. The level of food self-sufficiency in the county is 51%; however, 10% of the entire population is absolutely food insecure. Nutrition status of the population in the county remains poor. This was highly attributed to the frequent droughts experienced resulting to food insecurity (Kitui County Integrated plan 2018-2022, 2018).

Similar to the national trend, there are more females than males in Kitui County. The total population is 1,136,187 with 51.7% been females and 48.3% are males. Over a third (47.4%) of the females in the county are in the reproductive age bracket (15-49 years) (Kenya National Bureau of Statistics, 2019).

Although a lot of effort has been put in establishing the dietary practices of women, majority of the studies put their focus on pregnant and lactating women, leaving out a big proportion of women of reproductive age (WRA). This study sought to fill this gap by focusing on women of reproductive age who have children aged 6-23 months. A newly developed tool for assessing diet quality, Dietary Quality Questionnaire (DQQ), was used in collecting data. DQQ is a tool that comprises of twenty-nine food groups that are inclusive of both healthy and unhealthy foods. In this study, the data collected was later used to calculate six (6) diet quality indicators; food group diversity score (FGDS), MDD-W, All-5, NCD-Protect score, NCD-Risk Score and Global Dietary Recommendation (GDR) whose data is reported in this paper.

2.6.2 Methodology
2.6.2.1 Study area and population

Kitui County is one of the counties that is home to the Akamba community in Kenya. According to the 2019 Census report, Kitui has 1,136,154 persons with 549,003 and 587,151 being male and female, respectively. The county has 247 county villages that were established through the Kitui County Villages Act 2015 and are headed by a village administrator who is responsible for overseeing the county affairs at the village level. (Kitui County Integrated plan 2018-2022, 2018).

The county, situated in the eastern part of the country, comprises of eight Sub-Counties; Kitui West, Kitui Central, Kitui Rural, Kitui South, Kitui East, Mwingi North, Mwingi West and Mwingi Central. The study was conducted in three of the sub-counties where Kitui Enterprise Promotion Company Ltd (KEPC) sources its agricultural foods supplies for processing. The sub-counties are Kitui Central, Mwingi West, and Kitui East. KEPC is host to the Kitui foodLAND hub.

2.6.2.2 Research design

A cross-sectional study design was adopted for this study. The afore mentioned design involved collecting and describing data from the study population at one point in time (January 2023) (Kumar & Ranjit, 2011).

2.6.2.2 Study population

The target population was households with children aged 6-23 months and their mothers aged 15-49 years in the three (3) sub-counties in Kitui County. The mothers were the respondents for the study. A total of 558 rural mother and child dyads were selected for the study.

The sample size has been calculated using the Fisher et al. (1991) formula, using Kitui County's prevalence of stunting (38.2%):

$$\frac{Z^2 PQ \; x \; DEFF}{d^2}$$

Where:
- N = Desired sample size
- Z = Level of significance of 95%
- P = prevalence rate of stunting (38.2%)
- Q = 1-p
- D = Level of accuracy – used 5% standard error.
- DEFF = Design effect (in this case DEFF =1.5).

In the case study under evaluation the formula equates to:

$$\frac{1.96^2 \; x \; 0.382 \; x \; 0.618 \; x \; 1.5}{0.05^2} = 544 \, households$$

2.6.2.3 Sampling procedure

A Sub-county is divided into locations, which are further sub-divided into sub-locations, villages and clusters of "Nyumba Kumi" or community units. Simple random sampling technique was used to select the study clusters which are the villages. According to the Kitui Village Act 2015, the wards are further divided into villages that range between five to seven per ward. A list of all villages within a sub-location was developed to suffice as the sampling frames. Random sampling was used to select three (3) villages per ward and subsequently households with children aged 6-23 months per village to participate in the study.

Households with the target respondents – (mother 15-49 years of age with a child aged 0-23 months) was selected through snowballing and random walk techniques. In the event a household has more than one child falling in the category of interest, the older younger child was included in the study.

The first household was identified by locating a starting point within the village of interest, and then followed by the spinning of a pen/bottle. Enumerator moved in the direction and the first house that meets the mother-child pair criteria was recruited for the study. The next household was identified by snowballing technique. Snowballing entailed already interviewed mother's giving directions to the next appropriate household while random walk entailed groups spinning a pen/bottle to mark the direction the teams will follow as they identify household with mother-child pairs for the study.

2.6.2.4 Data collection tools and procedures

An online semi-structured questionnaire which was administered via face-to-face interviews was used in data collection. The questionnaire was translated into the local language (Kikamba) and to enhance clarity a Kiswahili language version was availed. The questionnaire captured data on socio-demographic and socio-economic characteristics, household food production and purchasing behavior, and mothers' level of empowerment. The first section of the questionnaire captured data on: the age and gender of child, age of mother, mother's level of education, share of income dedicated to the purchase of food and the household experience of food shortage. To estimate diet Quality for the mothers, the Global Diet Quality tool described in *https://www.globaldietquality.org/dqq* was used in the current study to estimate several dietary quality indicators. DQQ tool includes 29 food groups.

The dietary quality indicators estimated from the DQQ tool were as follows; food groups dietary diversity score (FGDs), minimum dietary diversity for women (MDD-W), All-5 score, NCD-Protect score, NCD-Risk score and Global Dietary Recommendations score (GDR).

2.6.2.5 Data Analysis

Using R for stats software, the data was first analyzed and summarized as frequencies and percentages. The Continuous variables were analyzed and presented as ranges, maximum, minimum and means with their respective standard deviation. Kruskal- wallis test was performed to test if the selected variables were significantly related or not. All reported p-values were considered statistically significant at a level of $p < 0.05$.

2.6.3 Results
2.6.3.1 Eating habits of women with children aged 6-23 months

During the study period a high proportion of respondents 96.1% (almost all) did not observe or celebrate any feast day (nor fasted). The analyzes of questions regarding food and drinks consumed were carried out excluding households for which the reference day was a celebration or a feast or a fast day in which special food products were eaten or in which people ate more or less than usual.

The distribution of food intake habits in the study population is typical of a rural population in a developing country. The staple from grain is usually the highest at 90.9%, followed by vitamin A – rich orange fruits/vegetables 80.8% and 80% (it was mango season in the area), sweetened tea/coffee/milk drinks at 84% (the milk in the tea is negligible), fluid milk at 78% could have been for children. Legume dishes are very popular in the study area at 67.7%. There must have been an overlap between unprocessed red meat (non-ruminant) 1.7% and poultry 3.9%. The local tribe

is known for local indigenous poultry rearing, but the local consumption of the same is poor. All the other foods/drinks the proportions consumed ranged from 0.4% (cheese – being an expensive commodity) to 33.8% roots and tubers consumption (very high consumption of roots and tubers could also indicate eminent drought) (Figure 39).
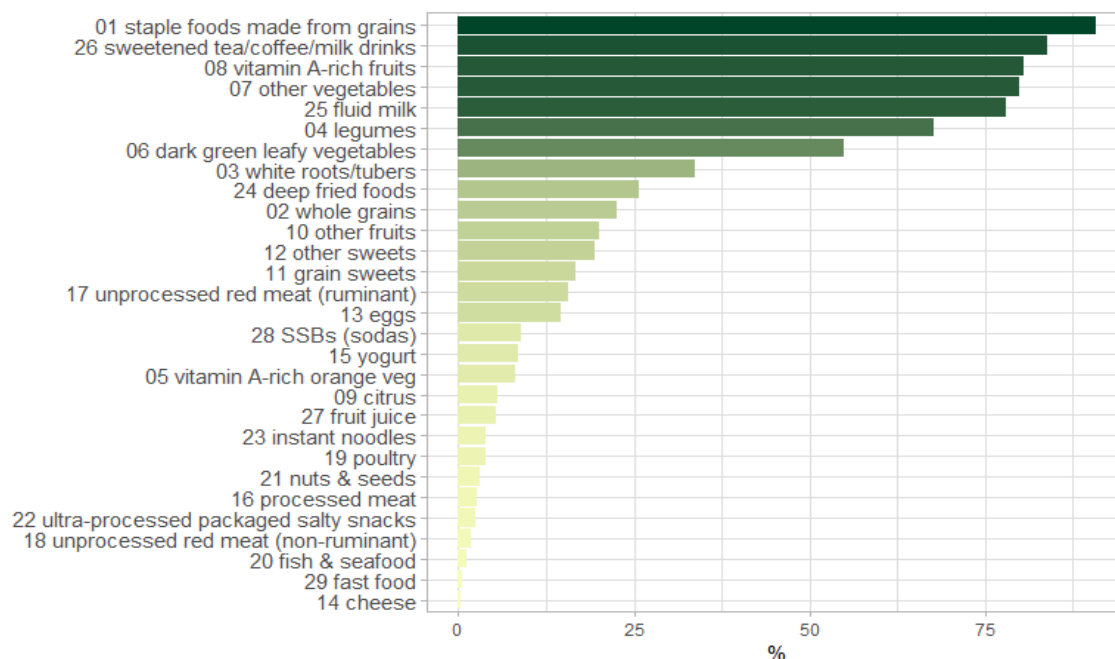
Figure 39. Food and drink that the respondents consumed.

2.6.3.2 Dietary Diversity Score (FGDS)

Food Group Diversity Score (FGDS) is not validated as an indicator of nutrient adequacy for the general population, but equity to food group diversity can be assessed. The FGDS is a semi-continuous score (0-10), expressed as the average score out of 10 for the population. The overall food group mean was 5.20 ± 1.69 on the whole study population (or respondents). **Most of the age group category consumed mostly between 4 to 6 food groups**, however the range varied from 1 to 9 food groups consumed. Age class 25-30 years had a range of 1 to 8 food groups consumed, while age class 15 to 20 years and 20 to 25 years both had a range of 2 to 9 food groups consumed. In light of level of education categories, **post-secondary education had most respondents consuming 5 to 7 food groups** with a range of 2 to 10 food groups consumed in the study population. Both the primary and secondary level of education had most of the respondents consuming 4 to 6 food groups with a range of 1 to 9 food groups.

When considering the share of income allocated to purchase of food by households, **households that spent about half (50.0%) of income for food, their FGDS ranged between 2 and 9**. But, for households that income was less than half allocated to food, the food groups consumed ranged from 1 to 10. In the category where a very limited part of the income was for food, the foods consumed 2 to 9 while the most people consumed 4 to 7 food groups. The respondents who experienced serious food shortages had most people consume between 4 to 6 food groups

with a range of 1 to 9 which could have been brought about by respondents turning to less conventional foods to meet their food needs. The respondents, who indicated having suffered some food need difficulties, consumed mostly between 4 to 7 food groups ranging of 1 to 10 foods (typical indicator of a stress situation). The respondents who had more than enough foods consumed 6 to 8 food groups ranging from 4 to 10 however, this were very few.

The respondents who had just about what food they needed consumed 6 to 8 food groups with a range of 3 to 10 food groups. These groups were very few in numbers (Figure 40). Food Group Diversity Score (FGDS) by age class, education level and share of income for food purchase). In summary, **the overall average of the food groups consumed across for all respondents in the categories of age class, education food needs and shared food income was 5 food groups. The age class, education level and sharing of food income all fluctuated between 5 and almost 6 food groups as the most consumed.** The category respondents with food needs had the most fluctuation in the groups with some as low as five food groups and as high as 8 mean food groups which might indicate the disparity in the food security in the study population. The age classes has an almost similar mean within the groups, with no significant difference ranging from 4.83 to 5.35 food groups (p=0.2093). The education categories had means which were significantly difference, that ranged from primary education at 4.84 and the highest other category at 6 food groups (p= 9.9e-05 or 0.000099). In the category of respondents sharing income for food there was no significant difference among the means (lowest 5.06 to highest 5.58 food groups) (p= 0.2590). There was a significant difference (p=0.0000 or 2.3e-09), within the food needs category with the lowest group consuming a mean of 4.91 and the highest consuming a mean of 8 food groups. The respondents with high food group means were very few in proportion and where there are significant differences could be pointers of where food security interventions could be targeted. The group of respondents with high minimum of up to 8 food groups also had a maximum of 8 food groups indicating consummation of local conventional foods while categories and groups with minimum 1 food group and maximum 10 could be trying to optimize the range by eating other foods which are less preferred in the community in times of lean season. The standard deviation ranged from 1.48 to 1.92 a very narrow range.
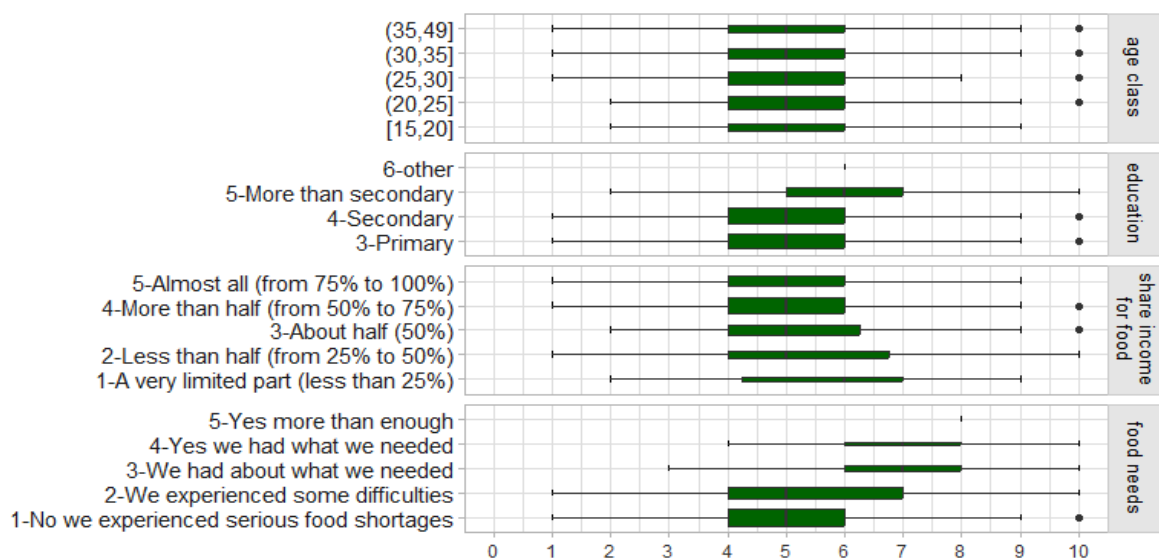
Figure 40. Food Group Diversity Score (FGDS) by age class, education level and share of income for food purchase

2.6.3.3 Minimum Dietary Diversity for Women of Reproductive Age (MDD-W)

Minimum Dietary Diversity for Women of Reproductive Age (15-49) is achieved when ≥5 out of 10 specific food groups, defined for FGDS, are consumed by an individual over the course of a day. Most of the respondents (65.2%), reported having consumed or met the MDD-W in the previous 24 hours, while as 34.8% did not meet the target food group (5 food groups).

In all the age classes, **more women responded to having met the MDD-W than those who had not**. Age class 20-25 were the highest at 103 persons out of 161, followed by 25-30 with 100 women responding that they have eaten ≥5 food groups while 47 had not. The lowest was age class 15-20, where only 37 women consumed ≥5 food groups and 26 had not out of 63 women of that age category. For all age classes, the women who responded that they had eaten a diet which consisted of MDD-W were all more than 50%. Age class 15-20 had the lowest, 58.7% of the women responded that they had ≥5 food groups yet those who had not were almost similar at 41.3%. Age class 30-35, had the highest proportion of respondent 70.2%, followed by 25-30 at 68.0%. In rural areas age class could determine MDD-W, the older the more endowed, then specific responsibility of educating children might affect the age class 35-49 years.

In the category primary school attainment, 118 respondents out of 209 had ≥5 food groups, and secondary school level of education 175 out of 258 women consumed ≥5 food groups. There was a significant difference, in that, as education level category increased and response to having met the MDD-W increased (p=0.000). Education level could influence the MDD-W of the respondent, with mothers with a higher level of education having a more diverse the diet. It is noteworthy, as the education level progressed from primary level where the MDD-W was 56.5% to 81.8% among mothers who had attained more than secondary education.

Sharing income for food is a common practice with respondents sharing a very limited part at 73.1 % and households with women who spent almost all income for food had an MDD-W of 66.9%. All the other categories of shared food income fall between these two categories. As income tends

to increase the proportion of funds allocated to food tends to decrease. This shows that MDD-W increased with an increase in income.

No group responded that they had more than enough food to lack any needs. The respondents who experienced serious food shortages the MDD-W was 61.4% while those who had some difficult meeting food needs 67.8% met the MDD-W. The MDD-W for women who had "about what we needed" was 91.3% compared to those who "had enough food they needed" at 85.7% This could be subjective as food needs were only limited to the study population's food environment, availability and access, which might change with changing seasons (*Table 14*).

Table 14. Minimum Dietary Diversity (MDD-W) by age class, education level and share of income for food purchased.

	No		yes		X2	
	Number n=186	Percent p=34.8%	Number n=349	Percent p=65.2%	statistic	P-value
Age class					3.27	0.514
[15,20]	26	41.3	37	58.7		
(20,25]	58	36	103	64		
(25,30]	47	32	100	68		
(30,35]	28	29.8	66	70.2		
(35,49]	27	38.6	43	61.4		
Education					16.9	0.00073
3-Primary	91	43.5	118	56.5		
4-Secondary	83	32.2	175	67.8		
5-More than secondary	12	18.2	54	81.8		
6-other	0	0	2	100		
share income for food					3.98	0.41
1-A very limited part (less than 25%)	7	26.9	19	73.1		
2-Less than half (from 25% to 50%)	21	36.2	37	63.8		
3-About half (50%)	25	28.4	63	71.6		
4-More than half (from 50% to 75%)	91	38.6	145	61.4		
5-Almost all (from 75% to 100%)	42	33.1	85	66.9		
Food needs					nd	nd
1-No we experienced serious food shortages	133	38.6	212	61.4		

2-We experienced some difficulties	49	32.2	103	67.8
3-We had about what we needed	2	8.7	21	91.3
4-Yes we had what we needed	2	14.3	12	85.7
5-Yes more than enough	0	0	1	100

2.6.3.4 All-5: Consumed all five recommended food groups

Out of 535 respondents, a **higher proportion 55.3% did not consume All-5 food groups while 44.7% consumed All-5 food groups in the 24-hour period**. However, it was not determined whether the difference was significant. Table 15 shows, that in all categories, the respondents who stated they had consumed All-5 food groups in the 24-hour period of the interview were less than the persons who did. In the age class category, 20-25 years (87 count out of 161 persons) had the most respondents stating that they had not consumed 5 food groups followed by 25-30 years category (78 out of 147). A similar number of respondents, 135 in both the primary (out of 209) and secondary education attainment (out of 258) did not meet All-5 score. In the category where respondents had obtained a post-secondary education 26 out of 40 met All-5 food groups which are slightly more than 50%.

In the category where the respondents stated whether they shared food income, 129 out of 236 stated that they did not consume the five food groups (More than 50% to 75% of the income). This category was followed by where almost all (from 75% to 100%) of the income was spent on food with 76 out of 127 within the category not consuming All-5 food groups. On the other hand, women who experienced serious food shortages those that did not consume all-5 food groups were 206 out of 345 while 80 out of 152 within the category of those who had experienced some difficulties (Table 15).

When the proportions of the persons who had responded to not having consumed 5 food groups across and within all the categories were calculated the picture was different. The age class category those who had not consumed 5 food groups ranged from 62.9% (35-49 years) to 53.1% (25-30 years), but there was no significant difference between those who said they had consumed the 5 food groups and those who had ($p=0.6467$).

In the education category, there was a significant difference between those who had not consumed 5 food groups and those who had ($p=5.7e-04$ or 0.00057). Those respondents who had not consumed 5 food groups were higher in the primary (64.6%) and secondary (52.6%) categories but lower in the post-secondary category (60.6%).

In the shared income for food groups, the respondents who stated they had not consumed the 5 food groups had higher proportions than the respondents who had not. The proportions of the respondents who had not consumed 5 food groups (in the last 24 hours) ranged from 60.3% being highest to 50.0% lowest. However, the difference between categories was not significant ($p= 0.4664$).

There was a significant difference in the food needs variable, between those who consumed the 5 food groups and those who did not (p =0.0026). The respondents who experienced serious food shortages 59.7% and those who had difficulties meeting food needs 52.6% did not consume 5 food groups. However, in the variable food needs, those who had about all the food they needed and consumed 5 food groups were 73.9% and those respondents who had all they needed 71.4% and consumed the 5 food groups were higher than those who had not consumed the 5 food groups (Table 15).

Table 15. Consumed all five recommended food groups (All-5) by age class, education level and share of income for food purchased.

	No		Yes		X2 Statistic	P-value
	Number	Percent	Number	Percent		
Total	296	55.3	239	44.7		
Age class					2.49	0.6467
[15,20]	37	58.7	26	41.3		
(20,25]	87	54	74	46		
(25,30]	78	53.1	69	46.9		
(30,35]	50	53.2	44	46.8		
(35,49]	44	62.9	26	37.1		
Education					17.46	5.7E-04
3-Primary	135	64.6	74	35.4		
4-Secondary	135	52.3	123	47.7		
5-More than secondary	26	39.4	40	60.6		
6-other	0	0	2	100		
Share income for food					3.58	0.4664
1-A very limited part (less than 25%)	12	46.2	14	53.8		
2-Less than half (from 25% to 50%)	35	60.3	23	39.7		
3-About half (50%)	44	50	44	50		
4-More than half (from 50% to 75%)	129	54.7	107	45.3		
5-Almost all (from 75% to 100%)	76	59.8	51	40.2		
Food needs					16.38	0.0026
1-No we experienced serious food shortages	206	59.7	139	40.3		
2-We experienced some difficulties	80	52.6	72	47.4		
3-We had about what we needed	6	26.1	17	73.9		

4-Yes we had what we needed	4	28.6	10	71.4
5-Yes more than enough	0	0	1	100

2.6.3.5 NCD-Protect score

The NCD-protection score had a mean of 3.42±1.39 for the whole respondent in the study population, meaning that most of the respondents often consumed food from the GDR. In the age class all the categories had mean NCD-protection score ranging from 3.14± 1.18 (15 to 20 years) to 3.51±.1.50 (20 to 25 years) and there was no significant difference among the age class group category. The minimum across the group was 1 and maximum 9 score.

There was a significant difference (p=0.0163) in the NCD-protection score among the education level categories. Primary level education had 3.19±1.36 and highest from other education level of 4.00 ± 0.00 (other education level had both minimum and maximum point of 4.00). Across the group categories the minimum point was 1 and the maximum was 9.

There was no significant difference among the category of shared income for food (p=0.2855). The mean minimum was 3.33±1.44 from more than half of the income food shared group. The mean maximum was at 3.81±1.44 from very limited part of the income for food shared (this category had minimum 2 and maximum points 6). The minimum point across the group was 1 and maximum 9 points.

There was a significant difference (p=3.6e-05 or 0.000036) in the group determining food needs. The lowest mean minimum point was 3.25± 1.24 (from the group that experienced serious food shortages) to a mean maximum of 6.00 ±0.00 (from the group that had more than enough food). This group also had both minimum and maximum point at 6 points. The minimum point of the category was 0 and maximum 9 points (Figure 41).
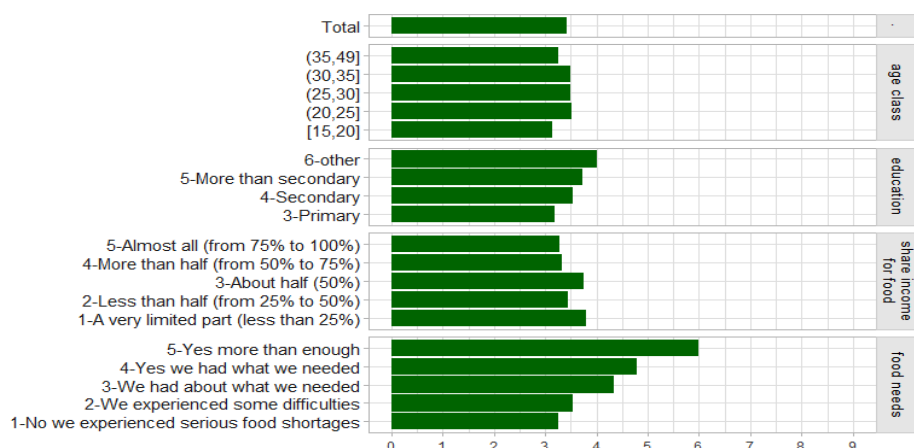
Figure 41. NCD-Protect score by age class, education level and share of income for food purchase - average values.

 2.6.3.6 NCD-Risk score

The NCD-Risk score had a mean of 1.14±1.59 for the study population, meaning that most of the respondents sometimes or never consumed food not recommended by GDR. In the

age class all the categories had mean NCD-Risk score ranging from 0.75±1.23 (15 to 20 years) to 1.27±1.68 (20 to 25 years) and there was no significant difference (p=0.2233) among the age class group category. The minimum across the group was 0 and maximum 8 score.

There was a significant difference (p=0.0011) in the NCD-Risk score among the education level categories. Primary level education had 0.89±1.68 and highest from other education level of 1.50 ± 1.70 (post-secondary education level). Across the group categories the minimum point was 0 and the maximum 8.

There was no significant difference among the category of shared income for food (p=0.1297). The mean minimum was 0.99±1.43 from (almost all the food income food shared group). The mean maximum was at 1.85±2.05 from very limited part of the income for food shared. The minimum point across the group was 0 and maximum 8 points.

There was a significant difference (p=3.8e-06 or 0.0000) in the group determining food needs. The lowest mean minimum point was 0.92±1.36 (from the group that experienced serious food shortages) to a mean maximum of 3.00±0.00 (from the group that had more than enough food). This group also had both minimum and maximum point at 3 points. The minimum point of the category was 0 and maximum 8 points (Figure 42).
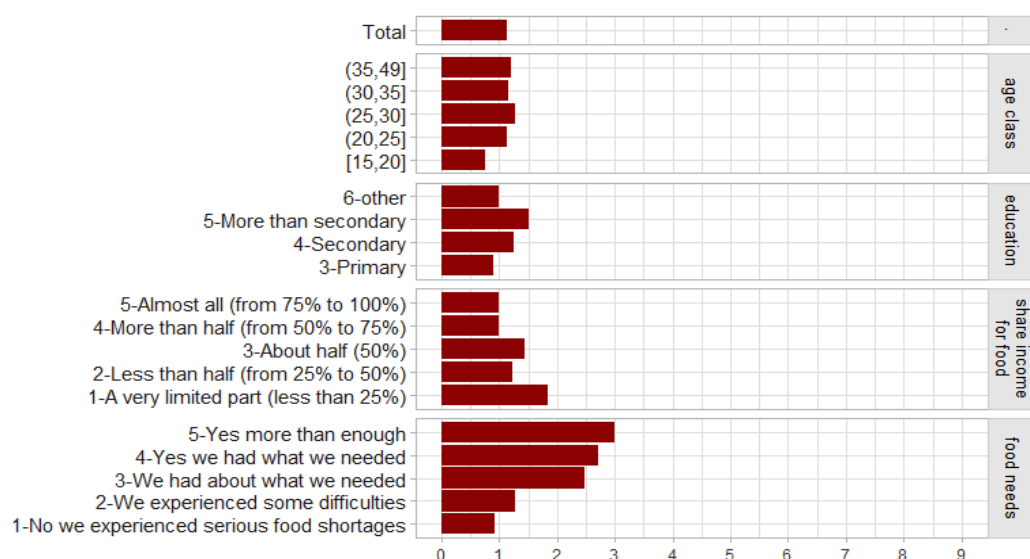
Figure 42. NCD-Risk score by age class, education level and share of income for food purchase - average values

2.6.3.7 GDR score

The GDR score had a mean of 11.29±1.57 for the study population. In the age class all the categories had mean GDR score ranging from 11.06± 1.53 (35 to 49 years) to 11.40± 1.57 (15 to 20 years) and there was no significant difference (p=0.2233) among the age class group category. The minimum across the group was 7 and maximum 15 score. There was a significant difference (p=0.0011) in the GDR score among the education level categories. Post-secondary education was lowest with 11.23±.1.81 and highest from other education level of 12.00 ± 1.41 (post-secondary education level the minimum score was 11 and maximum of 13). Across the group

categories the minimum point was 7 and the maximum 16. There was no significant difference among the category of shared income for food (p=0.1297). The mean minimum was 10.96±1.60 from (less than half of food money shared group). The mean maximum was at 11.33±2.05 from more than half of food income shared. The minimum point across the group was 7 and maximum 16 points.

There was a significant difference (p=3.8e-06 or 0.0000) in the group determining food needs. The lowest mean minimum point was 10.87± 2.14 (from the group that had about all food they needed) to a mean maximum of 12.00±0.00 (had more than enough food). This group also had both minimum and maximum point at 12 points. The minimum point of the category was 7 and maximum 16points (Figure 43).
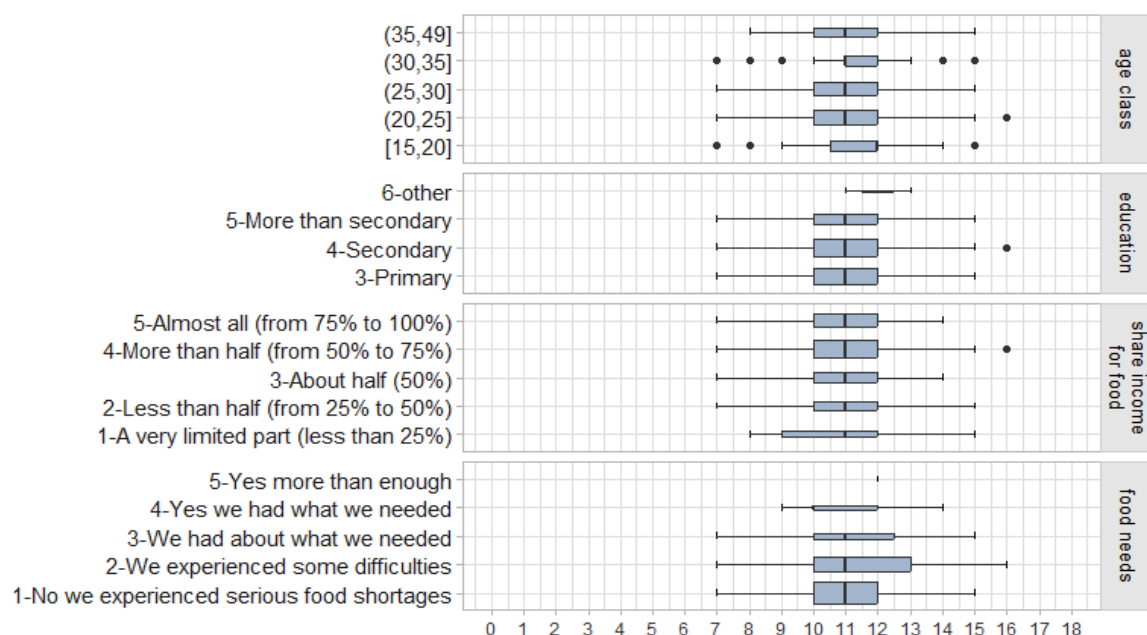
Figure 43. GDR score by age class, education level and share of income for food purchased

2.6.4 Conclusions

2.6.4.1 Conclusions on the Research question

- Women consumed limited animal sources foods even though milk is added into tea or coffee it is in negligible quantities. Consumption of cereal staples is high as expected, however, the accompaniment of legumes in a meal was much less. On the other hand, consumption of fruits and vegetables is unexpectedly high, notably because the study period was during the wet season and mango season.
- The MDD-W is quite high for the rural set up, and education levels had an important impetus for higher scores, but the less than half of population was meeting the ALL-5 food groups score. In addition to education level, high exposure to food shortages was an important contributor to meeting ALL-5 score by the mothers.
- The GDR score for the women population was quite high as expected for the people in the rural areas who were generally depending on either farm production, or with a high share of income allocated for purchase of food.

2.6.4.2 Policy recommendations

- The community needs to increase the consumption of animal sourced foods to improve their diet quality.
- The population needs to be cushioned against food shortages – either by innovative ways of food preservation and processing. The County and National government should initiate food policy framework that compel traders to have nutritious and safe foods in the markets. In addition, agricultural extension should be revived at the county level so as to support farmers in innovative food systems that are resilience to climate change.
- County government needs to promote increase of linkages among mothers through women group associations for information sharing and education - on dietary diversity, nutrient adequacy, income or money saving culture, agricultural practices and maternal childcare practices.

2.6.4.3 Recommendations for the project FoodLAND

- The project FoodLAND can enhance the capacity building of the community to be able to eat more of the animal sourced foods and/or introduce of nutrient dense novel food products through engagement of Community Health Volunteers (CHVs). This can be achieved through development of training materials for the CHVs and support of community dialogue meetings. In such dialogue meetings women can be taught on reduction of consumption of risky foods, intake of protective foods, nutrient-dense foods, food processing for preservation, food choice behavior change, table banking, income generation activities, income saving culture, and even agricultural activities such a kitchen gardens and uptake of quinoa crop in the region. The women can be organized into groups at the village level or even at the community unit level.
- The project FoodLAND can support the development of a mobile application to link the women groups to enhance nutrition information sharing among the groups spearheaded by the community health volunteers as well to increase associations or cooperatives among the women in the area. This will enhance sharing of success stories from the different community dialogue days.
- The project FoodLAND can support support mainstream media (local dialect radio and television) transmission of nutrient adequate information for nutrition in the life-cycle.
- The project FoodLAND can revisit periodically the community to assess the diet quality of the mothers during the dry season, when there are less vegetables and fruits expected in the farms.

2.6.5 References

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2.7 Food and drink consumption among children aged 6 -24 months, in rural Kitui County

Authors: Wambui Kogi-Makau, Dasel Wambua Mulwa Kaindi, Linet Thuku, Sophia Ngala, Jeff Wamiti, and Evans Chimoita (UoN)

2.7.1 Introduction

Food and drink consumption among children aged 6 – 24 months in rural communities remains varied in Kenya with most of the foods consumed being cereal based with minimal consumption of micronutrient-dense fruits (Huffman, Oniang, & Quinn, 2014; KNBS & ICF Macro, 2010) This exposes the children to various forms of both chronic and acute malnutrition. Malnutrition among children in Kenya remains a serious health problem that requires sustainable interventions to resolve. Among children, wasting and iron deficiency are the main forms of malnutrition that compromise growth, development, and survival (WHO, 2012). In Kenya, 22 % of children aged 6 – 24 months are iron deficient while 13.3 % have iron deficiency anemia (MoH, 2011). Approximately 35 % of children between the ages of 12 – 23 months are iron deficient in Kenya. There is no significant difference in the prevalence of iron deficiency between children living in rural (22 %) and urban (23 %) areas (MoH, 2011). Signs and symptoms related to iron deficiency include pallor, fatigue, irritability, susceptibility to infections, abnormal rapid breathing and unusual cravings for non-food items. Iron deficiency in children is associated with delayed cognitive development resulting in long-term impaired learning ability and school performance that can last up to five years (Moy, 1999). Iron deficiency also puts children at a risk of slowed physical growth and development as well as anorexia (loss of appetite) which can compromise food intake resulting in wasting (Moy, 1999).

Wasting is a form of acute malnutrition that occurs mainly due to an acute failure to receive sufficient nutrition. Wasting can also be brought about by a recent illness that inhibits nutrient intake and utilization or that accelerates nutrient losses especially through diarrhea and vomiting (WHO, 2005). In Kenya, four percent of children under the age of five years are wasted (KNBS, 2015). Wasting undermines children's physical and mental growth and thus impairs motor and cognitive development. This compromises a child's learning ability and school performance (WHO, 2012). In addition, wasting compromises a child's immune system increasing the frequency, severity and duration of infections and thus increasing the risk of childhood death (WHO, 2012). To fill this gap, **the aim of this study is assessing food and drink consumption patterns among children aged 6 -24 months**, in rural Kitui County, Kenya.

2.7.2 Methodology

For information on the study area, the data collection process, and the data analysis please refer to section 2.6.2.

2.7.3 Results

2.7.3.1 Eating habits - children (feeding immediately after birth and current breast- and bottle feeding)

Almost all the children had been breastfed (98.6%) in the study population. Half of the children were put to the breast (54.5%) while about 29% were put to the breast in less than 24 hours. In the first 2 days after delivery, 90.7% were not given anything other than breastmilk to eat or drink. Those children who were given any other thing was less than 10% (9.3%). About 72% of the

children were breastfed the previous day (yesterday). A proportion of 72.4% children did not drink anything from a bottle with a nipple the previous day/yesterday during the day or at night.

 2.7.3.2 Eating habits - children (questions about liquids)

About all the children drank plain water (95.3%). About half of them (51.7%) drank milk from animals. Tea, coffee, or herbal drinks was given to 43.8% of the children while 36.6% were given clear broth or soup to drink. All the other category of liquids given to children fell below 11.8% (e.g., formula) (Table 16).

Table 16. Liquids that your child may have had yesterday during the day or at night

variable	N	% no. of respondents
01.Plain water	511	95.3
02.Formula	63	11.8
03.Milk from animals	277	51.7
04.Yogurt drinks	62	11.6
05.Chocolate-flavoured drinks	21	3.9
06.Fruit juice or fruit-flavoured drinks	39	7.3
07.Sodas, malt/sports/energy drinks	42	7.8
08.Tea, coffee, or herbal drinks	235	43.8
09.Clear broth or clear soup	196	36.6
10.Any other liquids	1	0.2
Total Respondents	536	100

2.7.3.3 Eating habits -children (DQQ for children)

The Diet Quality Questionnaire (DQQ) is a standardized survey tool that was developed to capture local food intake realities and interpret the diet quality. Assessing both positive and negative features of diet quality is critical to understanding the foundation of poor nutrition outcomes and health. The food and distribution in the study population is typical of a rural population in a developing country. The staple from grain is usually the highest at 84.0%, followed by other vegetables at 76.1%, fluid milk 72.4%, vitamin A – rich fruits at 67.4% (mango season was on), sweetened tea/coffee/milk drinks 52.6%, white roots/tubers 47.8% and legumes at 46.5%: Legume dishes are very popular in the study. The local tribe is known for local indigenous poultry rearing, but the local consumption of the same is poor (2.6%) (Figure 44).
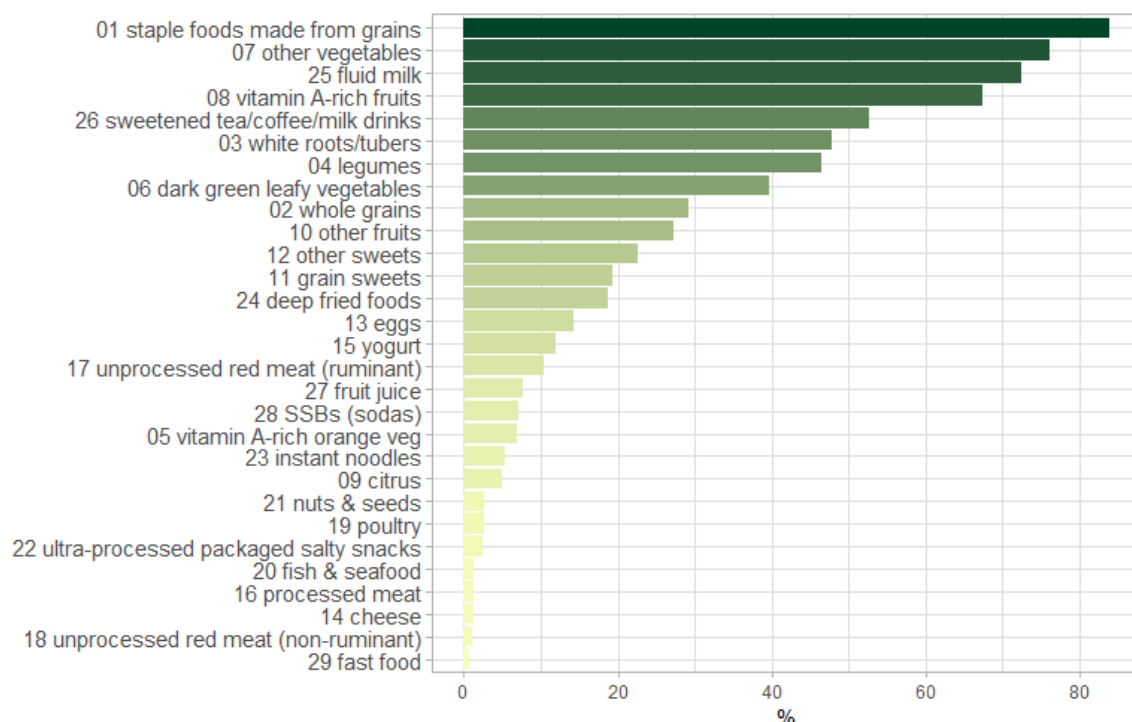
Figure 44. Foods and drinks consumed by the children.

2.7.3.4 Child Food Group Diversity Score (FGDS)

The FGDS for the study respondent children was skewed to the left, with a mean of 4.61±1.88. In the mother's age class all the categories had mean FGDS ranging from 4.16±1.68 (15 to 20 years old) to 4.85±1.87 (30 to 35 year old s) and there was no significant difference (p=0.0717) among the mother's age class and the FGDS of their children.

There was a significant difference (p= 0.00026) in the Child FGDS among the mother's education level category. Primary education was lowest with 4.19±1.84 and highest from other education level of 6.00±0.00 (other education category, level the minimum score was 6 and maximum 6). Across the group categories the minimum point was 0 and the maximum 10 FGDS.

There was no significant difference in the Child FGDS among the category of shared household income for food (p=0.0900). The mean minimum was 4.47±1.88 from (almost all the food income shared group). The mean maximum was at 4.65±2.40 from very limited part of the food income shared. The minimum point across the group was 0 and maximum 10 FGDS.

A significant difference was found (p< 0.00001) in the Child FGDS in the group determining food needs. The lowest mean minimum point was 4.31±1.78 (from the group that experience serious food shortages) to a mean maximum of 7±0.00 (had more than enough food). This group also had both minimum and maximum point at 7 FGDS. The minimum point of the category was 0 and maximum 10 FGDS.

Figure 45. Child Food Group Diversity Score (FGDS) by mother's age class, education level and share of income for food purchasing.

2.7.3.5 Child All-5: Consumed all five recommended food groups

The five food groups include: grains, vegetables, protein food sources, dairy products, and fruits. Each food group consists of various foods which are similar in nutrition make up and they play a significant role in healthy eating patterns. Food groups simplify dietary recommendations by focusing on foods rather than nutrients. As shown, the majority (68%) of the children; that is two out of every three children; did not consume all five recommended food groups with only 32% meeting the above-mentioned requirements (Figure 46).

According to Figure 46 for all categories, the children who consumed all the five food groups in the 24-hour period were less (171) than those who did not (364). In the mother's age class category, 25-30 years (51 consumed but 111 children not consumed) had the most respondent stating that they had not consumed 5 food groups followed by 25-30 years category (78 out of 147). A similar number of respondents, 135 in both the primary (out of 209) and secondary education (out of 258) attainment had children who did not consume the five food groups. In the category where the respondents had obtained a post-secondary education 40 respondent compared to 26 stated that they had consumed the recommended food groups.
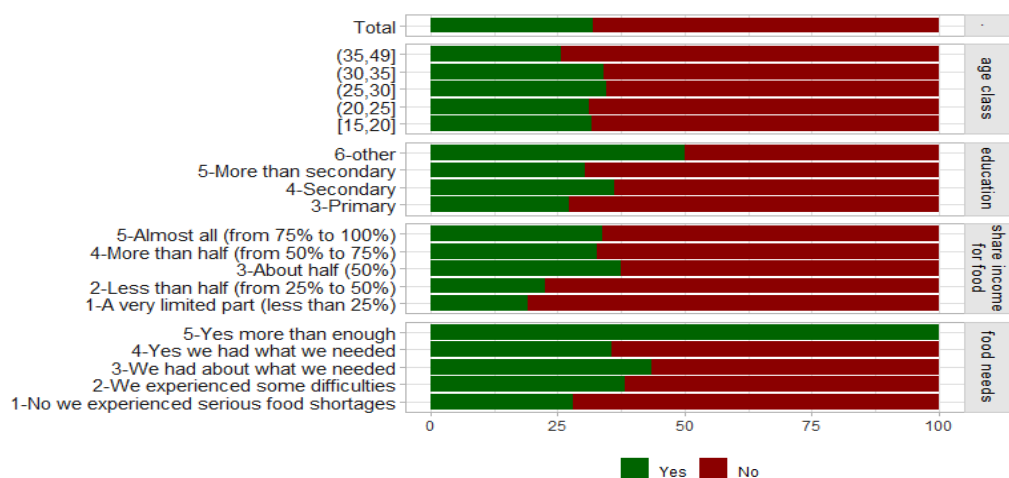
Figure 46. Child consuming all five recommended food groups (All-5) by mother's age class, education level and share of income for food purchasing.

Table 17 shows the Children All-5 by mother's age, education level and share of income for food purchasing. Children All-5 is the lowest for the mother's age class category of 25-35 years old (65.3% and 35-49 years old (74.3%). Yet, no significant difference was found between those who consumed the 5 food groups and those who did not (p=0.7339).

Regarding the mother's education category, there was no significant difference between those children who had not consumed 5 food groups and those who had (p=0.2145). The proportion of children who had not consumed 5 food groups was higher for mothers with primary (72.7%) and post-secondary (69.7%) education levels but lower in the 'other' category (50.0%).

In the shared income for food groups, the children who had not consumed the 5 food groups had higher proportions than the children who had. The proportions of the children who had not consumed 5 food groups (in the last 24 hours) ranged from 80.8% being highest to 62.5% lowest. However, the difference between categories was not significant p= 0.2092.

There was a significant difference in the food needs variable, between those who consumed the 5 food groups and those who did not p =0.0704. The children who experience serious food shortages 71.9% and those who had difficulties meeting food needs 61.8% did not consume 5 food groups. However, in the variable food needs, those who had about all the food they needed and consumed 5 food groups were 73.9% and those children who had all they needed 71.4% and consumed the 5 food groups were higher than those who had not consumed the 5 food groups.

As shown in Table 17, children whose mothers have an age comprised between 20-25 and 25-30 years old, had the highest consumption of food from the five recommended food groups (50 and 51%) respectively. In addition, most children from mothers who had attained secondary education (93%) consumed the five recommended food groups. Most children experienced severe food shortages (97%). There was however no significant difference between children from mothers of different age class, education level, share of income for food purchase and experienced food needs with consumption of the five recommended food groups.

It is important to note that, even though, age, education, share of income apportioned for food and food need were not significant for FGDs for children, Education (Kruskal-Wallis 13.49, p-value 0.0037) and food needs (Kruskal-Wallis 10.89, p-value 0.0278) were significantly associated with consumption of all-five food groups score.

Table 17. Child consuming all five recommended food groups (All-5) by mother's age class, education level and share of income for food purchasing.

	No		Yes			
	Number	Percent	Number	Percent	X2 statistic	p-Value
Total	364	68	171	32		
age class					2.01	0.7339
[15,20]	43	68.3	20	31.7		
(20,25]	111	68.9	50	31.1		
(25,30]	96	65.3	51	34.7		
(30,35]	62	66	32	34		
(35,49]	52	74.3	18	25.7		
education					4.48	0.2145
3-Primary	152	72.7	57	27.3		
4-Secondary	165	64	93	36		
5-More than secondary	46	69.7	20	30.3		
6-other	1	50	1	50		
share income for food					5.87	0.2092
1-A very limited part (less than 25%)	21	80.8	5	19.2		
2-Less than half (from 25% to 50%)	45	77.6	13	22.4		
3-About half (50%)	55	62.5	33	37.5		
4-More than half (from 50% to 75%)	159	67.4	77	32.6		
5-Almost all (from 75% to 100%)	84	66.1	43	33.9		
food needs					8.65	0.0704
1-No we experienced serious food shortages	248	71.9	97	28.1		
2-We experienced some difficulties	94	61.8	58	38.2		
3-We had about what we needed	13	56.5	10	43.5		
4-Yes we had what we needed	9	64.3	5	35.7		
5-Yes more than enough	0	0	1	100		

2.7.3.6 Child NCD-Protect score, NCD-Risk score, and Global Dietary Recommendations (GDR)

NCD-Protect score

The NCD-Protect score refers to an indicator of dietary factors that are protective against non-communicable diseases (NCDs). The score is based on consumption of food groups including: fruits, whole grains, vegetables, nuts and seeds, pulses as well as fibre. When distributed against variables of interest the mean value of the NCD-P for children ranged between 2.67 – 3.14 of the mother's age class, 2.73 – 3.50 of the education level of the care giver, 2.83 – 3.31 for the share of income of food and 2.86 – 5.00 for food needs (Figure 47). A significant difference was found between NCD-Protect Score and the mother's education level (p = 0.0037) as well as with the household food needs (p = 0.0278). No significant difference in NCD-Protect score and the mother's age class (p = 0.2581) as well as share of income for food (p = 0.0615) was found.
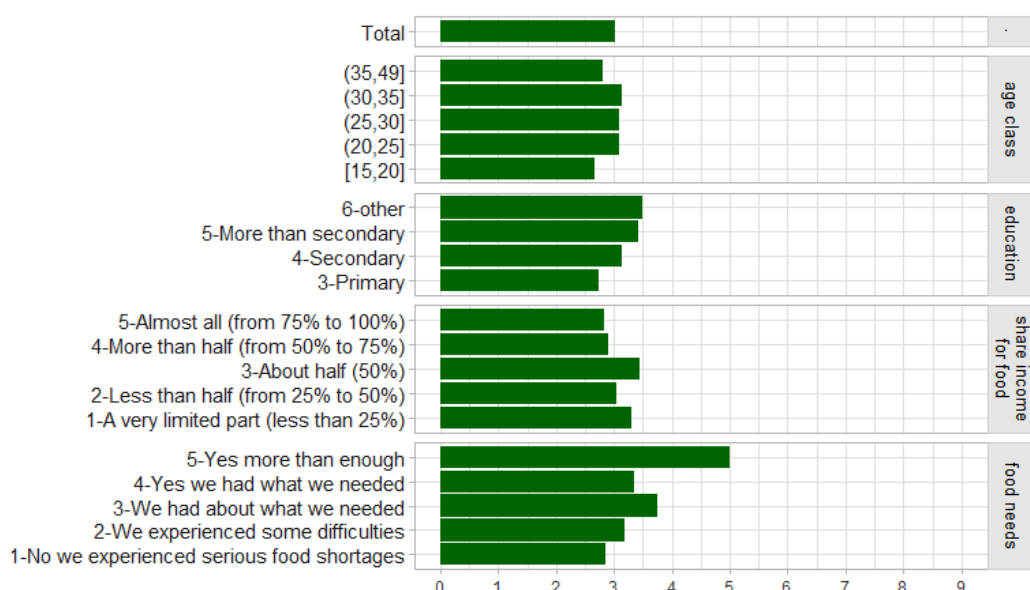
Figure 47. Child NCD-Protect score by mother's age class, education level and share of income for food purchasing - average values

NCD-Risk Score

The NCD-Risk Score is a standardized method for collecting data, on key NCD risk factors among populations analyzing and disseminating. The tool covers key risk factors for NCDs among them: unhealthy diets, physical inactivity, obesity, and abnormal blood lipids. The mean NCD-risk score for children varied depending on different variables of interest related to the mothers (Figure 48). By mother's age class, the mean was highest among caregivers aged between 25, 30 (1.20) and lowest among those aged 15, 20 (0.71).

Mothers who have attained only primary education had the lowest mean NCD-Risk score for their children (0.79) while those that attained more than secondary had the highest mean score (1.20). Households that had about 50% of the share of income for food had a higher NCD-Risk score (1.96) compared to those who more than half (50 – 75%) of their income was shared for food (1.23). Households that experienced severe food shortages had a low NCD Risk-score (0.81) compared to those that had more than enough food (3.00) (Table 18). As shown in Table 19,

NCD-Risk score was significantly related to education level of the caregiver (0.0400) and the share of income spent on food (0.0209).
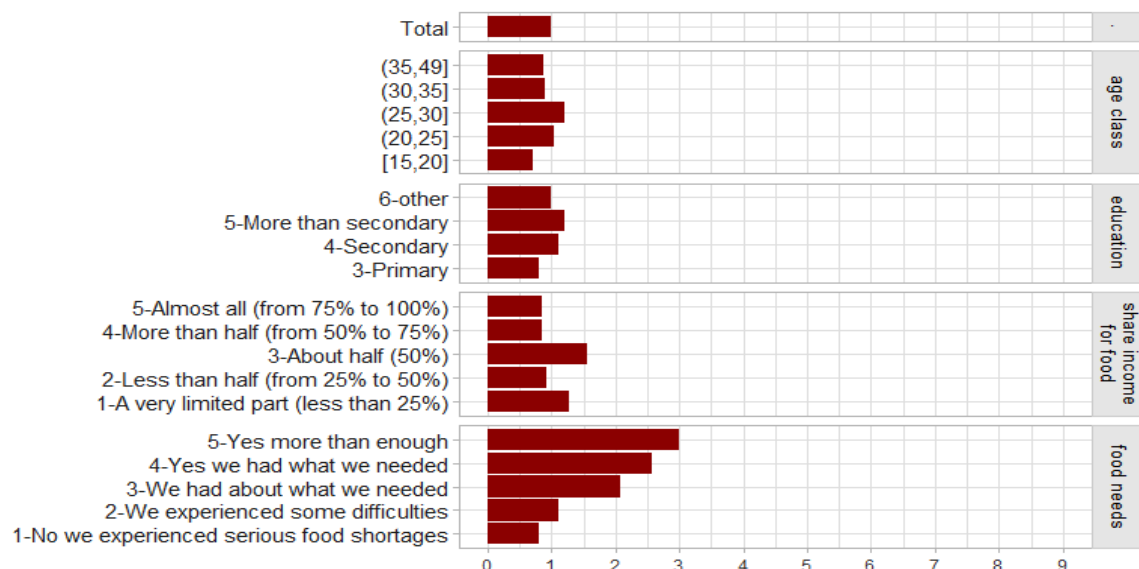
Figure 48. Child NCD-Risk score by mother's age class, education level and share of income for food purchasing - average values.

Table 18. Child NCD-Risk score by mother's age class, education level and share of income for food purchase - summary statistics.

variable	levels	n	perc	mean	st.dev	min	Q1	median	Q3	max
age class	[15,20]	63	11.8	0.71	1.10	0	0.00	0	1.00	5
	(20,25]	161	30.1	1.04	1.49	0	0.00	0	2.00	8
	(25,30]	147	27.5	1.20	1.64	0	0.00	1	2.00	8
	(30,35]	94	17.6	0.89	1.39	0	0.00	0	1.00	8
	(35,49]	70	13.1	0.87	1.43	0	0.00	0	1.00	6
education	3-Primary	209	39.1	0.79	1.24	0	0.00	0	1.00	6
	4-Secondary	258	48.2	1.10	1.66	0	0.00	0	2.00	8
	5-More than secondary	66	12.3	1.21	1.33	0	0.00	1	2.00	5
	6-other	2	0.4	1.00	0.00	1	1.00	1	1.00	1
share income for food	1-A very limited part (less than 25%)	26	4.9	1.27	1.87	0	0.00	0	2.00	6
	2-Less than half (from 25% to 50%)	58	10.8	0.91	1.47	0	0.00	0	1.00	7
	3-About half (50%)	88	16.4	1.57	1.96	0	0.00	1	2.00	8
	4-More than half (from 50% to 75%)	236	44.1	0.86	1.23	0	0.00	0	1.00	7
	5-Almost all (from 75% to 100%)	127	23.7	0.84	1.32	0	0.00	0	1.00	6
food needs	1-No we experienced serious food shortages	345	64.5	0.81	1.21	0	0.00	0	1.00	7
	2-We experienced some difficulties	152	28.4	1.10	1.57	0	0.00	0	2.00	8

variable	levels	n	perc	mean	st.dev	min	Q1	median	Q3	max
	3-We had about what we needed	23	4.3	2.09	2.47	0	0.00	1	3.00	8
	4-Yes we had what we needed	14	2.6	2.57	2.21	0	0.25	3	4.75	6
	5-Yes more than enough	1	0.2	3.00		3	3.00	3	3.00	3
Total	Total	535	100.0	1.00	1.47	0	0.00	0	2.00	8

Table 19. Test on relationship between NCD-Risk score and the following variables:

variable	test	statistic	df	p.value	signif
age class	Kruskal-Wallis	6.05	4	0.1954	
education	Kruskal-Wallis	8.31	3	0.0400	*
share of income for food	Kruskal-Wallis	11.56	4	0.0209	*
food needs	Kruskal-Wallis	20.62	4	3.8e-04	***

<u>GDR score</u>

The GDR score had a mean of 11.29±1.57 for the whole children population in the study. In all mother's age class the mean GDR score ranged from 10.94±1.66 (mothers between 35 to 49 years old) to 11.24±1.57 (mothers between 30 to 35 years old) and there was no significant difference (p=0.1954) among the mother's age class group categories. The minimum across the group was 7 and maximum 15 score (Figure 49). A significant difference was found (p=0.04) for the Child GDR score when compared with the mother's educational level. Mothers who had attained primary education had the lowest GDR score (10.94±.1.6)

A significant difference was also found when relating the GDR child score shared household income for food (p=0.0209). The mean minimum was 10.88±1.70 from (about half money (50%). The mean maximum was at 11.14±1.14 for less than half (from 25% to 50%) of money spent on food. The minimum point across the group was 7 and maximum 15 points. There was a significant difference (p=3.8e-04) in the group determining food needs. The lowest mean minimum point was 9.79± 1.72 (from the group that had about all food they needed) to a mean maximum of 11.09±1.66 (We experienced some difficulties).
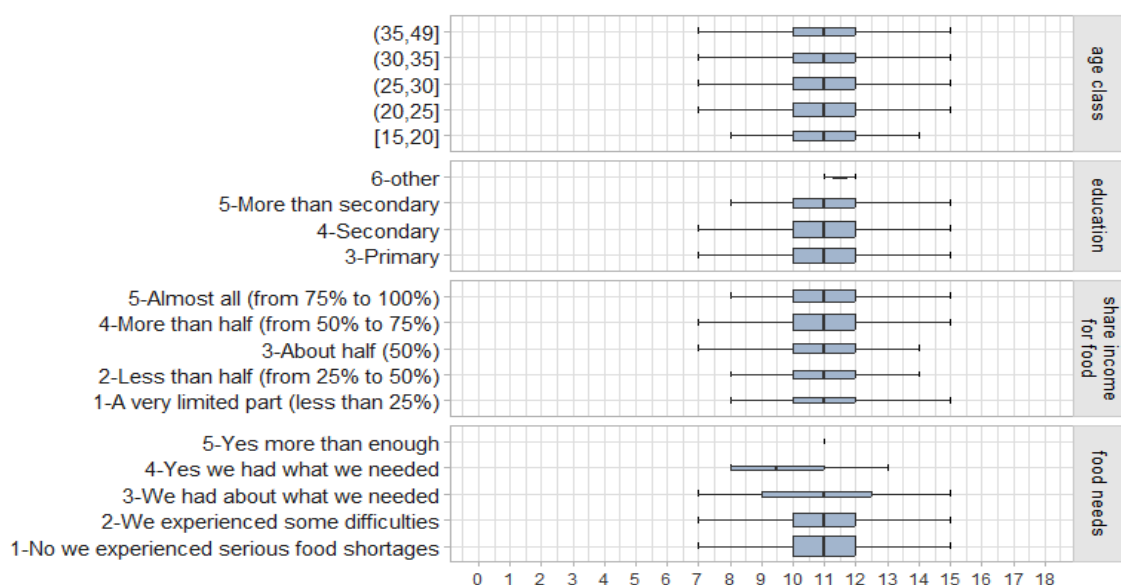
Figure 49. Child GDR score by mother's age class, education level and share of income for food purchasing.

2.7.4 Conclusions

2.7.4.1 Conclusions on the Research question

Within Kitui County, the desired practice of breastfeeding is universal with almost all the children experiencing breastfeeding. The discouraged practice of bottle-feeding lies within the confines of less than a third of the child population. **These two early childhoods feeding practices must be protected and continuously promoted. Implement actions to sustain both the practice of universal breastfeeding through continuous encouragement and the other persistent discouragement of bottle-feeding.**

In a twenty-four-hour food consumption span, two thirds of children are unlikely to consume the recommended five food groups. Education level of caregivers influences child's dietary quality where higher education implies a likelihood of consumption of a higher number of good groups. There is need to establish whether the mothers with low education are less aware of the needed levels food diversity. **Nutrition education should target creation of enhanced understanding of the quality of food groups and the reason why at least five groups are recommended**.

Overweight and Obesity (O&O) are somewhat neglected dimensions of malnutrition that need profound strategic policies. **Policies that expose (O&O) must be put in-place to moderate the thinking that malnutrition in Kitui County is confined to only undernutrition**.

The Minimum dietary diversity for the child needs to be recalculated based on 7 food groups and breastfeeding as the 8 group. The computation is done differently from that of the mothers. As it is the children ate poorly than the mothers.

2.7.4.2 Policy recommendations

- The Ministry of Health should develop a policy that when children are taken for vaccination and growth screenings, the nutritionists can take advantage of it for educating mothers on

Minimum adequate diet and especially encourage consumption of animal sourced foods to improve the diet quality of children.

- The Ministry of Agriculture should use food systems approach to ensure that foods are available in households or even in the markets to cushion community against food shortages and come up with interventions to support food security of households with children and other vulnerable members of the households.
- County government might initiate school feeding programs to increase diet diversity and micronutrient fortification of school meals.

2.7.4.3 Recommendations for the project FoodLAND

- FoodLAND should have a training of food processors in the hub on nutrient-dense food formulation, processing, and food preservation especially vegetables, fruits and animal sourced foods to be included in the developed novel foods.
- The FoodLAND Project should support introduction of nutrient dense novel food products for the school feeding programmes.
- The FoodLAND Project should support the initiation of kitchen gardens and rearing of small animals to boost child diet quality.
- The FoodLAND Project should support the introduction of nutrient dense food crops that are drought tolerant such as quinoa for adoption as a food security crop.
- The FoodLAND Project should support training on Food policy formulation and implementation to County government officials and stakeholders so that interventions can be within the stipulated policy frameworks especially regarding food security, diet quality, and food preservation.

2.7.5 References

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2.8 Rural consumer research: evidence from Beni Mellal Food Hub, Morocco

Author: Noureddine Mokhtari (ENAM)

2.8.1 Introduction

The specific objectives of the rural consumer research were to **assess the welfare situation of children and women of childbearing age (16-49)** based on a standardized questionnaire for all African partner countries. The list included indicators to assess market dependency for food products, food choices, and habits, including the quality of local diets, information on household social profiles, and issues related to empowerment, participation in the community, and women's role in decision-making.

In this study we covered 3 communities in the rural area of Dir Beni Mellal (Province of Beni Mellal; Figure 50). The set of indicators identified concerned mainly the nutrition and well-being of children under 2 years of age and their mothers. It also covered aspects of the assessment of the household's situation in terms of access to nutrition and resources, income levels, gender equity, and the assessment of future concerns and risks. **The information provided by this work will help us to propose plans and programs and to report on progress in improving the situation of rural women of childbearing age**.

This paper presents the demographic profile and socio-economic characteristics of the sampled households covered by the woman-child survey. The demographic profile and socio-economic characteristics include the composition of the household in terms of ages and sexes, the educational attainment of women, and information on social groups and community integration. We will also provide an overview of the socio-economic characteristics of the household based on key parameters such as income levels, level of food self-sufficiency, and available resources.

The information gathered **is intended to help interpret key demographic, socio-economic, and other characteristics of the well-being of children and young women in order to suggest ways to improve the quality of life of women and children in general in terms of nutrition, improved equity for women, and the sharing of resources and decisions within rural households in the whole region**.

2.8.2 Methodology
2.8.2.1 Study area presentation and context

The study area concerns the northern piedmont of transition between the morphologies of plain and mountain (Figure 50 and Figure 51). The foothills, or Dir4, is a place of fruit trees and olive forests that cling to the low slopes and spread into the plain. It is characterized by a permanent greenness, explained essentially by the abundance of water and the fertility of the soil. One of the characteristics of this area is the presence of a transition zone between the Atlas and the plain of Tadla. It is an inclined accumulation plane a few kilometers wide, consisting of the coalescence of alluvial cones supported on the detrital formations Mio Pliocene that form the bedrock of the plain.

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[4] Dir: means "belt". On the slopes of the High Atlas, this term refers to an area of low and medium hills and alluvial cones that operate the transition between the high limestone mountain and the plain. The soils are relatively rich. Karstic springs with regular and abundant flow gush out there. The space is judiciously distributed between small perimeters irrigated by a traditional system of seguias (orchards and intensive horticulture), non-irrigated fields, wooded areas and rangelands.

The Dir, especially developed north of Beni Mellal, receives water from the Atlas either through springs or through the effusion of the Jurassic water table under the alluvium. We can distinguish two piedmonts:

- The Northern piedmont: is located in the province of Beni Mellal. It extends between Tisqui and Zaouïa Cheikh and benefits from abundant rainfall and is the subject of our investigation.
- The southern Piedmont is located in the province of Azilal. It benefits from a significant rainfall but less than that of the northern Piedmont.

Projections based on data from 2014 (RGPH, 2014), indicate that the region's population would increase from 2.5 million in 2014 to 2.7 million in 2030, representing an overall growth rate of 8%. The average annual growth rate would be 0.52%, which means that an additional 13,700 inhabitants would be added to the population on average each year. In terms of demographic weight, the region of Beni Mellal Khenifra, which represented 7.5% of the total population of Morocco in 2014, would see its weight decrease slightly to almost 7% in 2030.

Figure 50. Region study area – Beni Mellal – Khenifra
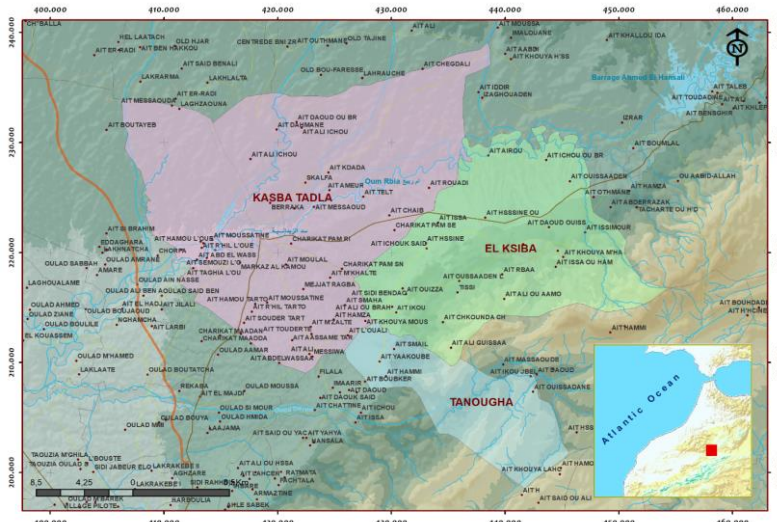
Figure 51. Study area - rural municipalities

2.8.2.2 Data collection procedures

The study was conducted in the rural area of Beni Mellal (Morocco) in 3 rural communes of the High Atlas foothills. The sample size consisted of rural women with a child under 24 months of age, aged between 15 and 49 years (reproductive age). A team of local interviewers was trained to translate the questions into the local language and was composed mainly of girls to facilitate communication with the women.

The entire questionnaire and diet texts were translated into Arabic, and the diet tables were adapted to the country's food context (ingredients). The data was recorded using a web-based application developed as part of the FoodLAND project and was used to verify the information provided in a consolidated manner and validate the quality of the data at the country level. In addition to socio-demographic variables, the survey collected data on all aspects related to the quality of life, empowerment, and the perception of women's role in the community.

2.8.3 Results
2.8.3.1 Household composition and size

Household size

Age and sex are the two most important demographic variables that form the basis of demographic classifications in vital statistics, censuses, and surveys. The age structure of the households surveyed in the region is typical of a society with an equilibrated population. It is evident that the pyramid is less broad, with the two lowest bases (0-2 years and 3-13 years) being narrow and almost at the same level as adults aged 14 and over, a pattern that is generally associated with a more rapid and recent decline in fertility. Roughly speaking, children under 14 years of age represent 53% of the population, while 46% of the households surveyed represent those over 14 years of age. The average household size was 5.52 for the entire survey sample.

It should be noted that the proportion of adults in the region as a whole (aged 15 to 59) was 60.5% in 2014 and that the proportion of adults is much higher in urban areas than in rural areas (61.5% compared to 58.6%), mainly due to the rural exodus, which mainly affects people of working age. Women are more present than men (61.8% against 59.6%). This structure by sex and age shows a slight increase in proportions compared to our sample due to the targeting of households formed by young women of childbearing age.

The median and modal number of **household members for the sample is between 4 and 6** (Figure 52). Almost 63% of households have four to six members, while 23% have more than six members, and only 3% are two-person households. It is worth noting that in rural areas of Morocco, the proportion of households with more than five members is about 9 percentage points higher than in urban areas.
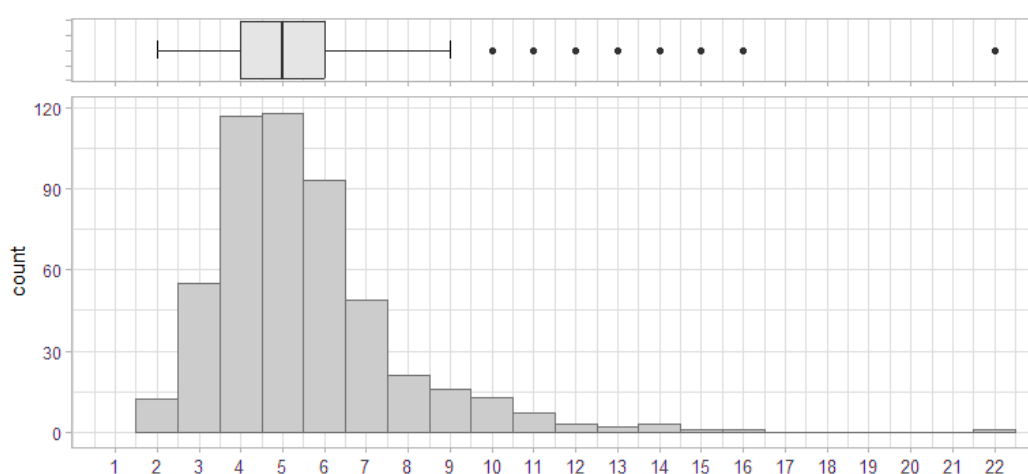
Figure 52. Household size - distribution

The profile of the head of household is essential to understanding the overall socio-economic context of households. In addition to age and gender distribution, other key factors such as social group, education level, and occupation determine the trajectory of the household and the possibilities for improving its well-being.

Number of children by household

Of the 512 households surveyed, the **average number of children was 2.37, with 2 as the median** (Figure 53). This implies that rural households practice family planning, which allows births to be limited in the region. The number of families with 5 or more children does not exceed 30, which represents less than 6% of the sample. A comparison of this figure with national statistics, shows that the number of children per household for the country is around 2.1 in 2021. Indeed, the fertility rate has declined from 2.2 children per woman in 2010 to 2.1 in 2021. Urban women are having fewer children than rural women (1.9 versus 2.4) (HCP, 2020). The results obtained therefore confirm this downward trend in fertility in rural areas and are in line with national statistics.

The family institution in Morocco today is very different from what it was a decade ago. These changes have profoundly altered the family structure, first because of the decline in the age at

first marriage, from an average of about 17.3 years for women in 1960 to 25.7 years in 2014, and secondly, the considerable role played by contraception. It was 19.4% in the early 1980s and has continued to increase to 70.8% in 2018 (HCP, 2022). However, it is also possible to consider an inverse causal relationship between the quality of life of agricultural populations and their fertility. It would be the deterioration of income, due to the shrinking of cultivated areas, which would cause an adjustment in the number of children, by delaying the age of marriage and the practice of contraception, to avoid the deterioration of living conditions. (HCP, 2011)
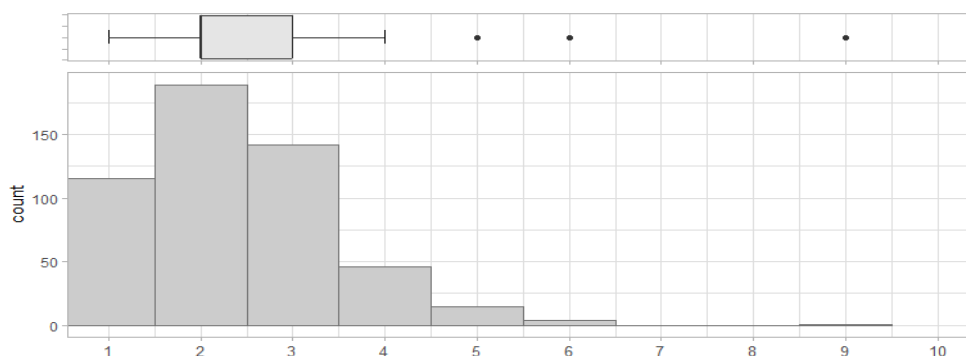
Figure 53. Number of children per household – distribution

Literacy and educational attainment

The importance of literacy for women needs no reiteration and is widely recognized. Women education is associated with several positive demographic, health, and nutritional outcomes. In this survey, women's literacy status was determined by their ability to read and write (illiterate and literate) and by levels of education between primary and more than secondary. The following table shows the proportion of women by education level.

Table 20. Respondents by education level

Levels	N	%
Illiterate	175	34.2
No qualification/literate	37	7.2
Primary	150	29.3
Secondary	90	17.6
More than secondary	54	10.5
Other	6	1.2
Total	**512**	**100.0**

Of the 512 young women surveyed, almost 35% were illiterate. Women with more than secondary education represent less than 12% of the surveyed population. **The overall literacy rate is about 65% if we consider all the women surveyed, including those with no qualifications**. This appears to be substantially low compared to the overall national objective of reducing the literacy rate to over 80%.

The obstacles that appear to prevent girls from enjoying their right to education are mainly related to socio-economic, cultural, and religious factors. Low enrolment and high drop-out rates among girls are due to early marriage and patriarchal ideology, which, in cases of low household income, tend to favor boys' access to education over girls'. Drop-out rates are higher in the transition from primary to secondary school if the possibilities of finding colleagues close to the place of residence

decrease. The continuation of girls' education seems to be linked to the family's assessment and perception of risks in the school environment, including distance and transport. According to Ennaji (2013), in the context of rural Morocco, unfortunately, for girls, access to school is much more difficult than for boys. Nevertheless, it should be noted that progress has been made in literacy, particularly for young people aged 15 to 24. Between 1990 and 2016, the youth literacy rate jumped from 29% to 62% for girls and from 55% to 82% for boys (RGPH, 2014).

The proportion of females with no schooling was lowest in the 15-20 age group, and as expected, it gradually increased in subsequent age groups. The educational attainment of those below primary school who had completed primary school was highest in the 20-25 age group, and for those who had completed secondary school in the 15-20 age group, indicating that school attendance and continuation of education to secondary school level have improved considerably among young women in recent decades.

There is a strong relationship between age and educational attainment (Pearson's Chi-squared test is highly significant), which is reflected in a decrease in school attendance with age (Figure 54). The percentage of women with primary and secondary education is highest in this rural area for the 15-20 age group and declines considerably as they move beyond secondary education, to only 7.7%. This shows the effect of marriage on further education for the specific case of our sample. Women who marry at an early age, even if they have been able to reach secondary school levels by more than 50% for the 15-20 age group, less than 8% of them manage to continue their studies while married.
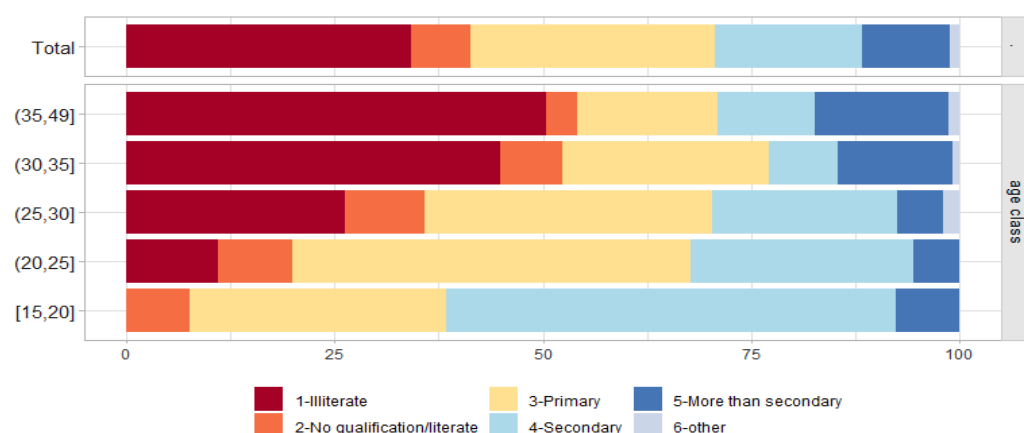
Figure 54. Education level by age class

Role in the household

The profile of the head of the household is essential for understanding the general socioeconomic context of the other members of the household and helps to map the proportion of female- and male-headed households. The status of women in the household varies considerably across the study area. **Only 11% of the women surveyed are heads of households**, while 85% are wives or related to the head of the household (Table 21). Given that household role is one of the main factors influencing the overall economic status of a household, these differences would have a profound impact on the levels of well-being and empowerment of the women and children surveyed.

Table 21. Respondents by role in the household

Levels	N	%
Household head	58	11.3
Head's wife/daughter/...	435	85.0
Head's relative	16	3.1
Other	3	0.6
Total	**512**	**100.0**

2.8.2.2 Employment and income

Women's employment (Respondents)

Most of the jobs of the women surveyed are in other jobs and housekeeping (93 %), followed by off-farm jobs (21 %) and informal and casual jobs (12 %). Wage-earning women represent only a small minority (3 %) (Table 22). Most women are not formally employed or outright unemployed (95 % reports no employment or informal/casual work). Female employees are generally better educated and older. This indicates that in rural areas, women from the poorest households are forced to work on a casual basis in low-paying informal sectors.

This confirms the results of previous work on the participation of Moroccan women in the labor market (World Bank, 2021). Indeed, the labor force participation rate of women in Morocco remains one of the lowest in the world. It has even regressed over the past 20 years, despite a higher GDP per capita, a lower fertility rate, and better access to education. With a rate of 21.6 % in 2018, Morocco ranked 180th out of a sample of 189 countries in 2018. In other words, 78.4 % of Moroccan women aged 15 to 65 were neither in the labor force nor looking for work.

It is noted that although the educational profile of the female population has improved, this has not translated into a greater proportion of educated women in the labor force. For example, 40% of unemployed women have a university education (while 8% have no education at all), and among employed women in rural areas (half of the employed women), 77% have no formal education and less than 1% have a university education. Although women have greater access to education, the participation rate of educated individuals has declined over time. Inactivity among women with a tertiary degree increased from 13 percent in 2010 to 19 percent in 2018 in rural areas and from 23 percent to 24 percent in urban areas over the same period. (HCP, 2020).

Table 22. Main forms of women's employment

Variable	N	% on respondents	single employment %
Farmer	2	0.4	100.0
Non-farm household employment	21	4.1	95.2
Off-farm regular worker	3	0.6	100.0
Off-farm informal/casual worker	12	2.3	91.7
Other	476	93.0	99.6
Total	**512**		

The household head's main employment

The employment status of the head of the household is critical for understanding the general socioeconomic context of the other household members. In addition to the age and gender

distribution, the education level of the head of the household determines the trajectory of the daily lives of the household members. In addition, it also helps determine the proportion of male-headed versus female-headed households.

The occupational status of the head of household varies considerably in our survey. While 4.6% reported being farmers, 36% of the household heads worked as self-employed (non-farm household employment) and 45% as workers in the informal sector or casual off-farm employment (Table 23 and Figure 55). Given that the level of occupation of the household head is one of the main factors influencing the overall economic situation of a household, these differences would have a profound impact on the levels of well-being of women and children identified in this survey.

The region's small rural centers have experienced a significant population surge in recent decades. Despite under-equipped public services and the lack of basic infrastructure, they have become more attractive to rural populations seeking new places to live. The pressure on very limited resources (especially agricultural land) has often led young rural people to move to nearby towns in the vicinity of their ancestral territories to benefit from the services offered (schools, health centers, labor markets, etc.) to be able to find and eventually cultivate their land in parallel with their non-agricultural activity.

We note that work in rural areas is mainly in the service sector and not in agriculture, as one might expect, especially in villages and rural settlements. This can be explained by the difficulty of accessing women of childbearing age, with a dependent child, and with a link to agriculture in the survey areas, since they are less accessible to interviewers than women located in rural centers.

Table 23. Household head's employment

Employment	N	%
Farmer	21	4.6
Non-farm household employment	165	36.3
Off-farm regular worker	26	5.7
Off-farm informal/casual worker	206	45.4
Other	36	7.9
Total	**454**	**100.0**
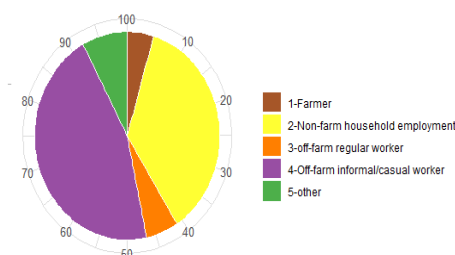
Figure 55. Household head's employment

Sources of household income

The data concerning the sources of household income shows that on average the total income is around 1740Dhs/household, of which approximately 90% comes from outside the farm (Table 24 and Figure 56). This confirms the previous results **concerning employment in rural areas, which is essentially non-agricultural**. Aid and external transfers are virtually absent. However, it should be noted that most of the women surveyed are distrustful about the declaration of monthly household income, either because they do not have a precise idea of it or because they do not have confidence in it.

Table 24. Average monthly household income from the different sources

Sources	Mean	st. Dev	min	Max
Farm income	141.67	215.45	0	550
Non-farm income	1,600.00	1,972.82	200	5,000
Remittances	0.00	0.00	0	0
Subsidy/aid	0.00	0.00	0	0
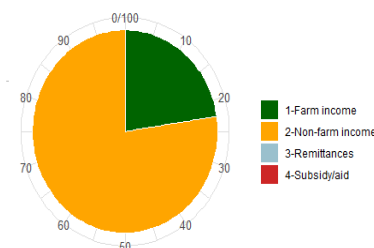
Figure 56 Average monthly household income

Sources	Mean	st. Dev	min	Max
Total	1,741.67	1,878.41	300	5,000

The analysis of the relationship between the age of the women surveyed and income levels shows that the **households of young women** (25-30) **have on average lower incomes** (< 1000Dhs) **than women over 35 years old** (>2500Dhs). This shows the difficulties of young couples in rural areas to meet their household needs, which could be explained by the difficulties of entering the labor market for young people.

Concerning the effect of the level of education on income, we note that **women with a primary level of education have higher income on average than other levels**, especially secondary education. This may be related to the labor market supply, which is more interested in primary school profiles that are less demanding in terms of salary but have a good level of operational skills. But this must also be analyzed in relation to the profile of the head of the household (generally a man) and its effect on income levels.

Analysis of the relationship between income levels and food shortages shows that, **overall, levels of food shortages are very weakly related to income levels** (not statistically significant). This may be because of self-consumption on household food shortage levels in rural areas, which reduces the dependence of households on cash income to meet their food needs.

2.8.2.3 Worries towards the future

Results show that almost all **households are very sensitive to the economic variables of prices, household income levels, and water availability** rather than events related to risk of land loss or disease infestation (Table 25). The economic crisis and inflation combined with the effects of last year's drought (2021-2022) seem to have increased household concerns about their near future, especially regarding food availability.

Table 25. Worries for the near future

Variable	mean
Food shortage/starvation	4.49
Infestation (insects, boars)/pest/fish disease	3.65
Dispossession of land	2.46
Cost increase (price of seed, fertilizer, feed)	3.91
Health (human disease)	4.34
Drinking water shortage	4.49
Climatic event (flood, drought, storm)	4.08
Loss of home	3.92
Increase of food prices	4.61
Loss of job	4.30
Income reduction	4.52
Social problems (theft, violence or crime)	3.94

Average values on a scale from 1: Not at all important to 5: Very important

2.8.2.4 Food choices

Origin of the household food

Morocco is experiencing a food transformation that affects both urban and rural areas. These changes in eating habits are the result of urbanization, economic growth, and the effects of changes in food availability (Allali, 2017). The Moroccan diet, typically Mediterranean, is based

on high consumption of cereals, fruits, and vegetables. There is a gradual diversification of diets, particularly in urban households and the upper socio-economic strata. Ready-to-eat meals and takeaway meals are becoming increasingly popular, encouraging the consumption of foods rich in sugar and cereals. This development reflects the ongoing nutritional transformation.

The portion of food products produced by households is very low overall and concerns only three categories of products: oils and fats, dairy products, eggs, and, to a lesser extent, cereals (Table 26). We note that for oils and in relation to dietary habits and production availability, households cover an average of 27% of their needs from their own production and 17% for dairy products. In general, it is noted that almost 60% of food needs are purchased in local places, with the remainder purchased in the nearest cities and urban centers.

This high dependence on the market and the recent increase in the price of basic necessities and foodstuffs on the market have made it difficult for even partially self-sufficient rural households to manage their family budgets. This explains the difficulties rural households have in meeting their food expenditures, as expressed through the levels of worry expressed above. This dependence on the market to satisfy food needs can also be explained by the profiles of the rural households surveyed, most of which have non-agricultural activities such as trade and salaried work.

In addition, there is a **good diversity of diets among the population, with all food categories being used by almost all the households surveyed**. This is related to the well-diversified rural Moroccan diet, which is generally inspired by the Mediterranean diet.

Table 26. Origin of household food products

Products	Gathered in the wild	Produced in our household	Bought in the village	Bought another village/city
Cereals and cereals products	2.0	7.4	56.8	39.3
Vegetables	0.4	3.1	58.8	40.0
Legumes and pulses	0.2	2.3	58.6	40.2
Fruits	0.4	2.0	59.6	39.1
Meat	0.2	2.0	59.4	39.1
Fish	0.0	2.0	59.0	39.8
Oils and fats	0.4	27.1	48.2	35.2
Dairies	0.2	17.4	51.8	34.4
Eggs	0.4	12.3	56.1	36.7

2.8.2.5 Food security

Share of the food consumed that is produced by the household

Only 16% of rural households surveyed report producing or receiving for free more than 50% of their food needs, and 51% report producing or receiving for free less than 25% of their food needs. This shows the **importance of cash income for households to meet their food needs** (Table 27 and Figure 57). Indeed, these households can be compared to households in transition to the urban environment, as they have little or no land and are oriented towards trade and informal work. They generally have small agricultural areas that do not allow them to maintain sustained and profitable agricultural activity throughout the year.

Table 27. Food that is produced or provided for free

Level	N	%
A very limited part (less than 25%)	264	51.6
Less than half (from 25% to 50%)	101	19.7
About half (50%)	65	12.7
More than half (from 50% to 75%)	9	1.8
Almost all (from 75% to 100%)	73	14.3
Total	**512**	**100.0**
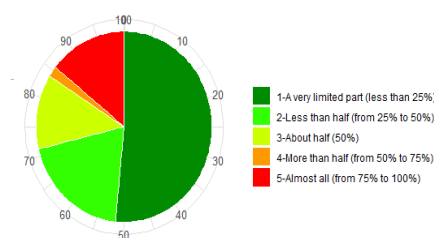
Figure 57 Food produced or provided for free

Share of household income spent on purchased food

Overall, the household food health situation, as reported by the women interviewed, has improved compared to the 2014 national population survey results. However, the situation varies considerably across groups of women. Almost **four out of five women (78%) reported that they spend 50% or less of their budget on food needs**. In addition, 14% of the women surveyed reported spending almost all of their income on food purchases (75 to 100%) (Table 28, Figure 58).

Table 28. Share of household income spent on food

Levels	N	%
A very limited part (less than 25%)	135	26.4
Less than half (from 25% to 50%)	143	27.9
About half (50%)	123	24.0
More than half (from 50% to 75%)	40	7.8
Almost all (from 75% to 100%)	71	13.9
Total	**512**	**100.0**
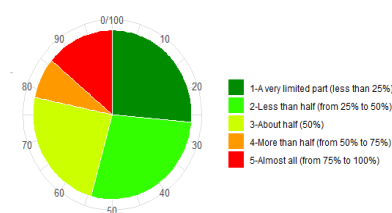
Figure 58. Share of household income spent on food

If we analyze the relationship between the share of household income spent on food and the variables age group and level of education, we find that **age has no significant effect on the share of income spent on food**. With respect to education levels, we note that **households with women with lower levels of education devote a significant higher share of their income to food**. This can be explained by the difficulty of finding work for people with a lower level of education in rural areas, given the number of young people without qualifications who are unemployed, and also because their income is lower. Indeed, the labor supply in rural areas is mainly focused on manual work and is more suitable for people who started working at a young age; their wages are often very low. Young people who are more qualified and less skilled in terms of professional qualifications have more possibilities in terms of flexibility in the labor market and are also more demanding in terms of wages.

2.8.2.6 Gender role and women empowerment

In Morocco, the activity rate of women was 19.8%, with a cumulative drop of almost 30% from 2004 to 2022. In the same sense, according to the "Global Gender Gap Report, 2022," Morocco ranks 139th out of a total of 146 countries for participation and economic opportunity. Several studies and analyses explain this low rate by the low level of women's education, territorial inequalities, women's economic conditions, the legal and regulatory framework, as well as social

pressures on women. All these factors hinder the improvement of women's participation in the country's economic activity.

Regarding the sharing of decision-making in the household, it is noted that **women are generally oriented towards making decisions on the use of resources and the management of agricultural production** (farming activities and sale or consumption). While other members of the family (usually the husband) oversee decisions related to the education of children, choice of food, and travel. This may be due to the dominance of small-scale farming (livestock and food crops) in the region, which suggests that women tend to engage in these activities in parallel with their household activities.
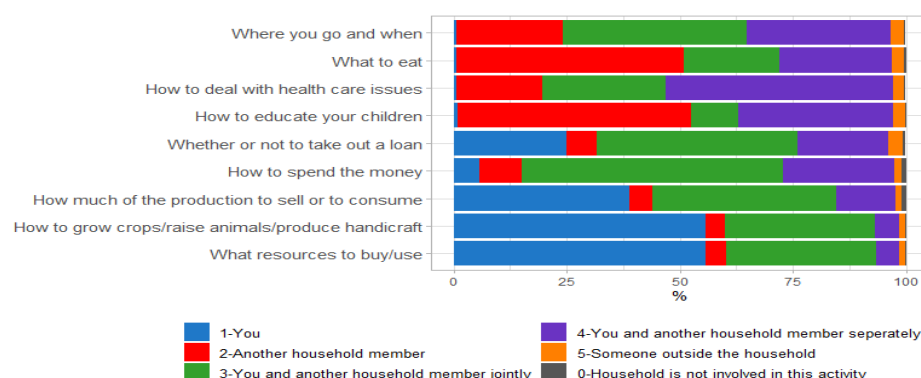
Figure 59. Decision-making at household level.

Happiness about responsibility/role in making decisions

Of the 491 women who responded to the question on the level of satisfaction with responsibility in the home, **85% said they were happy to very happy with the responsibility they have in the household** (Table 29). This may be too high a figure to expect, given that most decisions about activities outside the home are not shared with women. However, in a local context characterized by strong social pressure on women, women may feel satisfied with their rather limited role in decision-making within the household compared to men.

The role of education explains quite well this divergence between the level of satisfaction of women with the sharing of responsibilities within the household. There is a significant relationship between the level of education and the level of satisfaction of women with their responsibilities and   role in decision making within the household. This implies that **as women's level of education increases, they can participate in decision making and take on more responsibility within the household**. The satisfaction rates indicated must therefore be weighed in relation to women's education levels. The less education women have, the lower their participation in decision-making is, but also the greater their sensitivity is to social pressures and the social context that favors women's acceptance of their marginal status in household decision-making.

Table 29. Satisfaction with the women's responsibility/role in making decisions

Levels	N	%
Extremely unhappy	31	6.3
Unhappy	13	2.6
Neither happy not unhappy	31	6.3

Levels	N	%
Happy	151	30.8
Extremely happy	265	54.0
Total	**491**	**100.0**

Participation in groups and ties in the community

Women's participation in groups appears to be very limited. Of the 512 women of childbearing age surveyed, only 8 women belonged to local organizations, associations, or cooperatives, which represents less than 2% of the total. This can be explained by the weak link in the rural community, especially in small rural areas where social activity is almost nonexistent.

Despite the increase in the number of NGOs over the last two decades (Ennaji, 2016) to channel energies and attempt to solve the problems faced by women, it is noted that these initiatives remain very limited and fragmented in relation to the potential for women's empowerment and the possibilities for groups to find common projects with shared interests to consolidate. In rural areas, the lack of women's leadership and the weight of social status work against the integration of women into the community. Sensitivity to social pressures and the social context favor women's acceptance of their marginal status in the community.

Regarding women's views on the following statements: women's ability to contribute to household income like men (3,55); the statement that a man's role is to earn money; a woman's role is to take care of her home and family (3,54); and the idea that women can be as good leaders as men (3,35) (on a scale of 1 to 5).It is noted that although women are more aware overall of their potential to contribute to income on a par with men (3.54), they are on average less interested in sharing leadership with men (3.35). On the other hand, they generally agree on the primary role of women in managing the home and family.

This may seem contradictory to women's emancipation because if women are normally able to contribute to the household income in the same way as men, they can also be good leaders. This can be understood in the sense that women in the Moroccan social context find it very difficult to impose their leadership even though they contribute to the household income and participate heavily in household tasks. Women seem to be aware of the importance of their role in the home by accepting to take care of the household and the family, but they are less ready to impose their leadership in the household because of the social status of women, which is more favorable to men's leadership.

Women's time use: Hours spent daily

In the surveyed Food Hub, **women work an average of 12 hours per day**, mainly for household tasks, with about 7 hours for work. This shows the importance of work in the home for rural women in general and its importance for the well-being of the household.

Young women with secondary education and above and with a permanent job work up to 16 hours a day, of which 8 hours are devoted to household work. We note, therefore, that **working outside the home does not reduce the workload within the household for women**. This implies greater pressure on women who work outside the home, with a negative effect on overall household welfare. Previous studies analyzing the determinants of women's labor force participation (Paterno et al. 2008) corroborate the findings by stating that increasing years of education significantly induce female labor. The action plans undertaken in Morocco to promote female schooling, especially in rural areas, are expected to increase women's access to the labor

market and improve their social empowerment. However, women's work in the agricultural sector is somewhat more mixed and less favored by the increase in years of education, mainly because of the nature of the supply side of the agricultural sector, which focuses on cheap female labor for manual work in the fields. Indeed, 70% of the rural female labor force recruited by the agricultural sector is illiterate (HCP, 2013).

Furthermore, we note that when women spend more time at work (more than 5 hours per day), the share of income spent on food tends to decrease. This is very important to note because when women go out to work in rural areas, it is primarily to bring more income to the household and improve the household's food conditions.

The increase in women's participation in the labor market can indeed lead to an increase in their empowerment and an improvement in household food security. But, on the other hand, this phenomenon may be accompanied by greater pressure on women, especially about work in the home, in a largely patriarchal society.

2.8.4 Conclusions
2.8.4.1 Conclusions on the research question

The results obtained show that rural households with a mother and a child under 2 years of age consist of an average of 4 to 6 individuals. Nearly 63% of households have four to six persons, while 23% have more than six persons, and only 15% are three-person households.

Rural households in the region are highly dependent on the market for the purchase of food. The proportion of food products produced or received for free by the household does not exceed 25% for 50% of the households surveyed. This explains quite well the concerns of households about rising prices and inflation, as well as the reduction in income in relation to the economic crisis.

Moreover, the income devoted to food is relatively average; only 22% of households declare that they devote more than 50% of their income to the purchase of food products, and 27% declare that they devote less than 25% of their budget to this item of expenditure.

With regard to the situation of women, we note that education has a significant influence on household income levels and on their empowerment. Women with secondary school education and a permanent job have a positive impact on household income, which leads to a decrease in the proportion of income spent on food. In general, these women report having more opportunities to participate in household decisions compared to women without paid employment.

In contrast, we note that when working time increases for women, it is not accompanied by a decrease in time spent at home. Working women are occupied on average for 15 to 16 hours per day, which implies increased pressure on women with permanent work outside the household.

It is obvious that women who are better educated take part in decision-making to a greater extent, but they are also less sensitive to societal constraints and the social backdrop that encourages women to accept their marginal status in family decision-making.

2.8.4.2 Policy recommendations

At the regional level, women face physical and social barriers that reduce their participation at all levels and limit their potential in the market and in the household. Specific programs to address these limitations should include, among others, the following measures:

- Initial education and literacy for women who have not had the opportunity to attend school Many studies have shown the importance of women's education and its positive effects on children and nutrition (El Alaoui, 2015; Bloom, 2006).
- Train and organize women to be more skilled and empowered, to have easier access to the labor market, and to share decision-making.
- Improve policies for qualification and integration of human resources to better support women's participation in the market.
- Ensure access to capital and finance, in particular microfinance, with specific mechanisms for the promotion of women's NGOs to promote entrepreneurship and women's full participation in the formal economy.

2.8.4.3 Recommendations for the FoodLAND project

The FOodLAND project should support women's activities in agriculture and thus boost the women role in adding value to rural agricultural products. To this end, the following activities could be considered to improve rural women's access to the labor market and improve the overall household income:

- Initial training sessions on olive preservation techniques, which are an economically profitable but little-used activity in the region.
- To propose practical training workshops for women on the trade of local products, which should improve the monetary income of women and encourage their integration into the labor market.
- To propose, within the framework of the regional FoodHub, activities to support women in the creation of cooperatives and women's associations with the objective of improving women's organization and access to resources, including financing for income-generating activities. These organizations can also serve as platforms for the dissemination of practical advice on hygiene, nutrition, and the improvement of household living conditions.

In conclusion, specific indicators for rural consumers and specifically for the woman-child couple can be developed to evaluate the effects of the actions taken.

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2.9 Food consumption behaviour among rural women and children of age 6 to 23 months in Ndole and Kinda areas in Mvomero district, Tanzania

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2.9.1 Introduction

Despite the great progress made in improving food and nutrition security and reducing poverty over the past decades, undernutrition is still affecting billions of people worldwide (Ochieng et al., 2017). According to the 2022 Global Nutrition Report, approximately 149.2 million children under five are stunted, 44.5 million are wasted, 38.9 million are overweight, and 570.8 million girls and women of reproductive age (15–49 years) are anaemic. Although undernutrition affects both urban and rural low-income households, those in rural areas face more challenges than their urban counterparts due to social isolation, intermittent drought, limited participation of women in economic activities, limited market access, inadequate access to health care, and other socioeconomic factors such as lower education level and high unemployment rate (Madzorera et al., 2021).

In Tanzania, undernutrition affects infants and children under the age of five, as well as women of childbearing age. Approximately 3 million children under five years of age are stunted in Tanzania (TNNS, 2018). Currently, about 30% of the children under five years of age are moderately stunted while 9% are severely stunted; 3% are wasted, and 12% are underweight, while about 7.3% of non-pregnant women aged 15–49 years are underweight (TDHS-MIS 2022, TNNS, 2018). According to the Tanzania Demographic Health Survey and Malaria Indicator Survey, prevalence of chronic malnutrition in Morogoro region is high (30.6%) similar to the national average with an estimated wasting rate of 4% which s above the national average and underweight of 10%. Studies show that undernutrition is particularly high among low-income rural Tanzanian households, mainly because they consume carbohydrate-rich, staple-based diets low in minerals and vitamins (Madzorera et al., 2021, MoH et al., 2023). In addition, it was reported that only 46% of rural women in Tanzania meet their minimum dietary diversity requirement (i.e. consume at least 5 food groups out of 10 daily) and women's intake of protein, fruits, and vegetables is very low (Madzorera et al., 2021). Regarding the infants and young child feeding (IYCF) practices in Tanzania, timely initiation of breastfeeding is about 70% while exclusive breastfeeding for six months is 64%. In addition, about 19% of the children of age 6 to 23 months consumed minimum dietary diversity, 30% consumed sweet beverages while 9% ate unhealthy foods (MoH, et al., 2023). Although some interventions have been implemented to reduce the rate of malnutrition in Mvomero district, the rate of improvement is slow than expected. This study was done as part of FoodLAND project and **sought to assess food consumption behaviour and dietary diversity among rural women of reproductive age and their children of age between 6 to 23 months.** This study also looked at the food needs of the households to relate it with food consumptions. The report is structured in four sections as follows. In the following section the methodology adopted for the study is presented. Next, the results are presented and discussed. Then conclusion and recommendations are made towards the end of the report.

2.9.2 Methodology

2.9.2.1 Description of the study area

This cross-sectional study was conducted in Kinda ward where Ndole and Kinda are among the villages in the ward. Kinda ward is located in Mvomero Food Hub for Mvomero district (Figure 60). Mvomero is one of the six districts of the Morogoro Region. As of 2021 the district had

312,109 inhabitants. The North-west of the district is crossed by the Nguru Mountains, which are up to 2,100 meters high. This is where the study area (Ndole and Kinda) is located. To the South there is a flat land through which several permanent rivers flow. In the Southeast the land rises again and reaches 2600 meters at the peak of the Uluguru Mountains. Precipitation varies from 700 mm in the lowlands to 2300 mm in the mountains. The driest time is from June to September, when rains are generally scarce. The temperatures are between 18 and 30 degrees Celsius, with high altitude areas being generally colder.
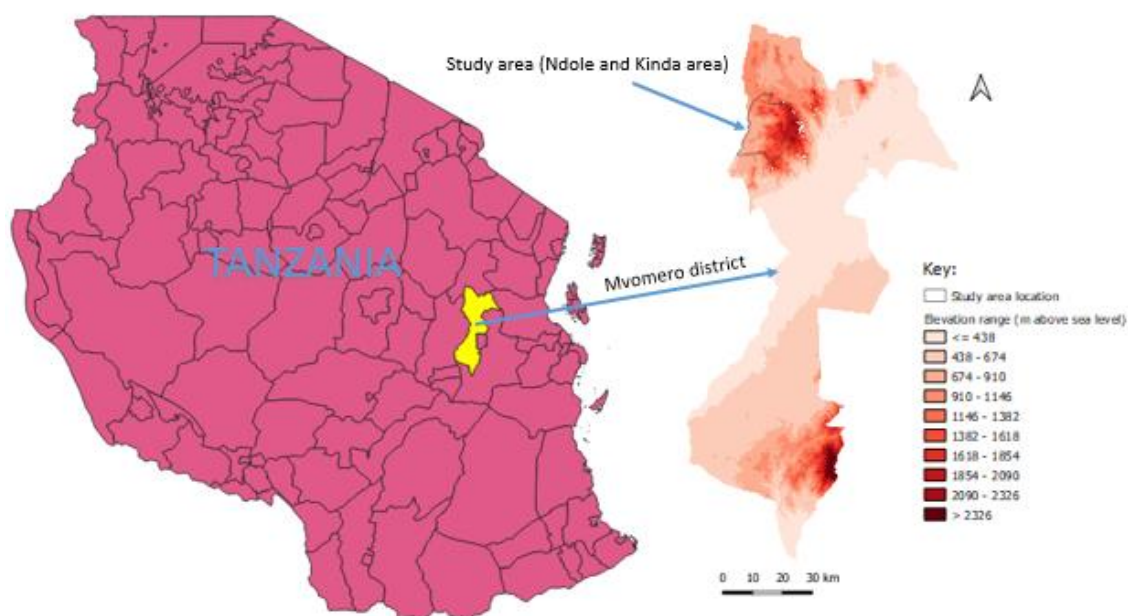
Figure 60. Study area location

The most common crops in the district are maize, millet, cassava, sweet potatoes, beans, rice, sugar cane, cotton, and vegetables in the river valleys. In Ndole and Kinda, major crops are maize, beans, banana, cassava, sweet potatoes, and vegetables. Animal husbandry as chickens, cattle and goats farming is also practiced.

2.9.2.2 Sampling and data collection

The data were collected from a series of villages (Kinda, Magunga, Makuyu, Matale, Ndole and Semwali) in Kinda ward re within the project's Food hub area. The food hub is mainly devoted to beans farming, one of the focus crops of the FoodLAND project. Sampling involved 518 randomly selected mothers with children of age 6 to 23 months. All women who resided in the area for over three months were eligible to participate. Age of the child was reported by the mother and confirmed by checking the postnatal clinic card. A structured pre-tested questionnaire translated from English to Kiswahili was administered by trained enumerators to the respondents to collect data on socio-demographic characteristics, food availability, food consumed over the past 24 hours preceding the survey, income expenditure on food and decision making in the household. In addition, Global diet quality questionnaire (GDQQ) for women and for the children was used to estimate food group consumption, dietary diversity score, global recommended diet (GRD), NCD-protective and NCD-risk scores. The enumerator read the examples of the foods for each food

group and marked one if any of the foods in the list within the food group was consumed or zero if none was consumed. The 28 food groups from the GDQQ were aggregated to form the 10 food groups for women DDS, seven food groups for children DDS, five food groups recommended in the food based dietary guidelines, the NCD-risk and NCD-protect food groups (refer to Sections 2.1 and 2.3 for additional specifications on the dietary scores).

The study was conducted after obtaining both the permit and ethical clearance. The research permit was obtained from relevant authorities including Sokoine University of Agriculture, regional, district ward and village authorities. Ethical clearance was obtained from the Tanzania National Institute for medical Research (NIMR) with reference number NIMR/HQ/R.8a/VOL.IX/3605. Participants were informed about the study, the procedure, benefits, and risks. They were also told that participation to the study was voluntary with the possibility for the participant to withdraw at any time. Those who agreed to participate were requested to sign a consent form. Respondents who did not meet the inclusion criteria were not interviewed.

2.9.2.3 Data analysis

Data were analysed using STATA and SPSS software. Results were reported as descriptive and association between variables were assessed using Chi-square and Kruskal-Wallis test.

2.9.3 Results

2.9.3.1 Meeting household's needs

The result shows that 43.6% (226 out of 518) of the households had some difficulty meeting their food needs in the previous year (Table 30). Moreover, individuals between the ages of 35 and 49 had a serious food shortage compared to younger women (15–20 years) (Figure 61). This concurs with the study conducted by Asesefa Kisi et al. (2018), which found that people of an older age in rural areas are vulnerable to food shortages because most of them are poor, have receding health, have insufficient access to social services, and have problems of neglect. In addition, households with no educational qualification or illiterates had experienced serious food shortages compared to those that were educated (Figure 61). It has been reported by Zhou et al., 2019 that the education level of household heads is an important variable that can affect a household's agricultural production and food security. Similarly, the study conducted by Kingu (2020) in the Singida region observed that the level of education determines the level of opportunities available to improve livelihood strategies, enhance food security, and reduce poverty. Furthermore, the study revealed that 30% of the surveyed households could only afford to purchase less than 25% of their household's food needs per year (Figure 61).

Table 30. Meeting the household's food needs

Status	N	%
Experienced serious food shortages	126	24.3
Experienced some difficulties	226	43.6
Had about what they needed	83	16.0
Had what they needed	79	15.3
Had more than enough	4	0.8
Total	518	100.0
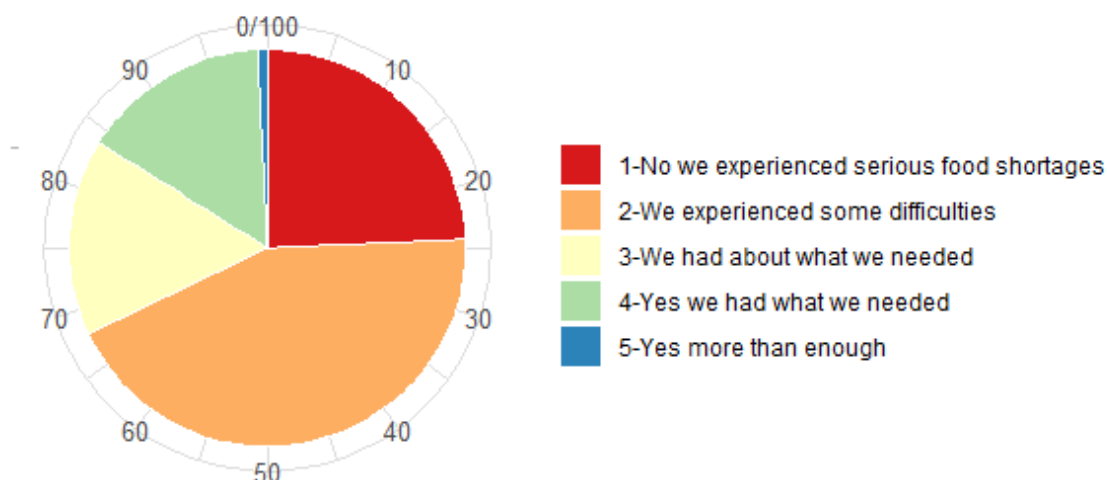
Figure 61. Meeting the household's food needs by age and education level

The study found that during the last year, households experienced food shortages in fish, meat, dairy products, and fruits at 79.2%, 75.7%, 73.9%, and 70.7%, respectively (Figure 61). Results also show that most of the sampled population consumes more cereal-based foods compared with higher-valued foods containing animal proteins such as meat, fish, and dairy products. This result is consistent with a study conducted by Mbwana et al. (2016) in Dodoma who found low consumption of animal-based proteins.

Table 31. Food shortage (% of respondents)

food product	N	% on respondents
Cereals or cereal products	335	64.7
Vegetables	226	43.6
Legumes and pulses	263	50.8
Fruits	366	70.7
Meat	392	75.7
Fish	410	79.2
Oils and fats	313	60.4
Dairies	383	73.9
Eggs	317	61.2
Respondents	518	
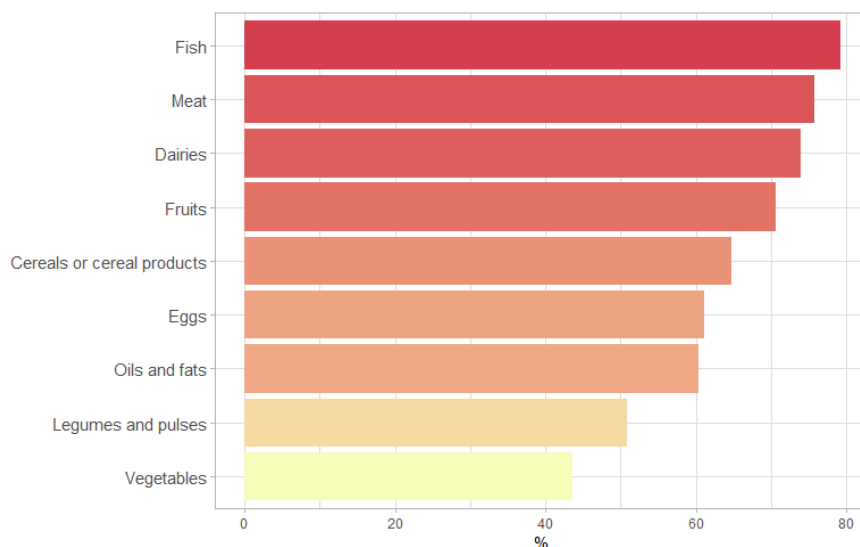
Figure 62. Food shortage by food groups (% of the respondents)

2.9.3.2 Food consumption habits for women

Foods and drinks women consumed in the past 24 hours before the survey

Results shows that among the 518 respondents, only 1.2% (n=6) indicated that they ate a special diet on a day that preceded the survey hence they were excluded during analysis of the questions that required information on the women or children's food consumption. About 92% of the respondents consumed staple foods made from grains followed by those who consumed other vegetables (72.3%), dark green leafy vegetables (70.7%), and legumes (44%). Animal source foods such as eggs, milk, meat, chicken, and fish were rarely consumed (Figure 63). This pattern of consumption may have implication for the nutritional status of women of reproductive age and could also affect nutritional status of the children. The TDHS-MIS (2022) reported a decreasing trend of stunting in the country from 48% in 1999 to 30% in 2022 with much higher proportion of the rural children (33.4%) being stunted compared to those from the urban areas (20.5%). Furthermore, results show that about one third of the women consumed deep fried foods. This indicates changes in food preparation methods where some of the foods like green banana, sweet potatoes, cassava, and yams that were previously prepared by boiling are now deep fried. These changes may lead to the increased risk of non-communicable diet related diseases.
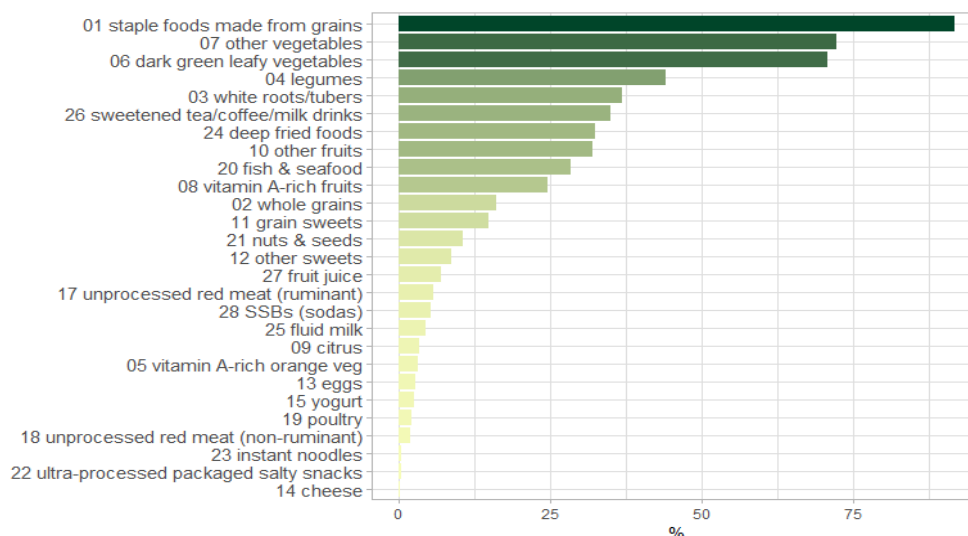
Figure 63. Food and drink that the respondent consumed

Food Group Diversity Score (FGDS)

A total of 28 food groups indicated in the diet quality questionnaire were aggregated into ten food groups to create food group diversity score (FGDS) as shown in Table 3. It was observed that the mean FGDS was 4 (SD1.52) with a range from 1 to 10 food groups. The mothers who attained secondary or higher education level had higher FGDS than those with primary education. However, this was not statistically significant probably due to small number of women with higher education level. The only significant association was on food needs whereby the women who had more than what they needed had higher FGDS compared to those who experienced food shortage (Table 32).

Table 32. Food Group Diversity Score (FGDS) by age class, education level and share of income for food purchase - summary statistics.

variable	Levels	n	perc	mean	st.dev	min	Q1	median	Q3	max
age class	[15,20]	141	27.5	4.21	1.57	1	3.00	4.0	5.00	8
	(20,25]	141	27.5	3.94	1.40	1	3.00	4.0	5.00	8
	(25,30]	98	19.1	4.02	1.51	1	3.00	4.0	5.00	8
	(30,35]	65	12.7	3.74	1.70	1	3.00	3.0	5.00	10
	(35,49]	67	13.1	3.91	1.44	1	3.00	4.0	5.00	8
education	1-Illiterate	209	40.8	3.90	1.45	1	3.00	4.0	5.00	8
	2-No qualification/literate	6	1.2	3.17	0.75	2	3.00	3.0	3.75	4
	3-Primary	266	52.0	4.09	1.57	1	3.00	4.0	5.00	10
	4-Secondary	29	5.7	4.07	1.60	1	3.00	4.0	5.00	7

variable	Levels	n	perc	mean	st.dev	min	Q1	median	Q3	max
	5-More than secondary	2	0.4	4.50	0.71	4	4.25	4.5	4.75	5
share income for food	1-A very limited part (less than 25%)	34	6.6	4.38	1.84	1	3.00	4.0	6.00	8
	2-Less than half (from 25% to 50%)	108	21.1	3.94	1.48	1	3.00	4.0	5.00	8
	3-About half (50%)	141	27.5	4.21	1.55	1	3.00	4.0	5.00	10
	4-More than half (from 50% to 75%)	161	31.4	3.94	1.46	1	3.00	4.0	5.00	8
	5-Almost all (from 75% to 100%)	68	13.3	3.63	1.38	1	3.00	3.5	4.00	8
food needs*	1-No we experienced serious food shortages	125	24.4	3.14	1.36	1	2.00	3.0	4.00	8
	2-We experienced some difficulties	224	43.8	4.09	1.33	1	3.00	4.0	5.00	8
	3-We had about what we needed	82	16.0	4.28	1.64	1	3.00	4.0	5.00	8
	4-Yes we had what we needed	78	15.2	4.72	1.43	2	4.00	5.0	5.00	10
	5-Yes more than enough	3	0.6	7.00	1.73	5	6.50	8.0	8.00	8
Total	Total	512	100.0	4.00	1.52	1	3.00	4.0	5.00	10

* Kruskal-Wallis test (p-value 0.000)

Minimum Dietary Diversity for Women of Reproductive Age (MDD-W)

Minimum Dietary Diversity for Women of Reproductive Age (MDD-W) (15-49) is achieved when ≥5 out of 10 specific food groups, defined for FGDS, are consumed by an individual over the course of a day (FAO and FHI 360, 2016). About one in three women (32.6%) attained the MDD-W (Table 33). It is assumed that diversified diet provides adequate micronutrients while balancing intake of macronutrients. This means the studied rural women are more likely to suffer from micronutrient deficiencies due to consumption of less diversified foods. Similar results were reported in a study conducted in rural Tanzania (Bellows et al., 2020). There was a slight non-significant association between education level and MDD-W, showing that women who reached more than secondary education had relatively higher MDD-W while none of the illiterate women had attained MDDS-W. About 47% of those who used less than 25% of their income for food had attained the MDD-W and only 19% among those who used almost all their income for food. There was a significant association (p=0.0131) between the women from the households who had more

than enough food with MDDS-W as all women from households with sufficient food consumed at least five food groups (Table 33).

Table 33. Minimum Dietary Diversity (MDD-W) by age class, education level and share of income for food purchase by count and %.

Variable	Levels	No		Yes		Total	
		n	%	n	%	n	%
Total	Total	345	67.4	167	32.6	512	100
age class	[15,20]	86	61.0	55	39.0	141	100
	(20,25]	100	70.9	41	29.1	141	100
	(25,30]	64	65.3	34	34.7	98	100
	(30,35]	48	73.8	17	26.2	65	100
	(35,49]	47	70.1	20	29.9	67	100
education	1-Illiterate	146	69.9	63	30.1	209	100
	2-No qualification/literate	6	100.0	0	0.0	6	100
	3-Primary	173	65.0	93	35.0	266	100
	4-Secondary	19	65.5	10	34.5	29	100
	5-More than secondary	1	50.0	1	50.0	2	100
share income for food	1-A very limited part (less than 25%)	18	52.9	16	47.1	34	100
	2-Less than half (from 25% to 50%)	75	69.4	33	30.6	108	100
	3-About half (50%)	85	60.3	56	39.7	141	100
	4-More than half (from 50% to 75%)	112	69.6	49	30.4	161	100
	5-Almost all (from 75% to 100%)	55	80.9	13	19.1	68	100
food needs*	1-No we experienced serious food shortages	111	88.8	14	11.2	125	100
	2-We experienced some difficulties	148	66.1	76	33.9	224	100
	3-We had about what we needed	52	63.4	30	36.6	82	100

Variable	Levels	No		Yes		Total	
		n	%	n	%	n	%
	4-Yes we had what we needed	34	43.6	44	56.4	78	100
	5-Yes more than enough	0	0.0	3	100.0	3	100

*Chi-square test (p<0.05)

3.2.4 Consumed all five recommended food groups

The Tanzania food based dietary guidelines recommends consumption of diversified foods from the five food groups namely starchy staples including grains, plantains, roots and tubers, vegetables, fruits, pulses, nuts and oily seeds, and animal source foods. A score of 5 indicates minimal adherence to dietary guidelines, because people who did not consume the food groups did not meet dietary guidelines. However, it is a minimum bar, because many people who consumed all five food groups still may not have met dietary guidelines in terms of quantities consumed. The results shows that only 12.6% (n=64) respondents consumed the recommended five food groups according to Food Based Dietary Guidelines. There was a significant association between food sufficiency and consumption of the five food groups. About 67% with more than enough food had consumed the five recommended food groups and only 5.6% among those who experienced food scarcity (Table 6).

Table 34. Consumed all five recommended food groups (All-5) by age class, education level and share of income for food purchase – count and percentage.

variable	Levels	No		Yes		Total	
		n	%	n	%	n	%
Total	Total	448	87.5	64	12.5	512	100
age class	[15,20]	123	87.2	18	12.8	141	100
	(20,25]	119	84.4	22	15.6	141	100
	(25,30]	87	88.8	11	11.2	98	100
	(30,35]	57	87.7	8	12.3	65	100
	(35,49]	62	92.5	5	7.5	67	100
education	1-Illiterate	182	87.1	27	12.9	209	100
	2-No qualification/literate	6	100.0	0	0.0	6	100
	3-Primary	234	88.0	32	12.0	266	100
	4-Secondary	25	86.2	4	13.8	29	100
	5-More than secondary	1	50.0	1	50.0	2	100

variable	Levels	No		Yes		Total	
		n	%	n	%	n	%
share income for food	1-A very limited part (less than 25%)	29	85.3	5	14.7	34	100
	2-Less than half (from 25% to 50%)	96	88.9	12	11.1	108	100
	3-About half (50%)	118	83.7	23	16.3	141	100
	4-More than half (from 50% to 75%)	143	88.8	18	11.2	161	100
	5-Almost all (from 75% to 100%)	62	91.2	6	8.8	68	100
food needs*	1-No we experienced serious food shortages	118	94.4	7	5.6	125	100
	2-We experienced some difficulties	199	88.8	25	11.2	224	100
	3-We had about what we needed	68	82.9	14	17.1	82	100
	4-Yes we had what we needed	62	79.5	16	20.5	78	100
	5-Yes more than enough	1	33.3	2	66.7	3	100

*Chi-square test: p-value=0.000

NCD-Protect score, NCD-Risk score, and Global Dietary Recommendations (GDR)

The NCD-protect score ranges from 0 to 9. It is a sub-component of the GDR score and reflects adherence to global dietary recommendations on healthy components of the diet. The NCD-protect score is based on food consumption from 9 healthy food groups during the past day and night. A higher score indicates inclusion of more health-promoting foods in the diet, and correlates positively with meeting global dietary recommendations. It is expressed as the average score for the population. The mean NCD-protect score was 3 (SD 1.45) with a range from 0 to 8 food groups. There was a significant association between NCD-protect score and the food needs, those with more food than what they needed had significantly higher mean NCD-protect score of 4.7 (SD 2.31) compared to those who experienced food shortage with mean of 2.1 (SD 1.25) (Figure 64).
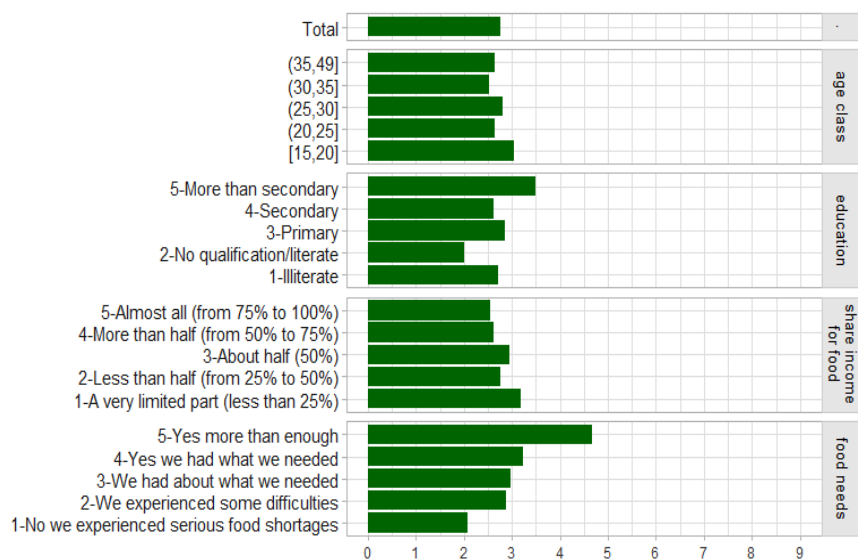
Figure 64. NCD-Protect score by age class, education level and share of income for food purchase - average values

The NCD-Risk score is also a proxy for ultra-processed food intake. A higher NCD-risk score is closely related to higher ultra-processed food consumption. The NCD-Risk score ranges from 0 to 9. It is a sub-component of the GDR score and reflects adherence to global dietary recommendations on components of the diet to limit or avoid. A higher score indicates higher consumption of foods and drinks to avoid or limit, and correlates negatively with meeting global dietary recommendations. The NCD-risk score is based on food consumption from 8 food groups to limit or avoid during the past day and night (one food group, processed meat, is double weighted). This is a negative indicator and is expressed as the average score for the population. The average NCD-risk score was around 0.77 (SD 1.10). It was further observed there was no significant association between age and NCD-risk score. Women who met their food needs had higher mean NCD-risk score of 1.33 (SD 0.58) compared to the others who were struggling to meet family food needs (0.27, SD 0.59) (Table 35). The younger women had significantly higher NCD-risk score compared to the older ones probably due to snacking high sugar, salty and fat snacks and beverages which are available and relatively cheaper. Generally, the NCD-protect score was higher than the NCD-risk score implying that rural women are more protected to NCDs as far as food intake is concerned.

Table 35. NCD-Risk score by age class, education level and share of income for food purchase - summary statistics.

Variable	Levels	n	perc	mean	st.dev	min	Q1	median	Q3	max
age class*	[15,20]	141	27.5	0.94	1.19	0	0.00	1.0	1.00	6
	(20,25]	141	27.5	0.74	1.04	0	0.00	0.0	1.00	5
	(25,30]	98	19.1	0.66	1.11	0	0.00	0.0	1.00	5

Variable	Levels	n	perc	mean	st.dev	min	Q1	median	Q3	max
	(30,35]	65	12.7	0.82	1.16	0	0.00	0.0	1.00	4
	(35,49]	67	13.1	0.55	0.96	0	0.00	0.0	1.00	4
Education	1-Illiterate	209	40.8	0.81	1.18	0	0.00	0.0	1.00	6
	2-No qualification/literate	6	1.2	0.17	0.41	0	0.00	0.0	0.00	1
	3-Primary	266	52.0	0.71	1.03	0	0.00	0.0	1.00	6
	4-Secondary	29	5.7	1.07	1.25	0	0.00	1.0	1.00	5
	5-More than secondary	2	0.4	1.50	2.12	0	0.75	1.5	2.25	3
share income for food	1-A very limited part (less than 25%)	34	6.6	1.21	1.61	0	0.00	0.5	2.00	5
	2-Less than half (from 25% to 50%)	108	21.1	0.75	1.06	0	0.00	0.0	1.00	6
	3-About half (50%)	141	27.5	0.83	0.98	0	0.00	1.0	1.00	4
	4-More than half (from 50% to 75%)	161	31.4	0.73	1.18	0	0.00	0.0	1.00	6
	5-Almost all (from 75% to 100%)	68	13.3	0.54	0.85	0	0.00	0.0	1.00	3
food needs*	1-No we experienced serious food shortages	125	24.4	0.27	0.59	0	0.00	0.0	0.00	3
	2-We experienced some difficulties	224	43.8	0.79	1.02	0	0.00	0.0	1.00	5
	3-We had about what we needed	82	16.0	1.02	1.34	0	0.00	1.0	1.00	6
	4-Yes we had what we needed	78	15.2	1.22	1.38	0	0.00	1.0	2.00	6
	5-Yes more than enough	3	0.6	1.33	0.58	1	1.00	1.0	1.50	2
Total	Total	512	100.0	0.77	1.10	0	0.00	0.0	1.00	6

* Kruskal-Wallis-test: p-value, 0.05.

The GDR score ranges from 0 to 18 and indicates adherence to global dietary recommendations, which include dietary factors protective against non-communicable diseases. The higher the GDR score, the more recommendations are likely to be met. The GDR score is based on food group

consumption during the past day and night. The GDR score is calculated as follows: NCD-Protect - NCD-Risk + 9 = GDR score It is expressed as the average score for the population. The mean GDR score was 11 (SD1.42) with a minimum of 6 and a maximum of 16 food groups (Figure 65 and Figure 66). No clear association between GDR score with education or share of income expenditure on food. However, compared with those with enough food with mean of GDR score of 12.3 (SD2.89), those who experienced food shortage had SGR score of 10.81 (SD1.8) (Table 10). Furthermore, a slight significant association was observed between age and GDR-score. However, clear trend could not be established.
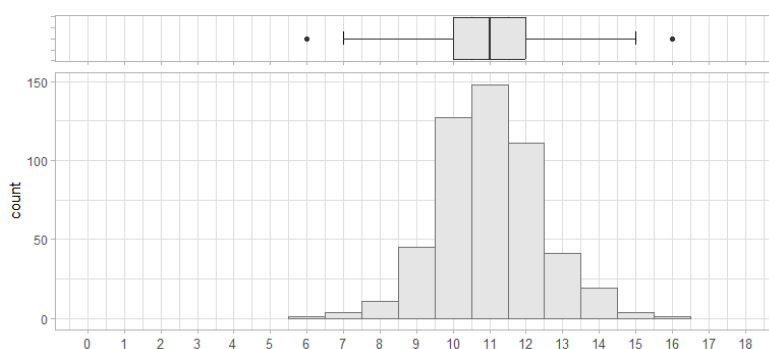
Figure 65. Global Dietary Recommendations (GDR) score – distribution.
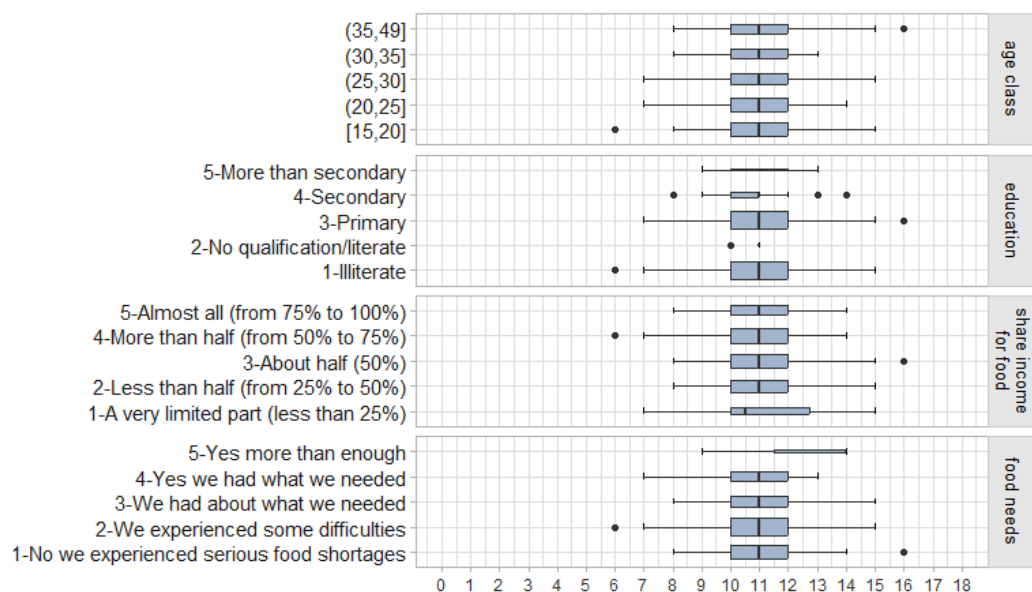
Figure 66. GDR score by age class, education level and share of income for food purchased.

Table 36. GDR score by age class, education level and share of income for food purchase - summary statistics.

variable	levels	n	perc	mean	st.dev	min	Q1	median	Q3	max
age class	[15,20]	141	27.5	11.09	1.47	6	10.0	11.0	12.00	15
	(20,25]	141	27.5	10.90	1.35	7	10.0	11.0	12.00	14
	(25,30]	98	19.1	11.14	1.46	7	10.0	11.0	12.00	15
	(30,35]	65	12.7	10.71	1.22	8	10.0	11.0	12.00	13
	(35,49]	67	13.1	11.09	1.54	8	10.0	11.0	12.00	16
Education*	1-Illiterate	209	40.8	10.89	1.36	6	10.0	11.0	12.00	15
	2-No qualification/literate	6	1.2	10.83	0.41	10	11.0	11.0	11.00	11
	3-Primary	266	52.0	11.14	1.46	7	10.0	11.0	12.00	16
	4-Secondary	29	5.7	10.55	1.43	8	10.0	11.0	11.00	14
	5-More than secondary	2	0.4	11.00	2.83	9	10.0	11.0	12.00	13
share income for food	1-A very limited part (less than 25%)	34	6.6	10.97	1.95	7	10.0	10.5	12.75	15
	2-Less than half (from 25% to 50%)	108	21.1	11.00	1.31	8	10.0	11.0	12.00	15
	3-About half (50%)	141	27.5	11.13	1.51	8	10.0	11.0	12.00	16
	4-More than half (from 50% to 75%)	161	31.4	10.89	1.34	6	10.0	11.0	12.00	14
	5-Almost all (from 75% to 100%)	68	13.3	11.00	1.29	8	10.0	11.0	12.00	14
food needs*	1-No we experienced serious food shortages	125	24.4	10.81	1.18	8	10.0	11.0	12.00	16
	2-We experienced some difficulties	224	43.8	11.10	1.50	6	10.0	11.0	12.00	15
	3-We had about what we needed	82	16.0	10.95	1.53	8	10.0	11.0	12.00	15
	4-Yes we had what we needed	78	15.2	11.01	1.34	7	10.0	11.0	12.00	13
	5-Yes more than enough	3	0.6	12.33	2.89	9	11.5	14.0	14.00	14

variable	levels	n	perc	mean	st.dev	min	Q1	median	Q3	max
Total	Total	512	100.0	11.00	1.42	6	10.0	11.0	12.00	16

Kruskal-Wallis: p=0.0262 age and p=0.000 for food needs

2.9.3.3 Eating habits of the child

Feeding immediately after birth and current breast- and bottle feeding practices

Breastfeeding is one of the ways to ensure child healthy and survival. World Health organization (WHO) and the United Nations International Children's emergency Funds (UNICEF) recommends that all children should be breastfed, and initiation of breast feeding should be done immediately within one hour after delivery. In the survey done in these rural communities, all children were breastfed and 3 out of 4 (75%, n=38) were put on the breast within one hour after birth (Figure 67). Most women fed their children breast milk alone within two days after delivery which means colostrum feeding was highly practiced with only a few (3.5%, n=18) who offered the infants with prelacteal feeds. All children were still breastfeeding either during the day or at night but about 26% gave their children something to drink in a bottle with nipple. Almost all children (95%, n=486) were given something to drink in a day preceding the survey. Other common drinks were clear broth or clear soup (30.3%), fruit juice or flavored fruit drink (21.1%) and tea, coffee or herbal drink (20.7%). Surprisingly, milk was not among the common drink for the rural children (Figure 68).
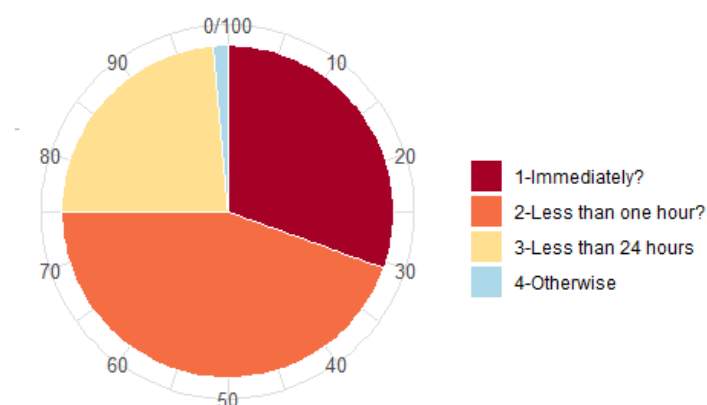
Figure 67. How long after birth was he/she first put to the breast?
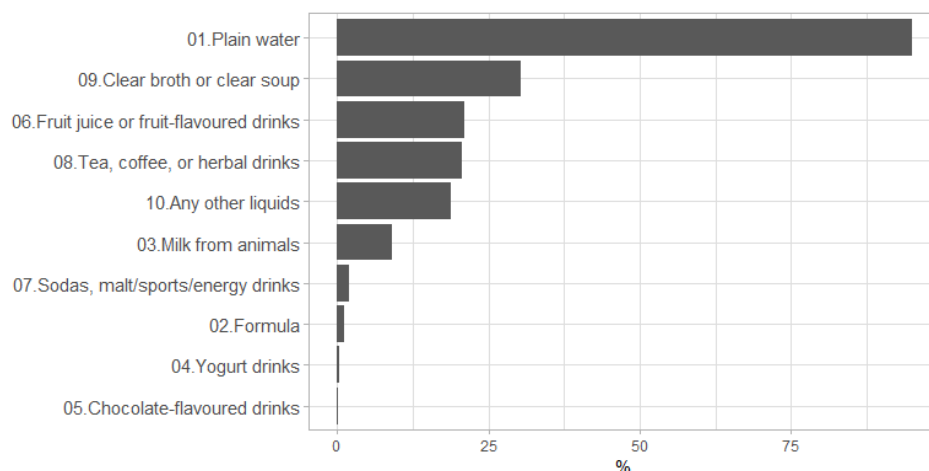
Figure 68. Liquids that your child may have had yesterday during the day or at night.

Diet quality for children

About 80% of the children consumed staple foods made from grains followed by other vegetables (55.9%), dark green leafy vegetables (54.5%) and legumes (35.5%). A higher proportion of the children consumed Vitamin A rich fruits than Vitamin A rich vegetables. This could be due to the fact that the survey was done during the mango season and almost every household own at least one mango tree. About 21% of the children consumed fish or sea foods. It was observed during the survey that fried or sun-dried sardines were available in the village which was an alternative relatively cheap source of protein. Animal source foods were rarely eaten. Besides, although almost every household keep local chicken, only 2.5% of the children consumed eggs (Figure 69).
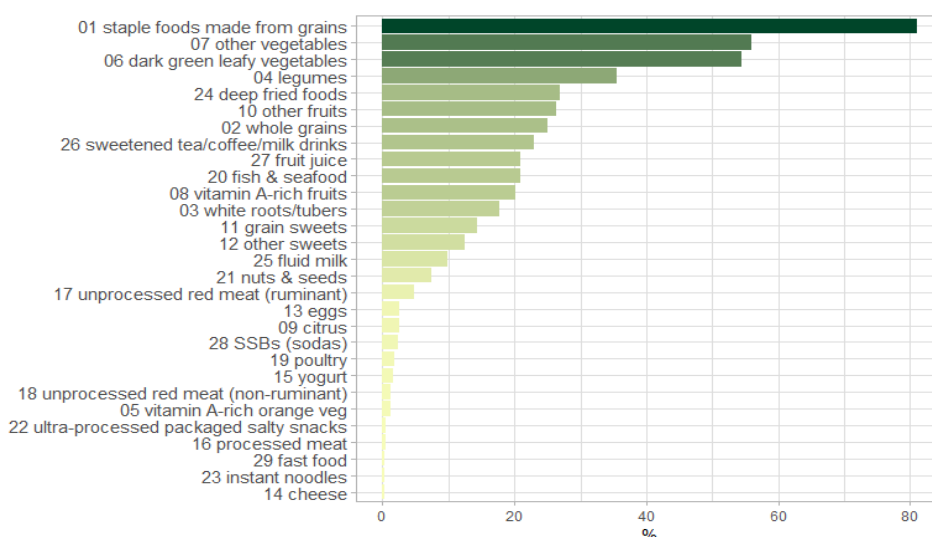
Figure 69. Food and drink consumed by the child (%)

The mean FGDS for children was 3.3 (SD 1.77) with the minimum being 0 and maximum was 9 food groups (Table 37). High FGDS for children at 3.4 (SD 2.07) was observed among children from households that used limited amount of income for food compared to 2.78 (SD 1.64) for those who used almost all the income for food. Likewise, children from the households who did not experience food shortage had higher FGDS of 4.33 (SD 3.06) compared with 2.59 (SD 1.44) for those who experienced serious food shortage. It was further noted that less than 10% of the children consumed the recommended five food groups in a day preceding the survey. Significant association was observed between household food availability and consumption of the recommended food groups where-by 66.7% of the children from households with enough food consumed all the five groups compared to 4% from the food insecure households (Figure 70). Low dietary diversity score is common among children of age between 6 and 23 months. Low dietary diversity and early complementation increase the risk for malnutrition among children. The inverse association between dietary diversity and the prevalence of stunting, underweight and wasting was reported in the study done in Tanzania (Khamis et al, 2019).

Table 37. Child Food Group Diversity Score (FGDS) by age class, education level and share of income for food purchase - summary statistics.

variable	Levels	n	perc	mean	st.dev	min	Q1	median	Q3	max
age class	[15,20]	141	27.5	3.47	1.94	0	2.00	3.0	5.00	9
	(20,25]	141	27.5	3.30	1.57	0	2.00	3.0	4.00	7
	(25,30]	98	19.1	3.13	1.63	0	2.00	3.0	4.00	9
	(30,35]	65	12.7	3.25	2.06	0	2.00	3.0	4.00	9
	(35,49]	67	13.1	3.54	1.67	0	2.00	3.0	5.00	8
education	1-Illiterate	209	40.8	3.29	1.65	0	2.00	3.0	4.00	9
	2-No qualification/literate	6	1.2	2.17	1.83	0	0.50	2.5	3.75	4
	3-Primary	266	52.0	3.41	1.86	0	2.00	3.0	4.00	9
	4-Secondary	29	5.7	3.17	1.69	0	2.00	3.0	5.00	6
	5-More than secondary	2	0.4	5.00	1.41	4	4.50	5.0	5.50	6
share income for food*	1-A very limited part (less than 25%)	34	6.6	3.71	2.07	0	2.00	3.5	5.00	9
	2-Less than half (from 25% to 50%)	108	21.1	3.40	1.65	0	3.00	3.0	4.00	9
	3-About half (50%)	141	27.5	3.65	1.79	0	2.00	4.0	5.00	9

120

variable	Levels	n	perc	mean	st.dev	min	Q1	median	Q3	max
	4-More than half (from 50% to 75%)	161	31.4	3.19	1.75	0	2.00	3.0	4.00	9
	5-Almost all (from 75% to 100%)	68	13.3	2.78	1.64	0	2.00	3.0	4.00	8
food needs*	1-No we experienced serious food shortages	125	24.4	2.59	1.44	0	2.00	3.0	3.00	7
	2-We experienced some difficulties	224	43.8	3.46	1.68	0	2.75	3.0	5.00	9
	3-We had about what we needed	82	16.0	3.74	1.85	0	3.00	3.0	5.00	9
	4-Yes we had what we needed	78	15.2	3.71	2.01	0	3.00	4.0	5.00	9
	5-Yes more than enough	3	0.6	4.33	3.06	1	3.00	5.0	6.00	7
Total	Total	512	100.0	3.34	1.77	0	2.00	3.0	4.00	9

*Kruskal-Wallis test: p<0.05
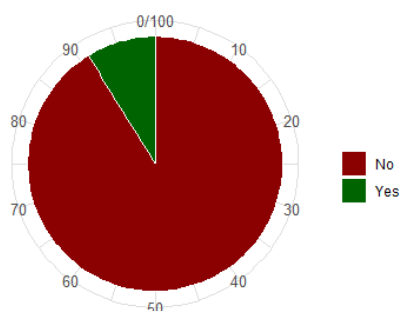
Figure 70. Child All-5: Consumed all five recommended food groups

Table 38 shows that less than 10% of the children consumed the recommended five food groups. There was a significant association (P<0.05) between recommended food group consumption and household food sufficiency. About 67% of the children from households with food sufficiency consumed all the five food groups compared with only 4% from the food insecure households. It is common that children are given foods from cereal staples, roots, and tubers and sometimes a combination of different cereals with limited intake of vegetables, legumes, and animal source foods. Promotion of consumption of diversified foods from each of the food groups is recommended.

Table 38. Children consuming all five recommended food groups (All-5) by age class, education level and share of income for food purchase - %

variable	Levels	No		Yes		Total	
		n	%	n	%	n	%
Total	Total	467	91.2	45	8.8	512	100
age class	[15,20]	128	90.8	13	9.2	141	100
	(20,25]	132	93.6	9	6.4	141	100
	(25,30]	92	93.9	6	6.1	98	100
	(30,35]	54	83.1	11	16.9	65	100
	(35,49]	61	91.0	6	9.0	67	100
education	1-Illiterate	193	92.3	16	7.7	209	100
	2-No qualification/literate	6	100.0	0	0.0	6	100
	3-Primary	240	90.2	26	9.8	266	100
	4-Secondary	27	93.1	2	6.9	29	100
	5-More than secondary	1	50.0	1	50.0	2	100
share income for food	1-A very limited part (less than 25%)	31	91.2	3	8.8	34	100
	2-Less than half (from 25% to 50%)	99	91.7	9	8.3	108	100
	3-About half (50%)	125	88.7	16	11.3	141	100
	4-More than half (from 50% to 75%)	148	91.9	13	8.1	161	100
	5-Almost all (from 75% to 100%)	64	94.1	4	5.9	68	100
food needs*	1-No we experienced serious food shortages	120	96.0	5	4.0	125	100
	2-We experienced some difficulties	206	92.0	18	8.0	224	100
	3-We had about what we needed	73	89.0	9	11.0	82	100
	4-Yes we had what we needed	67	85.9	11	14.1	78	100
	5-Yes more than enough	1	33.3	2	66.7	3	100

*Chi-square test: p<0.05

Child NCD-Protect score, NCD-Risk score, and Global Dietary Recommendations (GDR)

The mean child NCD–protect score was 2.3 (SD 1.5). There was no association between NCD-protect score with age or education of the parent. There was a significant association between NCD-risk score and the household food sufficiency where children from households with enough food had higher average NCD-protect score of 3.0 (SD 2.0) compared to 1.8 (SD 1.2) for those with limited food. Likewise, children from households that spent less than 25% of the income on food had significantly higher NCD-protect score of 2.7 SD 1.8) compared with those from households that spend almost all their income on food (1.8; SD 1.4) (Figure 71). Regarding NCD-risk score, it was observed that the mean score was 0.7 (SD1.04). Similarly, there was a significant association between the NCD-risk score for the children from households that spent less than 25% of the income on food compared with those from households that spent almost all their income on food (Figure 72).
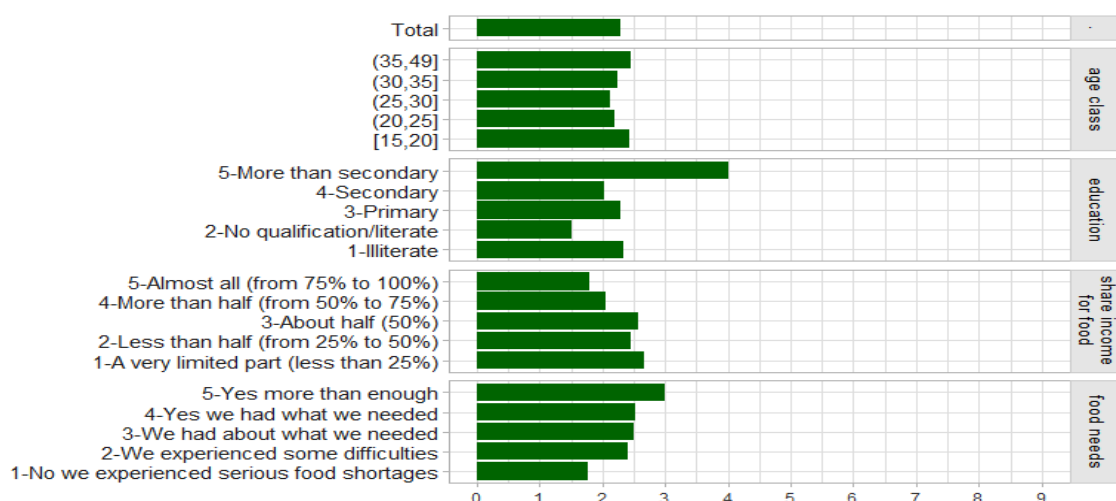
Figure 71. Child NCD-Protect score by age class, education level and share of income for food purchase - average values.

Significant for share of income for food and on food needs (Kruskal-Wallis test: p<0.005)
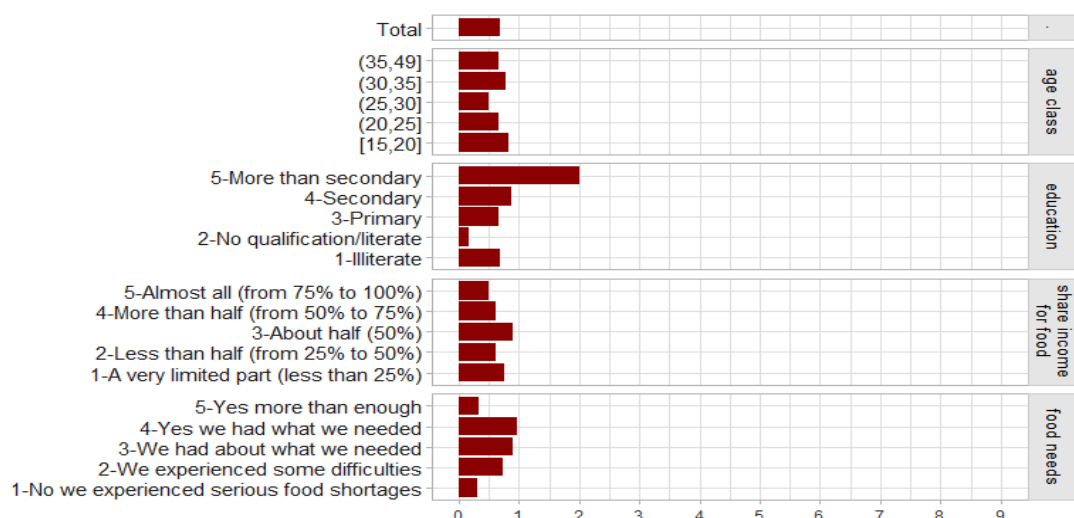
Figure 72. Child NCD-Risk score by age class, education level and share of income for food purchase - average values.

Significant for share of income for food and on food needs (Kruskal-Wallis test: p<0.005)

Global dietary recommendation score

The global dietary recommended score (GDR-score) for the children ranged from 6 to 15 food groups with the mean of 10.6 (SD1.4). Significant association was observed only with the food needs where children from households with food sufficiency had significantly higher GDR-score than those from food secure households (Table 39).

Table 39. Child GDR score by age class, education level and share of income for food purchase - summary statistics.

variable	Levels	n	Perc	mean	st.dev	min	Q1	median	Q3	max
age class	[15,20]	141	27.5	10.61	1.48	6	9.00	11.0	12.00	14
	(20,25]	141	27.5	10.54	1.32	8	10.00	11.0	11.00	14
	(25,30]	98	19.1	10.62	1.34	8	10.00	10.0	11.75	14
	(30,35]	65	12.7	10.46	1.43	8	10.00	10.0	11.00	14
	(35,49]	67	13.1	10.79	1.61	6	10.00	11.0	11.50	15
education	1-Illiterate	209	40.8	10.65	1.46	6	10.00	11.0	12.00	14
	2-No qualification/literate	6	1.2	10.33	1.21	9	9.25	10.5	11.00	12
	3-Primary	266	52.0	10.61	1.41	6	10.00	11.0	11.75	15
	4-Secondary	29	5.7	10.17	1.20	8	10.00	10.0	11.00	14

variable	Levels	n	Perc	mean	st.dev	min	Q1	median	Q3	max
	5-More than secondary	2	0.4	11.00	2.83	9	10.00	11.0	12.00	13
share income for food	1-A very limited part (less than 25%)	34	6.6	10.91	1.62	8	10.00	11.0	12.00	14
	2-Less than half (from 25% to 50%)	108	21.1	10.82	1.48	6	10.00	11.0	12.00	15
	3-About half (50%)	141	27.5	10.68	1.49	6	10.00	11.0	12.00	14
	4-More than half (from 50% to 75%)	161	31.4	10.43	1.33	8	9.00	11.0	11.00	14
	5-Almost all (from 75% to 100%)	68	13.3	10.29	1.19	8	9.00	10.0	11.00	14
food needs*	1-No we experienced serious food shortages	125	24.4	10.47	1.17	8	10.00	10.0	11.00	13
	2-We experienced some difficulties	224	43.8	10.67	1.43	8	10.00	11.0	12.00	15
	3-We had about what we needed	82	16.0	10.60	1.59	6	10.00	11.0	11.00	14
	4-Yes we had what we needed	78	15.2	10.54	1.58	6	9.00	10.0	11.75	14
	5-Yes more than enough	3	0.6	11.67	1.53	10	11.00	12.0	12.50	13
Total	Total	512	100.0	10.60	1.42	6	10.00	11.0	11.25	15

Significant for share of income for food and on food needs (Kruskal-Wallis test: p<0.005)

2.9.4 Conclusions

2.9.4.1 Conclusions on the Research question

Low dietary diversity among women and children was observed in Kinda and Ndole villages. Poorly diversified diets is one of the primary indicators of inadequate nutrients intake which is a risk for malnutrition. There was **limited consumption of animal source foods from mothers and their children**. The main protein and iron source was legumes and some leafy green vegetables. Although consumption of NCD-risk foods was low, there was **high consumption of deep-fried foods and SSBs among children and women**. Almost all the diet quality variables were significantly associated with household food sufficiency.

2.9.4.2 Policy recommendations

- Promotion of proper food preparations and good combination of food varieties between and within the food groups is necessary to improve nutrients intake.

- Nutrition education targeting all rural household members should be emphasized to promote healthy eating habits and proper child feeding practices.
- Government should support and promote crop and animal diversification in production and consumption.
- Rural communities should be supported to diversify sources of income so as to increase purchasing power while considering proper food choices to avoid the risk for NCDs.

2.9.4.3 Recommendations for the project FoodLAND

- Project should conduct training in the study areas to create awareness on nutrition to both women and men. Men should attend these training since they are the ones who mainly make decision on how the household's income should be used.
- Given the low consumption of animal proteins (meat, eggs and dairy products) we found, it is recommended that FoodLAND researchers collaborate with the district officials who are responsible for Livestock development to promote livestock keeping in the area especially poultry keeping.
- There should emphasis in promoting the beans with increased levels of iron and zinc that have been selected in this project (Task 4.1.1). People in the study areas will benefit by using beans not only as source of protein and minerals but also as source of income. That will allow them to use the income to purchase other food items that are not being produced in their area.
- Project should inform the district officials responsible for education matters on the study results that shows low level of education among women in the study areas, so that appropriate interventions can be made. Low level of education has effect in understanding nutritional matters.

2.9.5 References

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2.10 Women empowerment in Rural areas of Tanzania: Kinda ward in Mvomero district

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2.10.1 Introduction

Since the declaration of the 'Women's Decade' in 1975, and especially after the Beijing Conference held in 1995, women empowerment has featured strongly in development agenda across the globe. Indeed, women's development in general and in particular women empowerment has become a global phenomenon and continues to generate interest and attention among both scholars and development practitioners. From a policy perspective, the international community through the United Nations is pursuing the implementation of the 17 Sustainable Development Goals by 2030. Gender equality is the fifth SDG, which the UN aims to achieve by empowering all women and girls across all global societies.

Interest and the motivation for supporting women empowerment is due to the benefits associated with it. In this regard, women empowerment, as observed by Kumar (2013) has many benefits including the fact that when women are empowered to do more and be more, the possibility for economic growth becomes apparent. Besides, eliminating a significant part of a nation's work force on the sole basis of gender can have detrimental effects on the economy. In addition, female participation in counsels, groups, and businesses helps to increase efficiency (Kumar 2013). It is further argued by authors that in almost every society and in every sphere of life women assume unequal position and status; thus it is necessary to empower them by providing equal opportunities.

In this study we sought to **explore the status of women empowerment among rural women in Kinda ward in Mvomero District**. These initial findings will be useful to assess the women's ability in controlling and benefitting from local resources, assets, income, decision making processes including food purchasing and dietary requirement decisions in rural Tanzania.

2.10.2 Methodology

For information on the study area, the data collection process, and the data analysis please refer to section 2.9.2.

2.10.3 Results

2.10.3.1 Socio-demographic profile of the women and their households

Age has always been one of the key factors in determining population dynamism. In Ndole and Kinda villages, the average age of the respondents was about 26 years old with minimum and maximum age of about 16 and 49 years old respectively. The results also shows that a large percentage of the respondents are between 15 to 25 (55%) years old, followed by 25 to 30 (18.9%) years old, 30 to 35 (13.1%) years old, and 35 to 49 years old (12.9%) (Figure 73).
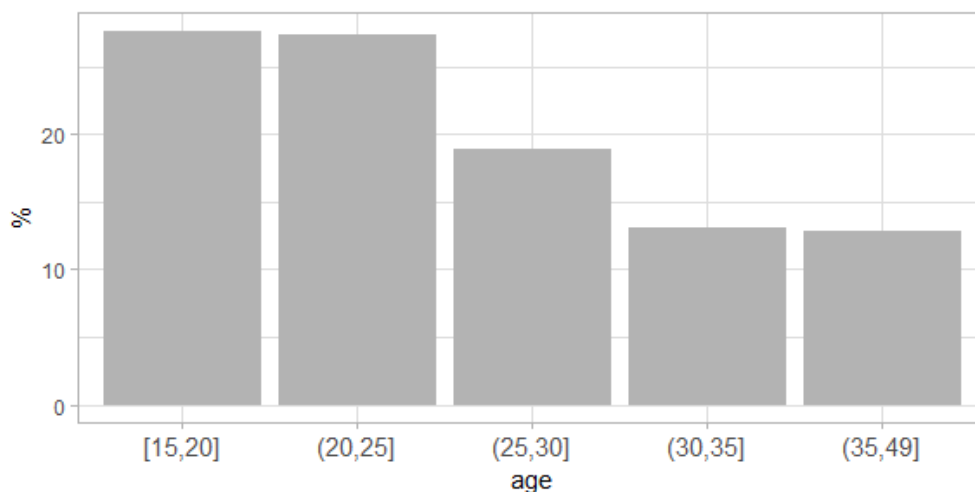
Figure 73. Age of respondents by class

The average number of children in the household is 3 whereby the largest household had 11 children as opposed to the smallest one with only one child. The analysis also shows that half of the women has one to two children, and this indicates that most of the women were in early reproductive age. A few of interviewed women (approx.18%) have more than five children (Figure 2).
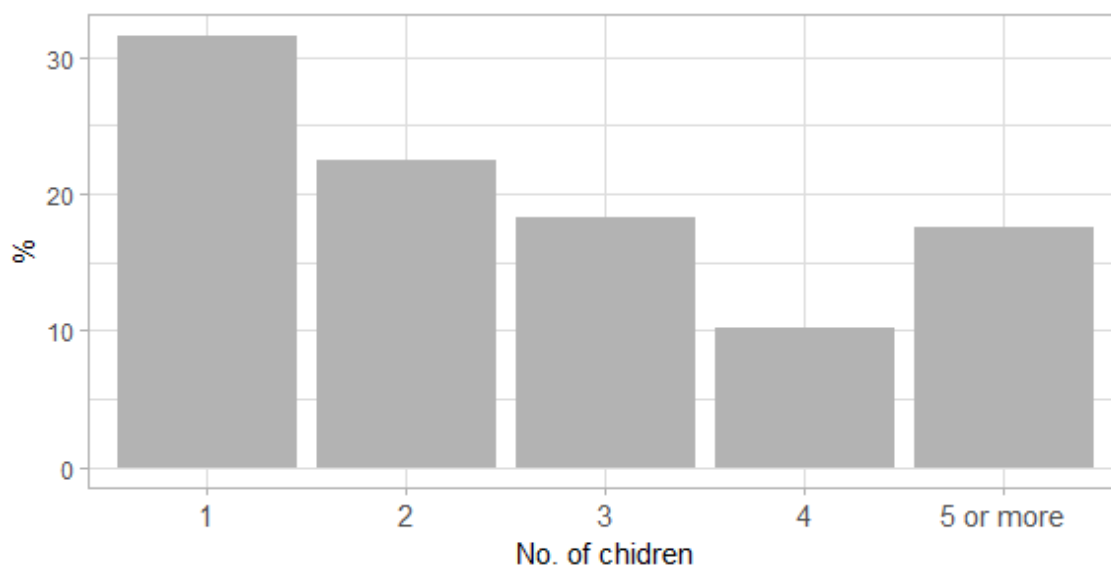
Figure 74. Number of children in the household

Slightly more than a half of the women (52%) who participated in the study has completed at least their primary education and few of them (about 6%) have also a secondary education level (Table 40). That means on average women in the study area can at least read, write, and count hence if they are educated on nutrition and the importance of adopting new technologies, they are likely to follow the program and probably adopt the technologies. However, 41% of the women have

not received any formal education. This suggests that the level of illiteracy among women is also high. Many women aged from 15 to 20 have no formal education (50%) compared to other age categories (Table 40). There is a probability that majority of the women in each age category have early drop-out from school, maybe due to early pregnancy or they did not have access to education services. **Therefore, any intervention introduced should consider the level of education of the women in rural areas and how to target (through nutritional and information campaigns) those who are illiterate.**

Table 40. Education level by age class - %

variable	levels	1-Illiterate	2-No qualification/literate	3-Primary	4-Secondary	5-More than secondary	6-other	Total
Total	Total	40.9	1.2	51.7	5.8	0.4	0	100
age class	[15,20]	50.3	0.7	44.8	4.2	0.0	0	100
	(20,25]	39.4	0.7	54.2	5.6	0.0	0	100
	(25,30]	25.5	3.1	61.2	8.2	2.0	0	100
	(30,35]	45.6	1.5	42.6	10.3	0.0	0	100
	(35,49]	41.8	0.0	56.7	1.5	0.0	0	100

The analysis shows a statistically and significant relationship between age and the level of education (Table 41). This means that older respondents were more able to receive education than younger ones, as most of the younger women have no education. This calls for attention of the district officials responsible for education matters to see how this situation can be improved.

Table 41. Test on the relationship between Education level and age class

Test	Statistic	df	p.value	Signif
Pearson's Chi-squared test	32.96	16	0.0075	**

The average number of members in the household is 5, consisting of one adult men and women (2 adults), one child aged 0 to 2, and two children aged 3 to 13. The results also suggest that the average number of adults with salary/revenue is two with an average of one woman with salary/revenue (Table 42).

Table 42 Number of household members.

Household members	n	Mean	st.Dev	min	Q1	Median	Q3	max	NAs
men (adults 14 or older)	518	1.22	0.77	0	1	1	1	5	0
women (adults 14 or older)	518	1.46	1.00	1	1	1	2	12	0
children (aged 3-13 years)	518	1.50	1.30	0	0	1	2	8	0
children (aged 0-2 years)	518	1.04	0.20	1	1	1	1	2	0
no. total of components	518	5.22	2.23	2	3	5	6	21	0
no. total of adults	518	2.68	1.41	1	2	2	3	13	0
adults with salary/revenue	518	2.10	0.96	0	2	2	2	8	0
women with salary/revenue	518	1.15	0.65	0	1	1	1	4	0

2.10.3.2 Main forms of employment and sources of income

Results show that women are engaged in various economic activities to generate income. However, most women are employed in agriculture (77%) followed by other economic activities (63%) (Table 43). The other economic activities include mining, and the selling of local alcohol beverages.

Table 43. Main forms of employment

Type of Employment	N	% on respondents	single employment %
Farmer	470	90.7	76.6
Non-farm household employment	78	15.1	25.6
Off-farm regular worker	2	0.4	0.0
Off-farm informal/casual worker	62	12.0	25.8
Other	19	3.7	63.2
Respondents	518		

multiple responses

According to the study results, 77% of the women who are not head of households are involved in agriculture, 10% are employed in non-farm activities, 9% are involved in off farm informal activities and the remaining 4% are off farm regular workers and others (Figure 4). **This implies that most of the households in the surveyed area are dependent on agriculture.**
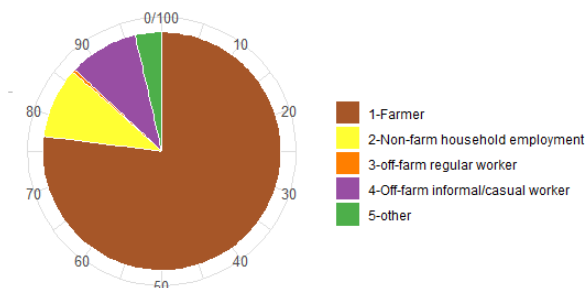
Figure 75. Household head's main employment

The sources of household income are distributed into four categories: agriculture, non-farm income, remittances, and aid/subsidies (Figure 76). Table 44 shows that there is a gap of 26 ("000" TZS) between a household's monthly incomes obtained in agriculture and non-agriculture. On average monthly household income obtained from agriculture is 69 ("000" TZS) and 43 ("000"TZS) from non-farm. The results also indicate that the maximum monthly income from agriculture is 1 000 ("000" TZS) while non-farm is 600 ("000" TZS). This indicates that **a larger percentage of household income is earned from agriculture than other non-agricultural activities** (Table 44).
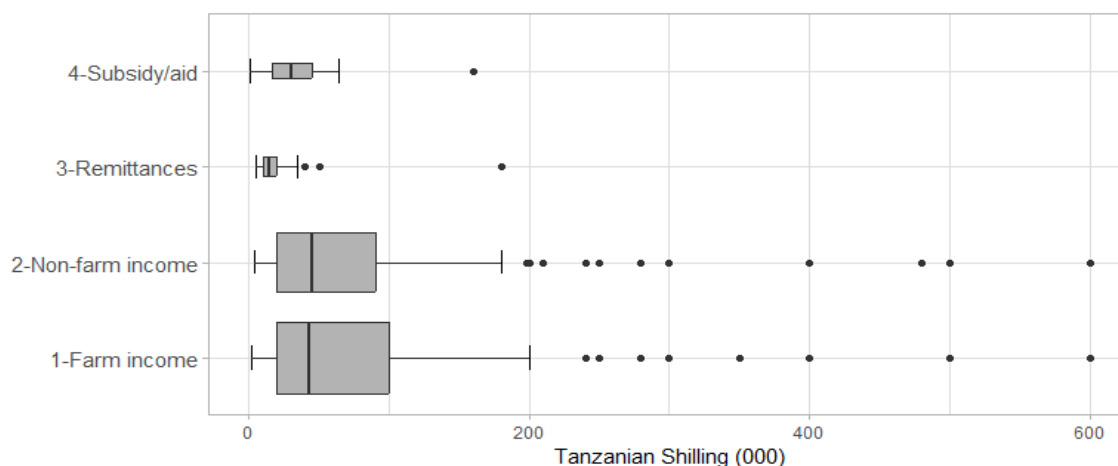
Figure 76. Monthly household income: sources - distribution

Table 44. Average monthly household income from the following sources - summary statistics

Sources	Mean	st.Dev	min	Q1	Median	Q3	max	NAs
Farm income	69,574.88	101,097.53	0	10,000	30,000	86,000	1,000,000	0

Sources	Mean	st.Dev	min	Q1	Median	Q3	max	NAs
Non-farm income	43,577.25	80,646.90	0	0	12,000	50,000	600,000	0
Remittances	1,601.80	9,899.07	0	0	0	0	180,000	0
Subsidy/aid	1,402.53	9,625.41	0	0	0	0	160,000	0
Total	116,156.45	138,783.56	3,000	30,000	70,000	150,000	1,550,000	0

values in Tanzanian Shilling

Table 45 shows that about 88% of household members aged between 15 and 35 years old have a higher average monthly income than household members aged between 35 and 49 years old. The reason for this scenario is not very clear it could be that younger women are more productive than older women since they can be able to engage themselves in various income earning activities than older ones. The results also suggest that women that have attained formal education (primary and secondary levels) show higher household monthly income levels (119 "000" to 133 '000" TZS) compare to the households with women without any formal education (illiterate) (103 "000" to 105 "000" TZS) (Table 46). It is possible to infer that these women, thanks to the education they have received, support greatly the households in earning higher incomes, due to their knowledge and skills to practice in agriculture production they have achieved through education. The given results suggest that **any intervention to be made in the study area should focus on improving income especially to the population with no formal education**.

Results shows that the level of food insecurity is high as indicated in Table 45, about 68% of the household members had food shortage and while 32% had food that met their needs. Lack of food for most of the household members could be due to low monthly income. This proves that there is a positive and significant relationship between income and food needs that means increased monthly household income leads to increased household food access (Table 46). **This suggests that there is need to educate farmers on the use of improved agricultural technologies such as improved seeds to increase the output produced and thus ensuring availability of food for home consumption and for sale so as to improve their income and increase the level of food security**.

Table 45. Monthly household income by age and education level - summary statistics

Variable	levels	N	perc	mean	st.dev	min	Q1	median	Q3	max
Age categories	[15,20]	140	28.0	102,298.6	109,171.4	10,000	30,000	71,500	147,000	750,000
	(20,25]	138	27.6	134,724.3	141,265.0	3,000	41,250	83,000	197,500	700,000
	(25,30]	92	18.4	107,734.4	135,867.8	5,000	25,000	51,750	144,000	800,000
	(30,35]	68	13.6	117,817.1	112,217.8	5,000	30,000	75,000	173,250	500,000

Variable	levels	N	perc	mean	st.dev	min	Q1	median	Q3	max
	(35,49]	62	12.4	93,669.4	94,765.9	5,000	20,625	50,000	143,750	350,000
Level of education	1-Illiterate	203	40.6	103,086.3	94,803.6	3,000	35,000	70,000	150,000	570,000
	2-No qualification/literate	5	1.0	105,400.0	56,531.4	52,000	75,000	100,000	100,000	200,000
	3-Primary	262	52.4	119,747.6	136,224.7	5,000	30,000	70,000	150,000	750,000
	4-Secondary	28	5.6	133,464.3	176,801.5	10,000	30,000	55,750	210,750	800,000
	5-More than secondary	2	0.4	40,000.0	14,142.1	30,000	35,000	40,000	45,000	50,000
Food needs	1-No we experienced serious food shortages	118	23.6	68,686.0	87,572.3	3,000	20,000	37,550	84,750	700,000
	2-We experienced some difficulties	222	44.4	110,355.9	127,136.9	5,000	30,000	70,000	131,125	800,000
	3-We had about what we needed	81	16.2	143,485.6	113,761.9	10,000	50,000	130,000	200,000	500,000
	4-Yes we had what we needed	76	15.2	152,869.7	142,538.6	10,000	50,000	98,750	207,500	750,000
	5-Yes more than enough	3	0.6	266,666.7	144,337.6	100,000	225,000	350,000	350,000	350,000
Total	Total	500	100.0	113,288.8	123,171.4	3,000	30,000	70,000	150,000	800,000

Table 46. Test on the relationship between total monthly household income age, education levels, and food needs.

Variable	test	statistic	df	p.value	Signif
age class	Kruskal-Wallis	8.70	4	0.0691	.
Education	Kruskal-Wallis	1.56	4	0.8153	
food needs	Kruskal-Wallis	53.73	4	6.0e-11	***

2.10.3.3 Women's role in the household and women empowerment

When they were asked of their role in the household, about 88% of the 518 sampled women responded that they are household head's wife/daughter, 10% that they are the household head, and 2% are relatives or others (Table 47).

Table 47. Women's role in the household

Role	N	%
Household head	49	9.5
Head's wife/daughter/...	455	87.8
Head's relative	12	2.3
Other	2	0.4
Total	518	100.0

Most households in the study area are male-headed (Table 48). The respondents in this survey were young mothers, thus only 9% of those who took the survey were the head of households. This observation aligned with Tanzania culture where majority of households are male headed.

Table 48. Household headship

Household head status	Percent (%)	Observation (N)
Female household headship	9	49
Male household headship	91	469

Women's empowerment was determined based on women's involvement in decision making at household level. When they are head of households, most of them (62-94%) decide on all household matters (Table 49).

Table 49. Decision making when respondent is household head (%)

Variable	You	Another household member	You and another household member jointly	You and another household member separately	Someone outside the household	Household is not involved in this activity
What resources to buy/use	92	2	2	0	0	4
How to grow crops/raise animals/produce handicraft	88	2	8	0	0	2

Variable	You	Another household member	You and another household member jointly	You and another household member separately	Someone outside the household	Household is not involved in this activity
How much of the production to sell or to consume	82	4	8	0	0	6
How to spend the money	92	4	4	0	0	
Whether or not to take out a loan	67	4	4	0	0	24
How to educate your children	86	4	6	0	0	4
How to deal with health care issues	88	0	12	0	0	0
What to eat	94		4	2	0	0
Where you go and when	94	4	2	0	0	0

However, when they are not head of households, majority of them are involved in joint decision making on various aspects (Table 50). These include matters to do with health (71%), crop and livestock production (59%), how much to produce and consume (57%), what resources to buy or use (55%), how to educate the children (55%) and how to spend the money (53%).

Table 50. Decision making when a respondent is not household head (%)

Variable	You	Another household member	You and another household member jointly	You and another household member separately	Someone outside the household	Household is not involved in this activity
What resources to buy/use	1	43	55	1	0	0
How to grow crops/raise animals/produce handicraft	1	39	59	1	0	0
How much of the production to sell or to consume	1	40	57	1	0	2
How to spend the money	1	45	53	1	0	0
Whether or not to take out a loan	1	27	37	0	0	34
How to educate your children	1	30	55	0	0	13
How to deal with health care issues	7	21	71	1	0	0
What to eat	38	17	44	1	0	0

Where you go and when	6	43	50	1	0	0

The study shows that majority of the women (about 63%) are extremely happy about their roles and responsibility in decision making in the household and only a few (11%) are unhappy while 13% are just happy (Table 51). About 22% of the respondents preferred not to disclose their satisfaction about their role in decision-making. As indicated in Figure 77 and Table 13, the happiness levels were significantly affected by age group and income for food, but were not by the level of education, role in household, and even food needs status of the respondent's household.

Table 51. Women satisfaction about responsibility / role in making decisions in the household.

Happiness levels	N	%
Unhappy	45	11.2
Neither happy not unhappy	53	13.2
Happy	53	13.2
Extremely happy	252	62.5
Total	403	100.0
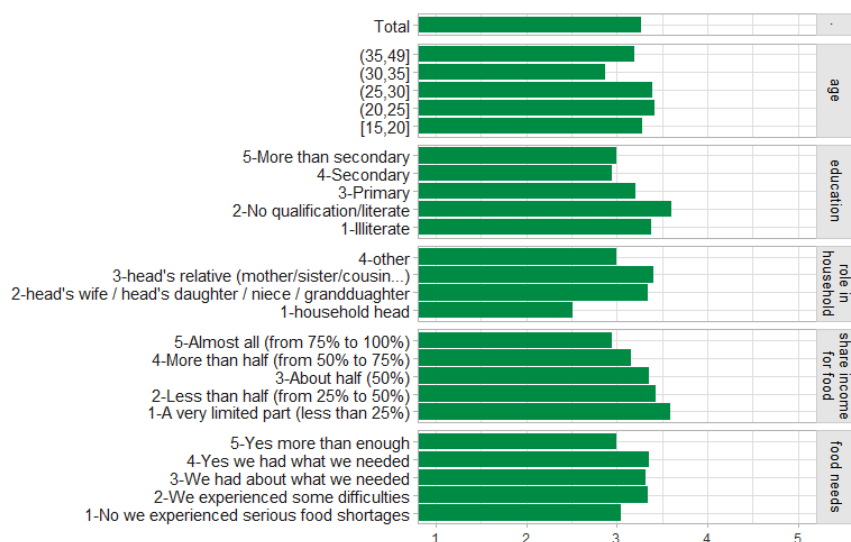
Figure 77. Satisfaction about responsibility / role in making decisions in household; average values on a scale from 1: Extremely unhappy to 5: Extremely happy

Table 52. Test on the relationship between Happiness about responsibility / role in making decisions in household and women age, education level, income level and Food needs.

variable	Test	statistic	df	p.value	signif
age class	Kruskal-Wallis	12.09	4	0.0167	*
education	Kruskal-Wallis	5.17	4	0.2699	
Q3.income.for.food	Kruskal-Wallis	10.99	4	0.0266	*
food needs	Kruskal-Wallis	6.10	4	0.1921	

There was no much difference in agreement among the age groups in support of the statements: Women are just as capable as men of contributing to household income; man's job is to earn money; a woman's job is to look after home and family; and Women can be as good leaders as well as men (Table 53). All age groups favoured these statements by showing agreement, above average, but not to the highest level of agreement.

Regarding how women's education level influenced the three women empowerment statements, those with higher than secondary school education strongly agreed that women are just as capable as men in contributing to household income, and that a man's job is to earn money and a woman's job is to look after home and family (Table 54). However, education did not influence very much the agreement to the statement that women can be as good leaders as well as men.

The groups with different food needs status had no big difference in opinion about capability of women to contribute to household income compared to men. They all agreed, but not strongly that women are just as capable as men of contributing to household income. The group had more than enough of their food needs, somewhat disagreed that a man's job is to earn money; and a woman's job is to look after home and family. The rest of the groups agreed, though not strongly, with the opinion that a man's job is to earn money; a woman's job is to look after home and family. All groups agreed that women can be as good leaders as well as men.

Table 53. Agreement with three women empowerment statements, average values

variable	Levels	A	B	C
Total	.	3.28	3.64	3.70
Age	[15,20]	3.20	3.81	3.37
	(20,25]	3.23	3.51	3.75
	(25,30]	3.68	3.73	3.98
	(30,35]	3.18	3.62	3.81

variable	Levels	A	B	C
	(35,49]	3.10	3.46	3.78
education	1-Illiterate	3.21	3.75	3.50
	2-No qualification/literate	3.67	4.50	3.00
	3-Primary	3.23	3.62	3.80
	4-Secondary	4.07	3.00	4.37
	5-More than secondary	5.00	3.00	4.50
food needs	1-No we experienced serious food shortages	3.03	3.93	3.67
	2-We experienced some difficulties	3.28	3.67	3.70
	3-We had about what we needed	3.51	3.49	3.69
	4-Yes, we had what we needed	3.47	3.33	3.75
	5-Yes, more than enough	3.25	2.50	4.00

values on a scale from 1: strongly disagree to 5: strongly agree

statement A: Women are just as capable as men of contributing to household income
statement B: A man's job is to earn money; a woman's job is to look after home and family
statement C: Women can be as good leaders as well as men

Table 54. Relationship between education and three women empowerment statements

Statements	Statistic	df	P.value	Signif
Women are just as capable as men of contributing to household income	46.51	16	0.000	***
A man's job is to earn money; a woman's job is to look after home and family	35.41	16	0.003	***
Women can be as good leaders as well as men	22.71	16	0.122	

2.10.4 Conclusions

2.10.4.1 Conclusions on the Research question

Women serve many different roles at household level. Women's role in decision making varies depending on their headship status. Most of them make decisions on all household matters when they are household head. However, as this study shows, households headed by women account for only a small proportion of households covered in this study. On the other hand, women are involved in joint decision making on various household matters. Besides majority were happy with the role that they play in society.

2.10.4.2 Policy Recommendations

From the study results, it is evident that **understanding gender roles and responsibilities will be a key factor in design and implementation of any effective intervention program particularly those targeting women**. However, the results suggest that still there is good number of young women who lack formal training. To bring sustainable change in rural settings (including dietary changes), it will be important to design program that will provide **out-of-school training to upgrade young women knowledge and skills to be in position to receive well other interventions packages**.

2.10.4.3 Recommendation for FoodLAND project

i. Convert the generated information to user-friendly formats that can be shared with wider communities in the surveyed areas.

ii. Produce policy briefs that can be shared to the public to inform on issues that need to be tackled to unlock potentials for young women in Mvomero rural areas.

iii. Advocate the need for formal education to women in the study area by presenting the results of this study to the relevant district officials. Since the women who do not know how to read and write are still young, programs for adult education are recommended in the area. At least knowing reading and writing will open doors for empowering women in this area to do more on food and income gaining activities than what they are currently doing.

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2.11 Rural consumer research: evidence from Fernana Food Hub, Tunisia

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2.11.1 Introduction

Tunisia is the smallest North African country, with a population estimated at 11.7 million inhabitants (INS, 2021). More than 70% of the population lives in urban areas. Residents of Greater Tunis exceed 25% of the total population, most of which lives all along the coastal zone in the east of the country. While the south and west are the areas with the lowest population density. According to the last national survey on budget, consumption and living standards conducted by the National Institute of statistics (INS, 2017), poverty rates regress to 15% in 2015. However, due to the geographic development inequities, poverty rate in rural areas is more than the double compared to urban areas (26% versus 10%). Higher unemployment rates, lack of equitable distribution of wealth, gender inequality (mainly due to the unequal participation to the workforce) lead to the widening of the social, economic and health gaps between Tunisians. The covid-19 pandemic added to the economic and social difficulties presents a serious threat to food security in Tunisia. Strategic studies analysing the four pillars of food and nutrition security in Tunisia have often shown that neither availability nor use nor stability represents a serious challenge for food security. However, physical, and financial access is increasingly difficult (ITES, 2017; FAO, 2016).

A disparity in consumption is notable between the two sexes in Tunisia with women consuming less than men, and between regions with the urban population consuming more than the rural population (Saidi & Mekki, 2020). The north-west and central west are the two regions that consume the least. In Tunisia, eating habits seem to be more modernised in urban areas, in better-off households or in households where the mother has a higher level of education (El Rhazi et al., 2015).

In this context the H2020 FoodLAND project was established to develop innovative technologies aiming at supporting the nutrition performance of local food systems in six Northern and Eastern African countries namely Morocco, Ethiopia, Kenya, Tanzania, Uganda, and Tunisia. FoodLAND's purpose is also to enhance biodiversity and food diversity, strengthen healthy diet diversity, and promote local food products. Tunisia, as one of the six countries under the FoodLAND project, has seen the emergence of food-related non-commutable diseases. Indeed, the current food diet has led to a high prevalence of obesity, overweight, and micronutrient deficiencies especially anaemia and iron deficiency.

This study on consumers' food behaviours and on dietary diversity and associated factors in Tunisia was carried out within the framework of the FoodLAND project. The objectives of this research were to **deepen the understanding of the behaviours in food consumption in rural area, namely in the selected food hub of Fernana and to evaluate the economic access to food, and women's empowerment according to socioeconomic conditions**.

2.11.2 Methodology
2.11.2.1 Description of the study area

Characteristics of the study area

Fernana is a delegation of the governorate of Jendouba which is is located in the Northwest of the Tunisia about 150km from the capital, with around 3,102 km superficies and 25km long coastline on the North side (API, 2018). The north-west of Tunisia is the least anthropized region. Indeed, the north-west is mainly rural (Alouane et al., 2013) with an urbanization rate of 27.9% in Jendouba.
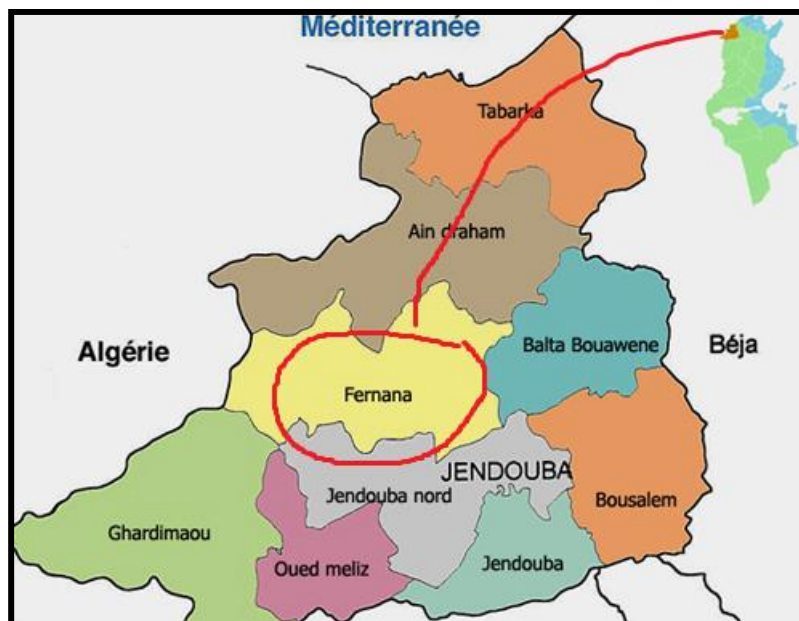
Figure 78. The Map of Fernana (Jendouba governorate)

Sociocultural and economic situation

Jendouba has 404 thousand inhabitants in 2019 with 3,144 new-borns (INS, 2021a) with a demographic density of around 130 inhabitants/km^2 (API, 2018). Jendouba has a negative population growth rate of -0.37% and a high poverty rate estimated at 21.5%(INS, 2020). It has 325 primary schools for 37,240 pupils, 52 secondary schools for 34,702 students and 4 universities (API, 2018). However the delegations with highest poverty rate namely Fernana (36.9%), Ghardiamou (27.2%), and Ain Draham (24.8%) are characterized by the highest school drop-out rates with 3,8% in Fernana (INS, 2020). Jendouba has 673 Km of paved roads, a Railway linking Tunis to Ghardimaou, and an airport in Tabarka with around 300 thousands travels/year (API, 2018).

Nutritional status

Jendouba is located in the Northwest of Tunisia, and therefore follows similar characteristics as the whole area. Northwest of Tunisia is the region that consumes the most soft-wheat with 96,8Kg/person in 2015. Indeed around 53,3% of calories are originated from cereals. It has also the highest oil consumption mainly subsidized vegetables oils with around 14,6% of calorie consumption. It is the second region in the term of calorie consumption with 2,625 calories/person in 2015. It is also characterized by the lowest calcium (714) intake and a low iron consumption (17,2) (INS, 2015).

2.11.2.2 Data collection and sampling

The data for this study was collected through a survey conducted with women-children peers aged between 6 and 23 months, at the Fernana foodhub, which is part of the FoodLAND project. The survey took place during the months of February and March 2023 in the region's health centers and the Fernana regional center for women and children's protection.

Target population and inclusion criteria

The survey targets 500 pairs of woman-child, living in rural region of Tunisia, namely Fernana. The women questioned were randomly selected and ought to be aged between 19 and 45 years old, having a child aged between 2 and 23 months.

General and ethical specifications

The survey is not to be run the day after a special day either festivity or Ramadan. To interview different segments of the population, the survey was done in three sessions namely morning, afternoon, or evening but never after 18h30 for security reasons. If the person surveyed does not check the inclusion criteria, the interview is ended before starting. All participants are informed of the objective of the survey. The questionnaire is conducted anonymously with the possibility for the candidate to choose not to answer a question that she finds not fit.

2.11.3 Results

2.11.3.1 Socioeconomic conditions

In this section, we present the result of 300 women surveyed by beginning of March 2023 (full set of data expected to be collected by the end of April 2023).

Education level and woman's role in the household

The age of respondents, ranges between 19 and 45 (median 32) and 34% of them have at least two children. Table 55 shows that 38% of women have secondary education, and the illiteracy rate is higher among women over the age of 35 years old (31.8%).

Table 55. Education level by age class - count

variable	levels	1-Illiterate	2-No qualification/literate	3-Primary	4-Secondary	5-More than secondary	6-other	Total
Total	Total	54	11	68	115	50	2	300
age class	[15,20]	0	0	2	1	0	0	3
	(20,25]	0	1	19	33	3	0	56
	(25,30]	8	0	10	40	15	1	74

variable	levels	1-Illiterate	2-No qualification/literate	3-Primary	4-Secondary	5-More than secondary	6-other	Total
	(30,35]	18	3	16	24	18	0	79
	(35,49]	28	7	21	17	14	1	88

Our results show that only 9% of the surveyed women are household head and that the main forms of employment are distributed as follow: 9% are farmers, almost 10% have non-farm household employment, 13% are off-farm workers and 70 % are homemakers (figure 1). The age of respondents, ranges between 23 and 45 (median 32) and 45% have at least three children. **Error! Reference source not found.** shows that 79% of women have at least primary education, and the illiteracy rate is higher among women over the age of 35 years old (32.1%).

Figure 79 Main forms of employment (Q14)

Sources of income of the household's head

According to the survey, there is significant variability between household incomes. In fact, the Average monthly household income varies between 0 and 1500 (TND) for farm income (ST.Dev=897.32), while it ranges between 0 and 4,000 (TND) for non-farm income (ST.Dev=876.33); Table 56).

Table 56 Average monthly household income from the following sources - summary statistics (Q17)

sources	Mean	st.Dev	min	Q1	Median	Q3	max	NAs
1-Farm income	410.55	897.32	0	0	0	0	5,000	0

sources	Mean	st.Dev	min	Q1	Median	Q3	max	NAs
2-Non-farm income	905.63	876.33	0	300	650	1,250	4,000	0
3-Remittances	190.95	498.50	0	0	0	0	2,000	0
4-Subsidy/aid	38.29	108.30	0	0	0	0	600	0
Total	1,545.43	1,091.56	180	600	1,200	2,390	5,000	0

Values in Tunisian Dinar (TND)

2.11.3.2 Physical and economic access to food needs

Purchasing food places and destination of the household's production

The table below indicates where the household obtained its food needs. Results shows that most of the food needs are either produced at the household or purchased in the markets of the village.

Table 57 Where the household obtained/bought food products.

products	0-Not used	1-Gathered in the wild	2-Produced in our household	3-Bought in the village	4-Bought in another village/city
Cereals and cereals products	0.0	0	80.7	87.3	1.3
Vegetables	0.0	0	55.0	92.0	2.7
Legumes and pulses	0.0	0	24.0	91.7	2.3
Fruits	0.0	0	25.0	95.7	5.7
Meat	0.0	0	18.0	94.0	10.0
Fish	0.3	0	0.7	76.3	25.0
Oils and fats	0.0	0	35.0	92.0	7.0
Dairies	0.0	0	17.3	93.7	2.0
Eggs	0.3	0	38.7	90.0	1.3

Based on collected data, it can be also noted that production of goods and services for own final use, by household members is a significant part of total production (53%) (Figure 80).

Table 58 Intended destination/use of your production (Q15)

Q15	N	%
1-all for sale/barter	2	0.7
2-mainly for sale/barter	25	8.3
3-partly for sale/barter, partly for family use	32	10.7
4-mainly for family use	26	8.7
5-entirely for family use	95	31.7
6-I don't produce	120	40.0
Total	**300**	**100.0**
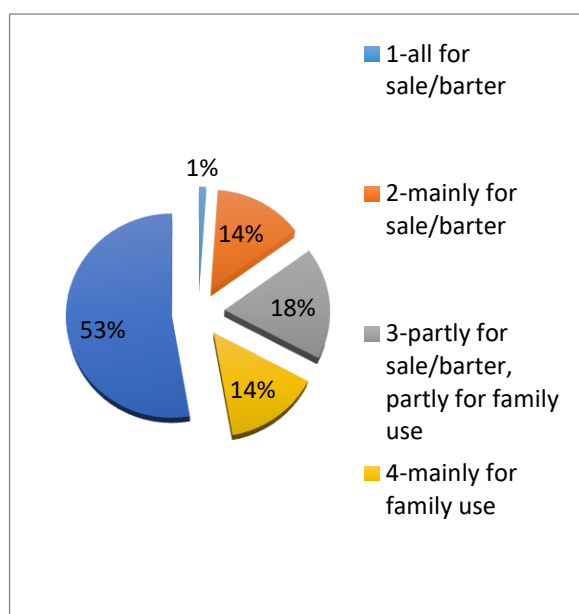
Figure 80 Intended destination use of production

Income dedicated to satisfying food needs

Based on collected data, it can be noted that about the half of the household's income is spent on purchasing foods.
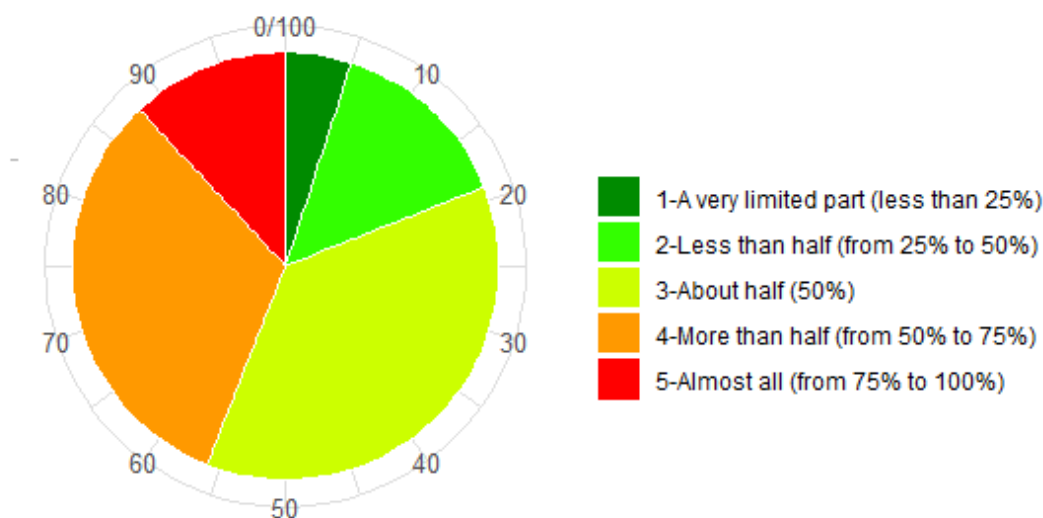
Figure 81 Share of household income spent on purchased food

It can be also observed that there is a significant relationship between total monthly household income and the satisfaction of food needs (Table 59)

Table 59 Test on the relationship between total monthly household income and the following variables

variable	test	statistic	df	p.value	signif
age class	Chi.square	20.71	16	0.1897	
education	Chi.square	26.84	20	0.1398	
Q2.food not purchased	Chi.square	70.27	16	9.0e-09	***
food needs	Chi.square	45.70	16	1.1e-04	***

2.11.3.3 Woman's empowerment in rural area

Participation in household decision-making

Our findings show that almost 40% of the interviewed women bear the responsibility for the production and decide on the destination of the various products, whether for sale or self-consumption. We can also observe from collected data that for at least 80% of cases, another household member takes care of the children's education and decide on what to eat. However, 50% of women surveyed participate jointly with another household member on how to spend the money and whether or not to take a loan.
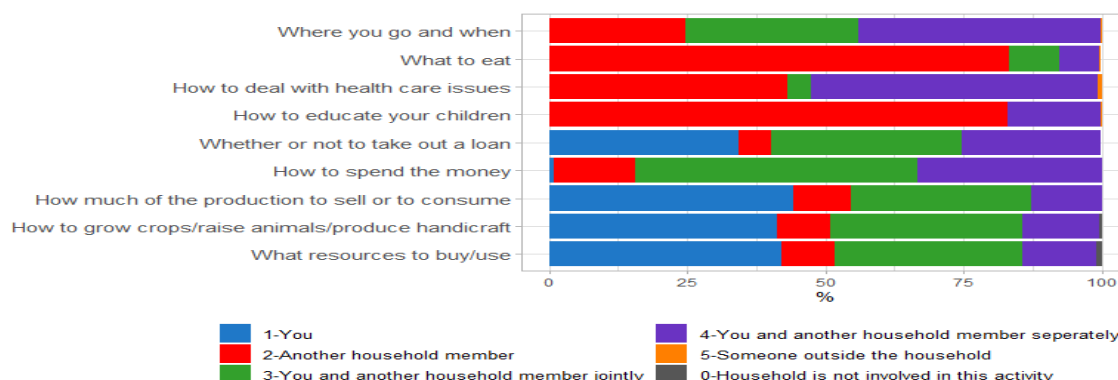
Figure 82 Role in household decision-making (Q19)

Women's satisfaction concerning the level of responsibilities in the household

According to answers to question Q20 on women' satisfaction, our results show that 68% of surveyed women (204/300) are satisfied about their responsibility or their role in making decisions in household. They declare to be happy or even extremely happy.

Table 60 Happiness about responsibility / role in making decisions in household

levels	N	%
2-Unhappy	35	12.5
3-Neither happy not unhappy	41	14.6
4-Happy	79	28.2
5-Extremely happy	125	44.6
Total	280	100.0

Involvement in groups/associations

Concerning Q21 dealing with the participation in groups and ties in the community, 14% of respondents are members of associations, while 26% are members of credit or microfinance groups (Figure 83).
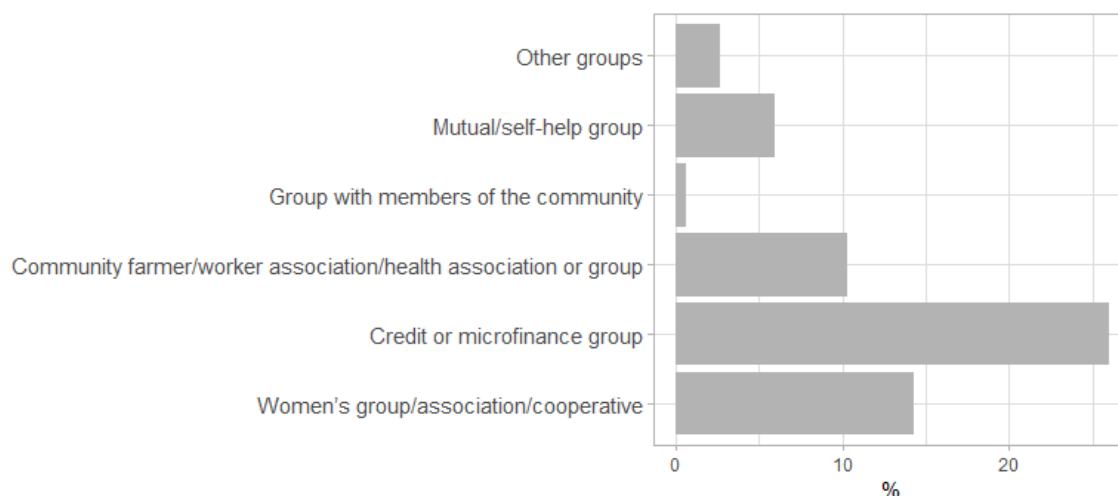
Figure 83 Participation in groups (Q 21)

Community opinions on the role that women can play in the household

As shown in Figure 84, the respondents declared that for community pairs, women are just as capable as men of contributing to household income are and could be as good leaders as well as men.
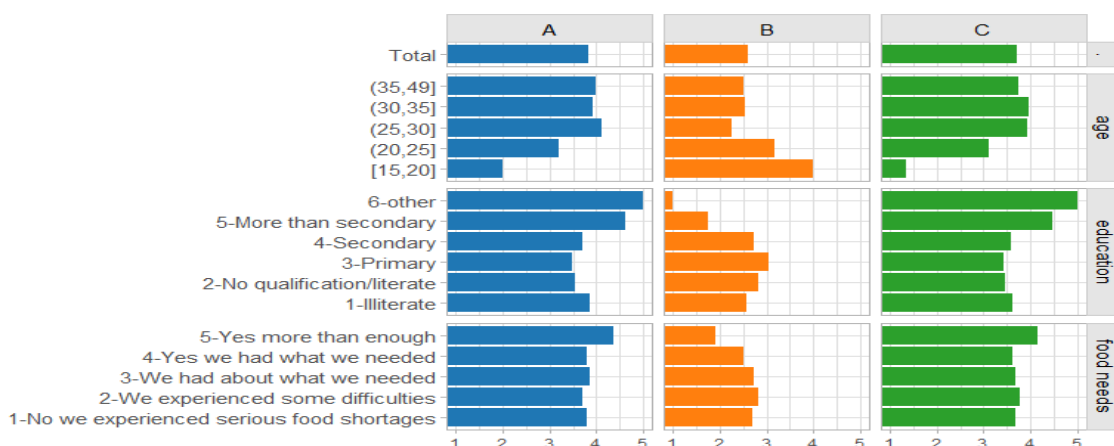
Figure 84 Your community: To what extent do you think your peers (in your community) agree with the following statements: A: "Women are just as capable as men of contributing to household income", B: "A man's job is to earn money; a woman's job is to look after home and family", C: "Women can be as good leaders as well as men" (Q22)

2.11.4 Conclusions
2.11.4.1 Conclusions on the Research question

Under the pressure of the proliferation of food-related diseases, the need for healthy and sustainable diets has emerged. This study aims to evaluate the Tunisian diet profile in rural area with focus on woman in reproductive age and their children aged between 2 and 23 months, its barriers, and promotions and to evaluate the economic access to food. To do so, a questionnaire

involving questions related to consumer socio-economic conditions and purchasing places asked to evaluate the diet diversity and the household economic access to food.

Our findings show that most women surveyed are illiterate or have a primary education. Very few of them are the head of their households, and their main job is to look after the household. On the other hand, our results also show that there are **social disparities between household's income in comparison to its different sources**. Households with non-farm income are better paid, this may have an impact on economic access to food needs. This is confirmed by the significant relationship between total monthly household income the satisfaction of food needs.

Finally, our results shown the **importance of women's empowerment in Tunisia**. Woman in rural area participate actively in decision-making: they decide about the agricultural production and the destination of the various products of her household. They also play an essential role on spending the money and taking loans.

To fight poverty, to facilitate access to food needs and to promote the enhancement of woman's role in the household, the Tunisian government has adopted strategies to assure food security. This strategy was based on direct allowances to families and price subsidies for essential food products like wheat, sugar, and vegetable oils (Drogue et al., 2020). This strategy has led to a switch in the Tunisian diet into an energy-dense food, especially salt and sugar.

2.11.4.2 Policy recommendations

Food security has long been a concern of Tunisian governments, but these concerns have not been addressed successfully using conventional public finance instruments. The current crisis in the food economy leads to an unsustainable situation; therefore, it is imperative to explore alternative reforms. The government's subsidy strategy does not favor the most vulnerable households, as the wealthiest also benefit. Mechanisms for providing subsidies to needy households need to be put in place.

Strengthening women role into economic life is necessary given the crucial role they play in the household. Women are the primarily responsible for the acquisition of the household's food needs, the health of their children, their education, as well as their own participation in the household's different agricultural activities.

At this level, the Ministry of Women's Affairs must emphasize this aspect through the implementation of:

- **access to micro-credits for the financing of small women's projects,**
- **training in manual trades such as the valorization of agricultural products (distillation of aromatic plants, simple craft processing,)**

Research and development projects are called upon to play a decisive role in this framework; such is the case of the FoodLAND project.

2.11.4.3 Recommendations for the FoodLAND project

Local food products play still an important role in the Tunisian diet and thus the income of the household is not an important factor in the decision-making of buying it. Project recommendations

must go in this sense: **encourage people to buy and consume local food product, especially in their near market.**

However, the households' access to food needs and the willingness to improve their diet is strongly related to the education level, their income, and the role of the woman in decision-making.

These themes, namely the promotion of local diets and gender equality, are at the core of the FoodLAND project. For this, the project must rely in WP6 "communications" on the call for the promotion of local food products, which are generally inexpensive and accessible to all consumers, mainly in rural areas. **The project can also promote the role of women and encourage them to participate in household income through some handicraft activities at home and marketed in local communities.**

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2.12 Effect of social capital on household food expenditure among women in Kamuli district, Uganda: A perspective of Engel's theory

Authors: Brian Ogenrwoth, Josephine Kisakye, Johnny Mugisha

2.12.1 Introduction

Social capital is a catalyst for social synergies and collective action (Munasib & Jordan, 2011). Social capital refers to arrays of an individual, household, institution, and associated attributes such as values, norms, attitudes, and relationships that lead to externalities to society and related socioeconomic development (Santini & Pascale, 2012). It can also be defined as an individual or a joint empathy exhibited to another person or groups of individuals to create a gain, advantage and opportunities (Gustafson & Nganje, 2006). Johannes (2011) classified social capital as macro, including legal and institutional framework, policy discourse and quality of governance. The micro elements of cognitive social capital include trust and collective action whereas structural social capital includes formal and informal institutions, transparency, decision making and mutualism.

The social capital index has been used by Maluccio et al. (2007) as a measure of social capital. Other studies have measured social capital as membership in a range of groups; farmers, women, water use, business, forest, watershed, contact with government officials, and informal saving (Husen et al., 2017), premium paid by farmers when they develop a cordial relationship with input suppliers (Gustafson & Nganje, 2006). Johannes (2011) measured social capital as; participation in community decision making index (coded very active and not very active and a scale of 1 and 0 put respectively). The total responses at the household level were summed up and added to the mean response of organizational support, averaged and multiplied by 100. **This study measured social capital by using individual meetings attended by household members in various groups and a decision making index was generated**.

The research question that this study aimed at addressing were; Does social capital have an effect on household food expenditure? Does proportion of income spent on food expenditure reduce with increase in household income?

2.12.2 Methodology
2.12.2.1 Data collection procedures and tools

The primary data of this study were those collected from the rural consumer research activities undertaken in Uganda. Additional information is provided in Section 2.1.

Two dependent variables were measured; food expenditure (continuous) and food per capita (continuous). Following Rubhara et al. (2020), a robust OLS (Multiple linear regression model was ran comparing two dependent variables and the one with a higher R^2 was chosen i.e. food per capita. Other than social capital (explained in the preceding section), other independent variables used in the model included respondent's age, education level, household size and others detailed in Table 61.

Table 61. A priori expectations for the explanatory variables used in the model

Variable	Type of Variable/measurement	Sign	Author (Year)
Independent variable			
Social capital dimensions			
Membership in women's group	Dummy (1=yes,0=no)	+	(Johannes, 2011)
Credit group membership	Dummy (1=yes,0=no)	+	(Johannes, 2011)
Community farmer	Dummy (1=yes,0=no)	+	(Johannes, 2011)
Self-help group	Dummy (1=yes,0=no)	+	(Johannes, 2011)
Other groups	Dummy (1=yes,0=no)	+	(Johannes, 2011)
Participation in decision-making	Continuous (averages multiplied by 100)	+	(Johannes, 2011)
Socio-demographic covariates			
Education level	categorical	+	(Johannes, 2011)
Age	Continuous Respondent's age in years	+/-	(Johannes, 2011), Sekhampu (2012), Rubhara et al. (2020), Osobase (2019)
Age squared	Continuous Exponential transformation	-	(Johannes, 2011)
Household income	Continous Total household income less remittances	+	Nzeyimana et al., 2020), Sekhampu (2012), Rubhara et al. (2020)
Remittances	Continuous	+/-	Nzeyimana et al., 2020), Osobase(2019)
Dependence ratio	Percentage ratio of non-workers to workers in each household		Nzeyimana et al., 2020), Rubhara et al. (2020)
Proportion of Food produced in the household	Categorical	-	study
Household size	Continuous

Numbers | + | (Johannes, 2011), Nzeyimana et al., 2020), Sekhampu (2012), Rubhara et al. (2020), Osobase(2019) |
Household head/role of woman	Categorical	+	Sekhampu (2012)
Education head	Categorical	+	Sekhampu (2012)
Women's form of Employment	Categorical	+	Sekhampu (2012)
Household's form of employment	Categorical	+	Sekhampu (2012)

2.12.3 Results

2.12.3.1 Descriptive statistics

The results in Table 62. showed that most (32.4 percent) of the mothers in the sample were between 20-25 years. The same age class was found to have the highest percentage of women to have attained the minimum dietary diversity (MDD), mothers belonging to higher age classes had increasingly lower percentage of those attaining MDD. The average number of children by the respondents was approximately 3.5 which is lower than the national average of 6.9 (UBOS, 2014). The average household size was 6.7 higher than the national average of 4.7 (UBOS, 2014). Most of the respondents were either illiterate (33 percent) or completed primary level (33

percent). According to the NPHC, 2014, the illiteracy levels among females in Kamuli district was at 31.4 percent. The results show that 33 percent of the women in the sample are illiterate. The majority of the respondents were farmers as shown in Table 1. About 47 percent of the women obtained their income from farming and 10 percent were employed in non-farm work.

About 67 and 66 percent of the respondents reported having experienced shortages of meat and fish respectively. This is an expected result as meat and fish are quite expensive in comparison to other foods and are usually reserved for special occasions. Conversely, lower percentages of respondents reported having experienced vegetables (33 percent) and fruits (26.8 percent) in the past year. This could be because most of the families the rural farming areas either grow the fruits and vegetables in their homes or gathered them wild and commonly constitute daily diets especially when in season.

Table 62. Descriptive statistics of respondents and their households

Variable	Percentage	Mean	Standard deviation
Age		26.77	6.68
Number of children		3.53	2.29
Household size		6.70	3.24
Monthly income		488,118	1,433,818.79
Age classes			
1. [15,20]	19.3		
2. (20,25]	32.4		
3. (25,30]	22.1		
4. (30,35]	14.3		
5. (35,49]	11.9		
MDD-w by age class (1= yes)			
1. [15,20]	54		
2. (20,25]	87		
3. (25,30]	66		
4. (30,35]	44		
5. (35,49]	27		
Education			
1. Illiterate	33.0		
2. No qualification	10.7		
3. Primary			
4. Secondary	33.0		
5. More than secondary	19.3		
6. other	3.4		
	0.6		
Mobile phone			
1. yes	54.7		
2. no	45.3		
Employment			
1. Farmer	46.9		
	10.1		

2.	Non-farm household employment	3.8
		5.4
3.	Off-farm regular worker	36.8
4.	Off-farm informal/casual worker	
5.	Other	

Food shortage

1.	Meat	66.8
2.	Fish	65.8
3.	Cereals or cerealproducts	59.2
		53.3
4.	Eggs	51.5
5.	Dairies	40.4
6.	Oils and fats	40.0
7.	Legumes and pulses	33.0
8.	Vegetables	26.8
9.	Fruits	

Ability to meet household needs

1.	No we experienced serious food shortages	8.5
2.	We experienced some difficulties	28.8
		25.4
3.	We had about what we needed	33.8
4.	Yes we had what we needed	3.4
5.	Yes more than enough	

The average monthly household income was 488,118 UGX. This mainly was obtained from non-farm income sources (325,512 UGX) followed by farm income (157,701UGX) and the least average monthly income was obtained from remittances (1, 428 UGX). This is because most of the agricultural production is at small scale hence non-farm employment offers more income as shown in Table 63.

Table 63. Average monthly household income from the following sources - summary statistics

sources	Mean	st.Dev	min	Q1	Median	Q3	max	NAs
1-Farm income	157,701.01	840,352.67	0	0	30,000	105,000	15,000,000	0
2-Non-farm income	325,512.43	988,993.50	0	0	150,000	330,000	17,900,000	0
3-Remittances	1,427.44	19,316.77	0	0	0	0	400,000	0
4-Subsidy/aid	3,477.14	18,124.16	0	0	0	0	200,000	0

sources	Mean	st.Dev	min	Q1	Median	Q3	max	NAs
Total	488,118.01	1,433,818.79	5,000	100,000	250,000	435,000	21,000,000	0

values in Ugandan Shilling

It was reported that 41% of the respondents reported that they consumed more than half of the food (between 50% to 75%) of food that is produced by the household, gathered in the wild or provided to you for free. This was followed by those who consumed almost all from 75% to 100%) who constituted 28% of the respondents as shown in Table 64. This is because producing own food, gathering food from the wild and receiving free food has low or no cost implication hence the rural poor can afford to access easily.

Table 64. Share of the food consumed that is produced by the household, gathered in the wild or provided to you for free.

Q2	N	%
1-A very limited part (less than 25%)	29	5.8
2-Less than half (from 25% to 50%)	64	12.7
3-About half (50%)	62	12.3
4-More than half (from 50% to 75%)	205	40.8
5-Almost all (from 75% to 100%)	143	28.4
Total	503	100.0

The results revealed that most respondents spent a limited part of the household income (less than 25%) on purchased food (34.6%) followed by less than half (25% to 50%) which constituted 28% of the respondents and the least response was obtained from those who consumed almost all their incomes (75% to 100%) which stood at 7% as shown in Table 65. This could be attributed to the fact that most rural households rely on food produced on their farms and have limited income and yet there are streams of other expenses to meet.

Table 65. Share of household income spent on purchased food

Q3	N	%
1-A very limited part (less than 25%)	174	34.6
2-Less than half (from 25% to 50%)	143	28.4
3-About half (50%)	84	16.7

Q3	N	%
4-More than half (from 50% to 75%)	65	12.9
5-Almost all (from 75% to 100%)	37	7.4
Total	503	100.0

2.12.3.2 Econometric analysis

The results revealed that social capital has a positive and significant effect on food per capita expenditure at a 10% significance level; decision-making in groups with members of the community (p=0.048) and decision-making in mutual/self-help groups(p=0.077).

It was also found that the covariates that had a significant and positive effect on per capita food expenditure included; non-farm household employment (p=0.000), off-farm salaried or wage worker (0.000) and off-farm casual worker paid daily (p=0.017) compared to one being farmer. It was also revealed that respondents who were educated had a significant and positive effect on per capita food expenditure compared to the illiterate ones; no qualification but literate (p=0.002), primary (p=0.010), secondary (p=0.008), more than secondary (p=0.001) and remittance had a significant and positive effect on per capita food expenditure (p=0.007).

On the other hand, covariates that had a significant but negative effect on per capita food expenditure were household size (p=0.000), total household income (0.000), proportion of food produced by household and obtained for free (p=0.005) and dependency ratio (p=0.02) as shown in Table 66.

Table 66. The robust OLS results showing the relationship between food expenditure and social capital and covariates

loghhfoodexp		Coef.	Robust Std. Err.	t	P>t	logfdpercapita		Coef.	Robust Std. Err.	t	P>t
Independent variables						**Independent variables**					
Social capital variables						**Social capital variables**					
womengroup		-0.02471	0.1195517	-0.21	0.836	womengroup		-0.02471	0.1195517	-0.21	0.836
creditgroup		0.079932	0.1228295	0.65	0.516	creditgroup		0.079932	0.1228295	0.65	0.516
communityfarmer		-0.14822	0.2290995	-0.65	0.518	communityfarmer		-0.14822	0.2290995	-0.65	0.518
memberscomm		**0.275404**	**0.1386701**	**1.99**	**0.048**	**memberscomm**		**0.275404**	**0.1386701**	**1.99**	**0.048**
selfhelpgrp		0.221516	0.1250281	1.77	0.077	selfhelpgrp		0.221516	0.1250281	1.77	0.077
othergrps		-0.76455	0.468118	-1.63	0.103	othergrps		-0.76455	0.4681181	-1.63	0.103
decsnmakingindx		-0.00125	0.0014398	-0.87	0.386	decsnmakingindx		-0.00125	0.0014398	-0.87	0.386
Covariates						**Covariates**					
logage		1.090475	0.7338842	1.49	0.138	logage		1.090475	0.7338843	1.49	0.138
age2		-0.00059	0.000434	-1.36	0.175	age2		-0.00059	0.000434	-1.36	0.175
loghhsize		**0.213354**	**0.1136444**	**1.88**	**0.061**	**loghhsize**		**-0.78665**	**0.1136444**	**-6.92**	**0**
logpropfdprduced		**-0.45356**	**0.1604822**	**-2.83**	**0.005**	**logpropfdprduced**		**-0.45356**	**0.1604822**	**-2.83**	**0.005**
tothhincome		**3.86E-07**	**7.78E-08**	**4.96**	**0**	**tothhincome**		**3.86E-07**	**7.78E-08**	**4.96**	**0**
dependencyratio		**-0.00081**	**0.0003479**	**-2.34**	**0.02**	**dependencyratio**		**-0.00081**	**0.0003479**	**-2.34**	**0.02**
womenemploy						womenemploy					
	2	0.002216	0.1525658	0.01	0.988		2	0.002216	0.1525658	0.01	0.988
	3	-0.10532	0.201319	-0.52	0.601		3	-0.10532	0.201319	-0.52	0.601
	4	-0.19867	0.2901509	-0.68	0.494		4	-0.19867	0.2901509	-0.68	0.494
hhheademploy						hhheademploy					
	2	**0.517419**	**0.1220717**	**4.24**	**0**		**2**	**0.517419**	**0.1220717**	**4.24**	**0**

	3	0.683996	0.140154	4.88	0		3	0.683996	0.140154	4.88	0
	4	0.311766	0.1306474	2.39	0.017		4	0.311766	0.1306474	2.39	0.017
	5	-0.09823	0.1600925	-0.61	0.54		5	-0.09823	0.1600925	-0.61	0.54
educlevel						educlevel					
	2	0.487012	0.1578083	3.09	0.002		2	0.487012	0.1578083	3.09	0.002
	3	0.286766	0.1111731	2.58	0.01		3	0.286766	0.1111731	2.58	0.01
	4	0.340386	0.128599	2.65	0.008		4	0.340386	0.128599	2.65	0.008
	5	0.672239	0.2064123	3.26	0.001		5	0.672239	0.2064123	3.26	0.001
	6	0.401939	0.6129739	0.66	0.512		6	0.401939	0.6129737	0.66	0.512
remittance		2.80E-06	1.03E-06	2.72	0.007	remittance		2.80E-06	1.03E-06	2.72	0.007
womanrole						womanrole					
	3	0.451206	0.4143047	1.09	0.277		3	0.451206	0.4143047	1.09	0.277
	4	0.296312	0.224421	1.32	0.187		4	0.296312	0.224421	1.32	0.187
_cons		7.218737	2.032818	3.55	0	_cons		7.218736	2.032818	3.55	0

$F_{(28, 435)}$	=	9.3		$F_{(28, 435)}$	=	11.04
Prob > F	=	0		Prob > F	=	0
R-squared	=	0.424		R-squared	=	0.4914
Root MSE	=	0.92032		Root MSE	=	0.92032

2.12.4 Conclusions

2.12.4.1 Conclusions on the Research question

Social capital has a significant and positive effect on household food expenditure. This has a multiplier effect on food security. An increase in total household income leads to an increase in food expenditure.

2.12.4.2 Policy recommendations

1. There is need to improve group governance and institutional quality to enhance household food security through the household food expenditure pathway.
2. More off-farm income generating activities should be created in order to more disposable income especially targeting women groups since they are the most affected
3. Functional adult literacy should be integrated in agricultural extension and community development programs.
4. Good agronomic practices (GAPS) should be enhanced by the various actors. This is because increased yields will be attained hence reduced food security incidences.

2.12.4.3 Recommendations for the project FoodLAND

1. Data could be collected targeting male respondents as well.
2. More social capital indicators could be considered in future studies. These include labour hours spent in community engagements, membership in groups, roles in community groups among other.

2.12.5 References

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3. Diet quality and food security among urban consumers of five African countries: results from the FoodLAND project

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3.1 Introduction

Achieving healthy diets for all is critical to reach the United Nations Sustainable Development Goals, but so far healthy diets are not assured for everyone and everywhere (Global Panel, 2017). Globally, suboptimal diets are related to malnutrition in all its forms such as undernutrition, micronutrient deficiencies, and non-communicable diseases (NCDs) (Afshin et al., 2019) .

However, there is a scarcity of individual dietary data at global level (Development initiatives, 2022), one of the reasons being that, until recently, the available methods for assessing dietary intakes were expensive and required high investments in training and technical skills (FAO, 2018). Nevertheless, in 2020, the Global Diet Quality Project launched a new tool for the implementation of a standardized low-burden data collection method at population level. The tool is a questionnaire designed to collect the food group consumption data needed to construct data quality indicators (Uyar et al., 2023) and is adapted to 140 countries. The FoodLAND project collaborated in the questionnaire adaptation and translation for Uganda, Tanzania, Kenya, Morocco and Tunisia, and these questionnaires were part of the surveys conducted within the project with urban populations, thus allowing for the assessment of the quality of their diet.

Relative to food security, currently there is no single indicator able to measure all dimensions of food security, and the use of a variety of indicators assessing the different aspects is therefore required whenever possible. In terms of comparability, however, the use of standardized indicators and their selection according to the aspect of food security of interest remains strongly recommended. In relation to food access, one of the standard indicators most widely used is the Household Dietary Diversity Score (FAO, 2010).

The level of food insecurity has been identified as one of the key factors shaping the quality of diets in different contexts. A 2014 review among US adult population concluded that food insecurity is adversely associated with diet quality, particularly intakes of nutrient-rich vegetables, fruit, and dairy (Hanson & Connor, 2014). And other studies have observed this association also in some African populations (Kehoe et al., 2021) (Bukari et al., 2021) although studies are scarce for this continent, and the use of different methodologies to calculate both the food security and diet quality indicators makes the comparisons exercise between countries challenging.

The objective of this contribution is to **assess and compare the diet quality and food security characteristics of the urban consumers of the twelve cities from five different African countries** that have collected the data for this purpose, and explore their association with contextual, household, and individual characteristics.

3.2 Methodology

3.2.1 Study population

The population surveyed were urban consumers over 18 years of age and responsible for food shopping within their households. The cities were the surveys were implemented in each country are described below.

- In Morocco the cities are Meknès in north-east inland Morocco with 500 000 people and Beni Mellal located in north-central region of the country with a population of around 2 million.
- In Tunisia, the city of Sousse in the north-east coast of Tunisia with a population of 1 million people, and the city of Jendouba, which is the capital of one of the Tunis governorates, located inland and with around 70 000 inhabitants.
- In Kenya, the three cities are located inland: Kitui, one of the most populated localities in Kenya, with 150 000 inhabitants and 160 kms east of country's capital Nairobi; Nyeri-located 150 kms north of Nairobi with approximately 140 000 people; and Kisumu, at the shore of Lake Victoria, the third largest city in Kenya with 700 000 estimated population, and located at 350 kms north-west from Nairobi and at the shore of Lake Victoria.
- In Tanzania, one of the cities is the capital, Dar es Salaam, located in the coast line and with more than 6 million inhabitants. The other city is Morogoro located inland, 190 km west from Dar es Salam, and with a population of around 300 000 people.
- In Uganda there are three cities participating in this survey: Kalerwe (one of Kampala´s neighbourhoods), Kampala (and more specifically Nakaseke district), and Kapeeka,

3.2.2 Data collection procedures and tools

Data was collected using a standardized questionnaire that was used in two different contexts:

a. A standardized out-of-store/in the household survey in which the enumerators read the questions to interviewees and recorded answers
b. A set of in-lab standardized economic behavioural experiments that included the survey for urban consumers, that was read and auto-completed by the participants

Data was collected using an ad-hoc app developed by the project in WordPress in cities where internet conditions allowed for it. In cities where internet access was limited data was collected in paper and then entered in the online app by enumerators.

3.2.3 Variables

The survey questionnaire included socioeconomic conditions and consumption behavior variables as well as standardized questions to compute the food security and diet quality indicators, as described below (and in deliverable D2.3).

- The household dietary diversity questionnaire was collected according to the FAO guidelines (FAO, 2010), in order to construct the household dietary diversity score (HDDS), a standardized food access security indicator that ranges from 0 to 12. The higher the score higher the food access in the household.
- The global diet quality questionnaire (Uyar et al., 2023), that is a standardized questionnaire adapted at country level to collect diet data. These diet data allow for the computation of multiple diet quality indicators, including:

  o NCD (non-communicable diseases) Protect score is a score that ranges from 0 to 9 and reflects adherence to global dietary recommendations on healthy

component of the diet. A higher score indicates inclusion of more health-promoting foods in the diet.

- o NCD (non-communicable diseases) Risk score also ranges from 0 to 9 but reflects adherence to components of the diet to limit or avoid. A higher score indicates higher consumption of foods and drinks to avoid or limit.
- o Global Dietary Recommendations (GDR) Score that proxies the adherence to global dietary recommendations. It ranges from 0 to 18 and the higher the GDR score, the more recommendations are likely to be met. Its computation is based on the NCD-Protect and the NCD-Risk scores.
- o Minimum Dietary Diversity for Women indicator for women of reproductive age reflects the likelihood of having the micronutrients needs covered for women 15 to 49 years of age.
- o Other diet quality indicators that reflect the consumption of specific food groups or items, like vegetable and fruit, animal source foods, sweet foods, and others.

Global diet quality questionnaires adapted at country level and description of the suite of Indicators to be derived from it are available at https://www.dietquality.org.

3.2.4 Statistical analysis

Different methodologies were used in statistical analyses, according to the type of analysis and the type of variables involved. For bivariate analyses, the chi-square test was used to verify the presence of a significant relationship between the qualitative variables, while non-parametric tests (Kruskal-Wallis or Wilcoxon) were used when comparing qualitative and quantitative variables. The use of non-parametric tests was dictated by the presence of quantitative variables whose distributions did not meet the assumption of normality.

Generalized linear models were used to interpret any relationships occurring between the diet indicators and socio-economic determinants (e.g., gender, education, income, etc.). These included logit regressions to analyze dependent variables which are dichotomous, while Poisson models for dependent count variables.

3.3 Results

3.3.1 Descriptive statistics

The mean age of respondents across all cities was 38 years, although in Tunis and Morocco cities mean age of interviewees was higher (47 years in Meknes and 43 years in Tunis) as compared to cities in Kenya, Tanzania and Uganda where most of the cities showed mean values below 40 years.

The percentage of female respondents was 55% for the overall sample, but cities like Kisumu in Kenya, Sousse in Tunis, and Kampala and Kapeeka in Uganda had more than 60% of respondents being women.

More than 50% of respondents in most of the cities had secondary or higher education (the only exception being Kapeeka city in Uganda with only 34%, and some cities like Tunis and Sousse in Tunisia, and Kalerwe in Uganda that had more than 75% of respondents with higher education.

In relation to income, the respondents of the cities in Tanzania and Morocco perceived their situation worse off compared with the country average, with more than 40% in Meknes and Morogoro reporting to have monthly incomes below average. However in the cities of Tunisia or in Kitui and Nyeri cities in Kenya less than 10% of respondents reported to have a lower income than average. In Uganda the situation differed by city, with 27% of respondents in Kalerwe

reporting a monthly income below average as compared to Kampala and Kapeeka with around 14%.

3.3.2 Food security

The mean of the Household Dietary Diversity Score for the pooled sample was 8 food groups, although cities like Tunis in Tunisia and Meknes in Morocco showed higher HDDS values with a mean around 9; and the city of Kisumu in Kenya reported a lower mean around 7.5 food groups, as shown in Figure 85.
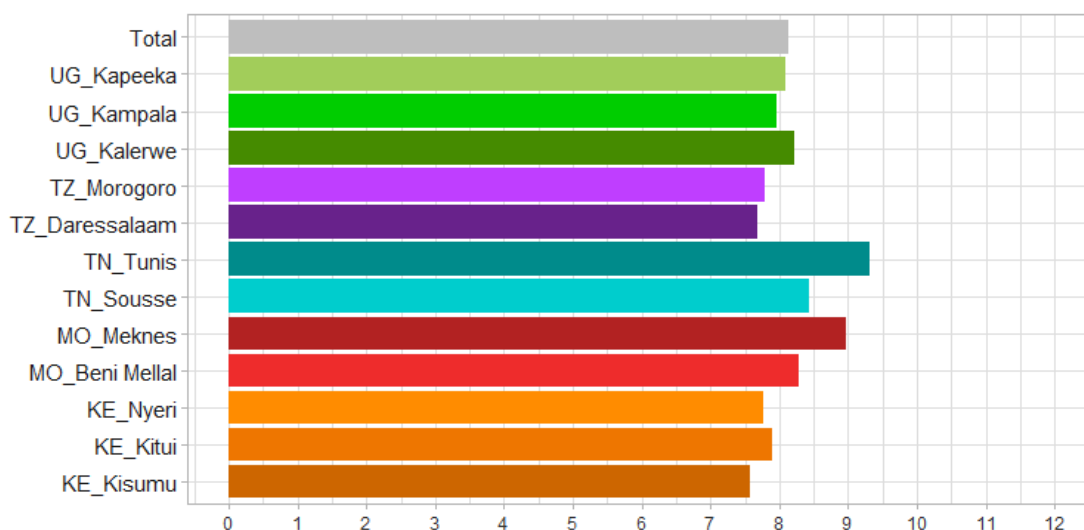
Figure 85. Household dietary diversity score (mean) by city

3.3.3 Diet quality

3.3.3.1 Non communicable diseases (NCD) scores (NDC-Protect score and NCD-Risk score)

The results of the NCD scores (Figure 86) show us that the urban consumers in Kenya are the ones to adhere more to the recommendations related to the healthy components of the diet (Figure 2 left side), with an overall NCD Protect score of 5 (out of 9). On the other side, urban consumers in Morocco show the lowest NCD Protect score with a mean of 3 although they also present the lower values for the NCD Risk score with a mean value at country level of 2 (Figure 2 right side).

However, the situation within the same country varies according to the city, as in Kenya we observe that Kisumu consumers show the highest NCD Protect score but also the highest NCD Risk score, while Kitui an Niery show a NCD Protect score around 4.5 and NCD Risk scores of 2.7 and 2.0 respectively. These differences may be related to the type of city as Kisumu is a large city whereas Kitui and Niery are medium-sized cities.

The consumers of the two cities in Tanzania show NCD Protect scores above 5.0 and NCD Risk scores at around 2.4 and at Uganda the NCD Protect is between 4.5 and 4.8 in the three cities, but the NCD Risk score is significantly higher for Kalerwe (2.7) than for Kampala or Kapeeka (1.7 nd 1.6 respectively).

Differences between cities of the same country are significant for all countries except for Tunisia where values of NCD scores are similar between cities (NCD Protect around 4.5 and NCD Risk around 2.6).
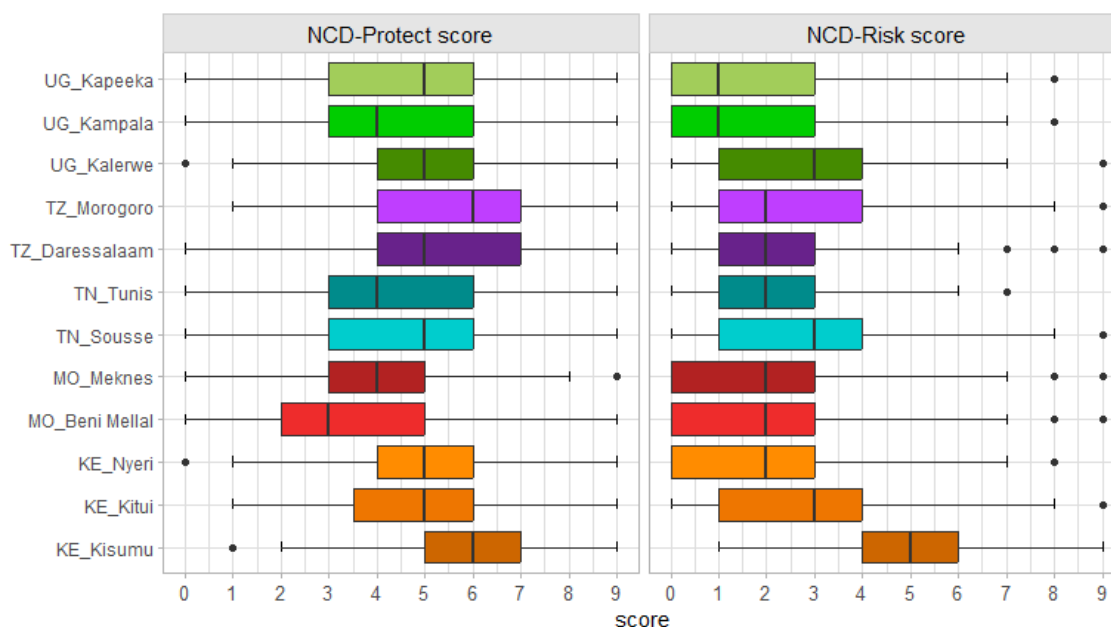
Figure 86. Distribution of non-communicable diseases (NCD) scores by city

Among the 9 healthy food groups counting for the computation of the NCD Protect score, the whole grains group is most consumed in Uganda (49%) followed by Tanzania (42%), Kenya (41%) and 10 percentage points lower Tunisia (38%) and Morocco (32%). At city level is Kisumu, in Kenya, the one to show a higher consumption of whole grains with 71% of the respondents having a positive response, followed by Kapeeka in Uganda with 62%, and the rest of the cities with values below 50%.

Pulses consumption is highest in Morogoro, Tanzania (74%) closely followed by Kitui in Kenya (66%), and lowest levels are in the two cities of Morocco, with 29% and 35% of respondents reporting consumption in Beni Mellal and Meknes respectively. At country level the country with highest consumption is Tanzania (69%) followed by Kenya (62%).

The city with higher consumption of Nuts and seeds was Kisumu in Kenya with 52% but the other two cities in the country showed values below 30% so the mean at country level was 33%. Thus, it was Tunisia the country with higher consumption at 45%, closely followed by Uganda with 43% of consumers reporting consumption of this food group.

Among the foods to avoid the Sweet beverages group is the most frequently reported in all countries, with values above 90% in Morocco and Uganda and the lowest being Tunisia with 80% of respondents reporting consumption. The second food group to avoid and more frequently reported was Sweet foods, that was highest in Tunisia (75%) followed by Morocco (51%) and the other three countries showing values below 40%. The consumption of salty snacks was also highly reported, by 63% respondents in Kenya, 52% in Tanzania, 47% in Uganda, and 33% and 28% in Tunisia and Morocco respectively.

3.3.3.2 Global Dietary Recommendations (GDR) score

The Global Dietary Recommendations score is a combination of the NCD Protect score and the NCD Risk score. The GDR results indicate that the urban consumers of Tanzania and Uganda are the ones that are more likely to meet the global dietary recommendations, with GDR values ranging from 11 t in the city of Kalerwe in Uganda to a mean GDR value of 12 (in a scale up to 18) in the cities of Morogoro in Tanzania and Kapeeka in Uganda.

The lowest GDR values within the cities studied were found in Beni Mellal (10.4) and Meknes (10.9) in Morocco.

The differences in GDR values between cities in the same country were significant for Kenya, Morocco and Uganda, but not for Tunisia or Tanzania.

The mean GDR values were higher among male respondents in Kenya and Tanzania, but higher among women in Morocco, Tunisia and Uganda. However, the differences by gender overall or in each of the countries studied was not significant.

In relation to education results are not conclusive as countries like Kenya show higher values of GDR among respondents with secondary or higher education as compared to primary or no qualifications while other countries show higher GDR among less educated respondents as compared to those with secondary or higher education. Furthermore, the association between the GDR score and the education level was significant only in Kenya, Morocco and Tanzania, but not in Uganda or Tunisia.
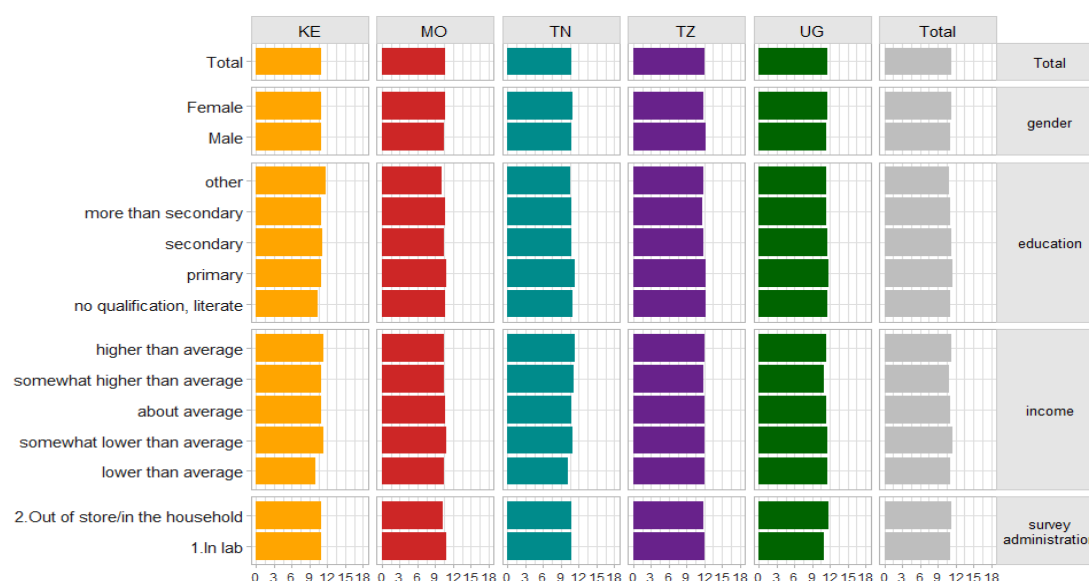
Figure 87. Distribution of the Global Dietary recommendations score by country and selected variables.

Finally, the relationship with the perceived level of income is more straightforward, as for all countries except Uganda the mean GDR is higher among respondents who perceive their level of income higher than average as compared to those that perceive themselves in the lower than average income level. Although this positive association was significant only for Kenya.

Factors associated with the adherence to the GDR

When we include the rest of the variables to test for their association with the GDR Score, we observe that age of the respondent is positively associated with the GDR score in Morocco, Tunisia and Uganda, where higher age of respondent was associated with higher GDR score.

In Kenya and in Tunisia, the respondent's consideration of the degree of healthy diet consumed in the household was also positively related to the GDR score. However, in relation to behaviour of food purchase, the degree by which the decision of food selection/purchasing was determined by the willingness of the respondent to be viewed as a good provider was negatively, and significantly, associated with the GDR in Kenya.

In Uganda, the HDDS was positively associated with the GDR (See

Table 67).

Table 67. Estimates of Poisson regression for GDR score, by country

Variable	Kenya (N=1352) Estimate (S.E.)	Morocco (N=729) Estimate (S.E.)	Tunisia (N=678) Estimate (S.E.)	Tanzania (N=903) Estimate (S.E.)	Uganda (N=1279) Estimate (S.E.)
Age of respondent		0.0022 (0.0008)**	0.0034 (0.0008)***		0.0022 (0.0007)***
Household dietary diversity score					0.0128 (0.0044)**
Degree of importance given to the self-image of "good provider" in the selection of foods to purchase (scale 1 to 5)	-0.0223 (0.0067)***				
Respondent´s consideration of households degree of adherence to healthy diet (scale 1 to 5)	0.0505 (0.0077)***		0.0386 (0.0127)**		
Respondents interest in buying new local food products (scale 1 to 5)		0.0296 (0.0112)**			
(Intercept)	2.2262 (0.0415)***	2.1534 (0.0593)***	2.1199 (0.0524)***	2.4880 (0.0096)***	2.2238 (0.0461)**
*** p<0,0001					
**p<0,001					

3.3.3.3 Minimum Dietary Diversity for Women

The proportion of women achieving the minimum dietary diversity ranges from 77.5% in Uganda to 91.5% in Tanzania, followed by 91,3% in Kenya, 88,9% in Tunisia and 83.3% in Morocco, and the distribution of number of food groups consumed varies from country to country (Figure 88).
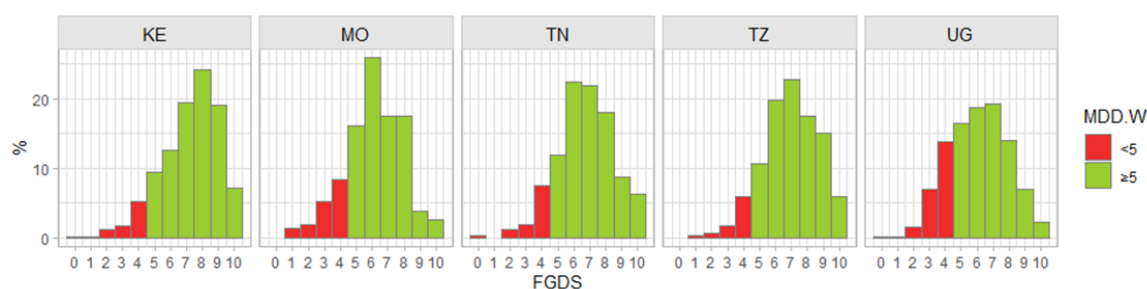
Figure 88: Number of food groups consumed by women of reproductive age

At city level, the highest MDDW scores are observed in Kisumu, Kenya (98,7%) and Morogoro, Tanzania (95,2%) although the other cities in these two countries showed values around 88%. Differences between cities within the same country being significant for these two countries Kenya and Tanzania, and also Uganda with Kalerwe having MDDW equal to 85% and Kapeeka and Kampala 77% and 72% respectively.

In the bivariate analysis the level of education was positively associated with MDDW in Morocco and in Uganda, with respondents reporting higher than average showing higher MDDW as compared to no qualification, literate respondents. And the level of income was significantly

associated in Morocco only, with MDDW being significantly lower in the lower than average food group.

Factors associated with MDDW

When we run the multivariate model, we observe that MDDW is positively associated with HDDS in the five countries studied, and in Uganda also if the nutrient content of foods is important when the respondent decides to by a certain product or if the respondent considers that the diet followed at the household is healthy. In Morocco there was another variable capturing food security that was positively associated and is the degree to which they were able to meet their food needs during the previous year.

Table 68. Multivariate regression results.

	Kenya	Morocco	Tunisia	Tanzania	Uganda
	(N=641)	(N=155)	(N=294)	(N=421)	(N=742)
	Estimate (S.E.)	Estimate (S.E.)	Estimate (S.E.)	Estimate (S.E.)	Estimate (S.E.)
Household dietary diversity score	0.6680 (0.0886)***	0.8675 (0.1827)***	0.2687 (0.0835)**	0.3307 (0.0681)***	0.6035 (0.0636)***
Household ability to meet the food needs during previous year (1 to 5 categories-scale)		1.2810 (0.3525)***			
Degree of importance given to the nutritious contents of foods in the selection of products purchased (scale 1 to 5)					0.2046 (0.0706)**
Respondent´s consideration of households degree of adherence to healthy diet (scale 1 to 5)					0.2825 (0.0920)**
(Intercept)	-0.4248 (0.8147)	-8.6468 (1.8202)	-0.1719 (0.6956)	0.0595 (0.4635)	-5.0658 (0.6065)***

3.4 Conclusions

3.4.1 Conclusions on the Research question

The indicators of diet quality measured by food groups' dietary diversity are very high for the samples of the twelve cities studied. The **MDDW was achieved by more than 85% of the women in 9 out of the 12 cities**. These values are much higher than the MDDW prevalence at country level estimated by other projects. For example our results show a mean MDDW of 89% for the urban consumers in Tanzania, while the country's mean MDDW in the 2021-2022 estimates of the Global Diet Quality Project was 36% (Global Diet Quality Project, 2022). We observe a similar situation for the rest of the countries, as national estimates of MDDW were 59% for Uganda, 69% for Kenya and 76% for Morocco that are significantly lower than the results we obtain. One of the reasons for these discrepancies might be the survey design, as we did not carry out a household survey but an out-of-store survey, meaning that interviewees were recruited outside market facilities and thus all urban consumers in our samples shared the characteristic of having access to a market facility. Other studies have already shown that access to market increases the likelihood of reaching MDDW in other African countries (Custodio et al., 2020).

However, diet quality is not only about food groups diversity, and low diversity of food items consumed within each food group as well as the consumption of unhealthy food items also impact in the quality of the diet and results were not that good for the cities studied. The Global Dietary Recommendations score ranges from 10.9 to 12.0 (in a scale from 0 to 18) for the five countries of interest and these values are aligned with those given by other projects at national level (the most discrepant result being for Tanzania with a value of 12.0 in our results as compared to 10.9 in the Global Diet Quality Project (Global Diet Quality Project, 2022). The NCD Protect and the NCD Risk are both higher in our results than the national estimates.

The factors associated with each of the dimensions of the quality of the diet also vary depending on the indicator studied and the country of interest. **Food security measured by HDDS is consistently associated with the MDDW, although for the GDR score the association is significant only in Uganda.** There are a series of variables related to purchasing behaviours that are related to the diet quality indicators and could be used to elaborate healthy eating promotion campaigns.

3.4.2 Policy recommendations

The policy recommendations should be tailored to meet specific areas of improvement in the quality of the diet since these differ greatly by country, city and group of consumers. Overall policies should be directed to the **further diversification of the food items entering in the household diets** and the **promotion of healthy foods consumption and the reduction of unhealthy foods consumption**.

Specifically, the **consumption of whole grains should be promoted in the North Africa countries**, Morocco and Tunisia, where there is a most urgent need to also reduce consumption of sweet foods, and both of these dietary characteristics can be related to their extremely high overweight and obesity rates.

On the other side, consumption of sweet beverages is also very high in the East African countries, as well as the salty unhealthy snacks which consumption is highest in Kenya and Tanzania. Consumer awareness-raising campaigns to lower the consumption of these products should be fostered at local level.

3.4.3 Recommendations for the project FoodLAND

The results from this work can help the FoodLAND project to orient its R&D tasks towards the realization of new / improved food items that can enrich the diversity of the local diets, to bridge the local food operators' choices with the consumers' needs and market opportunities, and to design tailored nutritional recommendations tackling the areas of improvement in the quality of the diets at appropriate scale (e.g., city and consumer groups).

Moving from these results, the FoodLAND Consortium is conducting in-depth analyses on the determinants of the diet quality indicators and on the consumers' food behaviors – to be combined with the findings derived from the experimental activities (next D2.4 sections from 4 to 6) and rural consumer surveys (section 2) both at project and country level – with the aim to consolidate knowledge of consumers' food decision-making and needs and to contribute to the diffusion of more balanced and healthy diets.

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4. Dietary and behavioural profiles of urban consumers: Evidence from FoodLAND Cities in five African countries

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4.1 Introduction

On the consumer side, the project FoodLAND aims at **providing background knowledge of African consumers' food preferences and behaviours and of their socioeconomic drivers and measuring the current level of dietary diversity**. These results will be key for the development in WP4 and WP5 of nutrition-responsive food supply systems, the production of local, novel foods, the design of marketing strategies, and the development and implementation of tailored nutritional recommendations.

To fulfil this objective, the provision of customized policy and nutritional recommendations requires the identification of homogenous consumer groups (e.g., according to age, education levels, diet quality, food security levels, etc.; Visschers et al., 2013), to tailor the recommendations to the needs and features of the specific consumers group. By understanding a consumer's dietary habits, preferences, and nutritional needs, the FoodLAND project can provide more tailored and effective advice (also from a communication and dissemination perspective) on how to improve their diet and overall health.

This chapter aims at enhancing the overall understanding of African urban consumers' preferences, behaviours, and attitudes towards food products, by **identifying groups of urban consumers with similar diets and behavioural profiles** (consumer profiling), while linking such profiles to the urban consumers' stated propensity to adopt nutritional dietary innovations as well as to socio-demographic variables.

4.2 Methodology

To identify dietary and behavioural profiles of urban consumers linked to socio-economic and demographic factors, we implemented two cross-country cluster analyses:

1. A **cluster analysis focusing on the urban consumers diet quality (DQQ)**. In this cluster analysis we profiled urban consumers according to a series of variables and indicators characterizing the consumer's diet. The objective of this profiling was (i) to assess whether we could discern groups of consumers with <u>similar dietary patterns</u>, (ii) to link these groups with urban consumers' propensity to adopt dietary innovations and socio-economic and demographic factors.

2. A **cluster analysis focusing on the urban consumers revealed preferences**. In this analysis we profiled urban consumers according to a series of information on behavioural precursors (e.g., trust, risk, and temporal revealed preferences) collected through the organization of incentivized in-lab behavioural experiments (Marini Govigli et al., 2022; D2.3). The objective of this profiling was like the one presented above, and namely (i) to assess whether we could discern groups of consumers with <u>similar behavioural patterns</u>, (ii) to link these groups with urban consumers' willingness to adopt dietary innovations and socio-economic and demographic factors.

The two analyses were run separately since the behavioural experiments were conducted only in five cities (Marini Govigli et al., 2022; D2.3), and thus have a different sample size (5,226 urban consumers for the cluster analysis 1, while 843 consumers for the cluster analysis 2).

4.2.1 Cluster analysis #1 – urban consumer diet

Survey variables describing the urban consumers' (individual) dietary quality (DQQ; Question 10 of the survey tool; D2.3) were used to build 15 indicators of dietary adequacy following GDQP (2022) (Table 69)

- Positive dietary quality indicators (the highest (or equal to 1 in dummy indicators) the indicator the healthier the consumer's diet)
    - The **food groups dietary diversity score (FGDS)** (10-food-group continuous score for the whole population. It has a total score of 0-10. The higher the score, the higher the likelihood of nutrient adequacy.)
    - The **All-5 score** (proportion of the total population consuming all five food groups typically recommended for daily consumption in food-based dietary guidelines around the world: fruits; vegetables; pulses, nuts, or seeds; animal-source foods; and starchy staples. A score of 5 indicates minimal adherence to dietary guidelines. It is calculated as a binary variable (presence of the five consumed groups or absence)
    - The **NCD-Protect score** (the NCD-Protect score is based on food consumption from 9 healthy food groups during the past day and night. It has a total score of 0-9. A higher score indicates inclusion of more health-promoting foods in the diet, and correlates positively with meeting global dietary recommendations)
    - The **Global Dietary Recommendations score** (GDR) (indicator to assess the adherence to global dietary recommendations, which include dietary factors protective against non-communicable diseases. It has a total score of 0-18).
    - **Vegetable or fruit consumption** (proportion of the population who consumed vegetables or fruits in the previous day).
    - **Animal-source food (ASF) consumption** (proportion of the population who consumed animal-source foods excluding processed meats in the previous day).
    - **Whole grain consumption** (proportion of the population who consumed whole grain in the previous day)
    - **Pulse consumption** (proportion of the population who consumed pulses in the previous day)
    - **Nuts and seeds consumption** (proportion of the population who consumed nuts and seeds in the previous day)

- Negative dietary quality indicators (the lowest (or equal to 0 in dummy indicators) the indicator the healthier the consumer's diet)
    - The **NCD-Risk score** (A proxy for ultra-processed food intake. It has a total score of 0-10. A higher NCD-Risk score is closely related to higher ultra-processed food consumption)
    - **Sweet beverage consumption** (proportion of the population who consumed sweet beverages in the previous day).
    - **Sugar-sweetened soft drink consumption** (proportion of the total population who consumed a sugar-sweetened soft drink in the previous day).
    - **Sweet foods consumption** (proportion of the population who consumed sweet foods in the previous day)

- o **Salty or fried snack consumption** (proportion of the population who consumed salty or fried snacks in the previous day)
- o **Processed meat consumption** (proportion of the population who consumed processed meats in the previous day)

Table 69. Variables used for the dietary quality cluster analysis.

Variable code	Dietary indicator	Type	Levels
vegetable_fruit	Vegetable or fruit consumption	factor	0:1
animalSource	Animal-source food (ASF) consumption	factor	0:1
sweetBeverage	Sweet beverage consumption	factor	0:1
sugarSweetDrink	Sugar-sweetened soft drink consumption	factor	0:1
sweetFood	Sweet foods consumption	factor	0:1
saltyFriedSnack	Salty or fried snack consumption	factor	0:1
WholeGrain	Whole grain consumption	factor	0:1
Pulse	Pulse consumption	factor	0:1
NutsSeeds	Nuts and seeds consumption	factor	0:1
ProcessedMeat	Processed meat consumption	factor	0:1
All.5	All-5 score	factor	0:1
NCD_P	NCD-Protect score	numeric	0:9
NCD_R	NCD-Risk score	numeric	0:9
GDR	Global Dietary Recommendations score (GDR)	numeric	0:18
FGDS	food groups dietary diversity score (FGDS)	numeric	0:10

Giving that the above presented variables are both continuous and dummy variables, only two clustering algorithms could be compared: partition around medoids and hierarchical clustering by Ward's method. The two algorithms were evaluated assessing the separation distance between the resulting clusters (from 2 to 10 partitions of the sample) using Gower's metrics. This comparative analysis allowed us to select the best partitioning methods as well as the optimal number of clusters. Two indices commonly used to evaluate the optimal partitioning strategy were used: (i) Silhouette and (ii) Hubert & Levin C indices. The results of this comparative analysis are shown in Figure 89. The partition around medoids algorithm provides better results for both indices. Concerning the choice of the optimal number of groups, no substantial differences were found when comparing the Silhouette values across the different groupings. We then opted for a partition of the sample that would limit extreme imbalances over the group size. **Based on this analysis, the partition around medoids method and a 4-cluster configuration were selected.**

Figure 89. Comparison of cluster algorithms and optimal number of groups; analysis on standardised data. Cluster algorithms: partition around medoids (pam), hierarchical clustering by Ward's method (ward.D2). Indices: Hubert & Levin C index (C), Silhouette (S).

4.2.2 Cluster analysis #2 – urban consumer behaviour

Four behavioural variables collected through the experiments were used in this cluster analysis (Table 70):

- **Urban consumer's risk propensity**. Consumer's attitudes to risk are obtained from the risk experiment (lottery) using a 1 to 10 score, with 1 showing a high willingness to avoid risks (risk averse) and 10 a high willingness to take risks (risk taker). These scores correspond to the switching point at which consumers start choosing the high stakes lottery in the series of 10 choices, rather than the low stakes lottery. Inconsistent choices of risk were removed.

- **Urban consumer's patience score.** This indicator was calculated from the risk experiment through the observed switching point of the consumer's time preferences. This score is based on the switching point from which consumers start choosing to wait for 2 more weeks (they choose the payment in 4 weeks rather than in 2 weeks), to get a higher payment. The patience score is measured on a 0 to 10 scale, where 0 indicates impatient consumers, whereas 10 indicates the highest levels of patience. Inconsistent choices (with more than one switching point) were removed.

- **Consumer's trust.** Two indications of the consumer's trust were obtained from the trust game, an experiment used in behavioural economics to measure trust in economic decisions. Two rounds of the Trust Game were executed. During the first round, urban consumers were paired anonymously. The consumer designed as "sender" was asked to transfer to the "receiver" a fix amount of token (0,25,50,75,100), which was then going to be tripled before it was passed on to the Receiver. The Receiver could decide to send back some, all, or none of this amount to the Sender. In the second round each consumer was paired with a local NGO or farmers' association that took part in the game as the Receiver. The amount of the endowment sent by senders to the receivers in both rounds, were used as indices of the consumer trust towards peers and the food value chain.

Table 70. Variables used for the behavioral cluster analysis.

Variable code	Variable	Type	Levels
risk	Urban consumer's risk propensity	numeric	1:10
time	Urban consumer's patience score	numeric	0:10
player.trust	Consumer's trust towards peers (average endowment sent to peers receivers)	Numerical categories	0;25;50;75;100
player.trust_inst	Consumer's trust towards food value chain (average endowment sent to food institutions)	Numerical categories	0;25;50;75;100

As first, the four variables of interest where standardised[5]. We then assessed three clustering algorithms: k-means clustering method, partition around medoids, hierarchical clustering by Ward's method. The three clustering algorithms were evaluated comparing the separation (Euclidian) distance between the resulting clusters (from 2 to 10 partitions of the sample). This comparison analysis allowed us to select the best partitioning methods as well as the optimal number of clusters. Four indices commonly used to evaluate the optimal partitioning strategy were used: (i) Calinski-Harabasz index, (ii) Silhouette, (iii) Hubert & Levin C index, and (iv) Davies-Bouldin index. The results of this comparative analysis are shown in Figure 90. Excluding the two-group solution, which is considered too general, we observe that the Calinski-Harabasz and Silhouette indices reach the maximum value at a four-cluster partitioning for the k-means algorithm. The Hubert & Levin C-index, for which the optimum corresponds to the minimum value, tends to decrease as the number of clusters increases, however a steep reduction is observed at the four-group partitioning, after which the decrease decelerates. **Based on this analysis, the k-means method and a 4-cluster configuration were selected.**

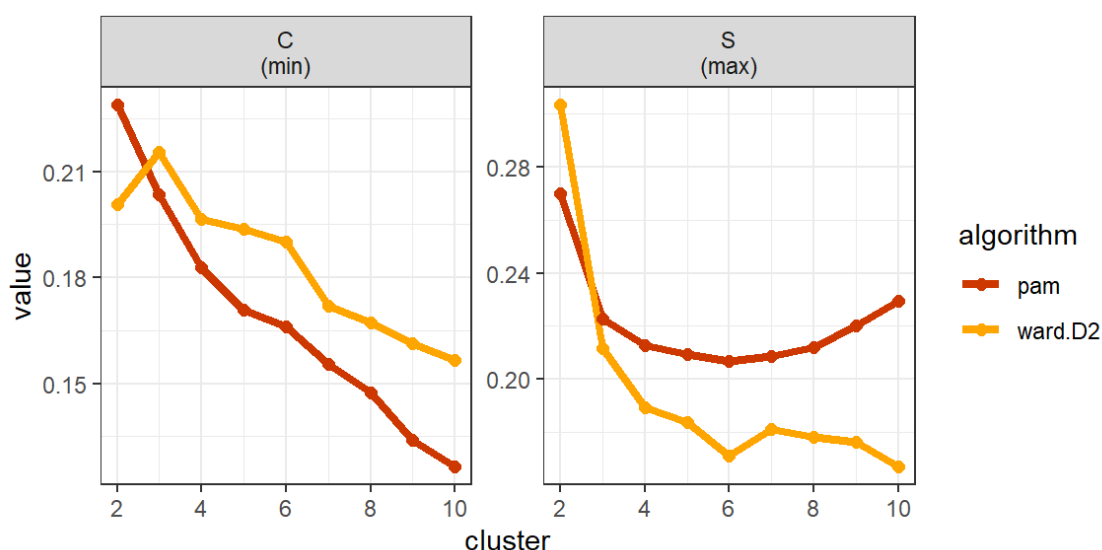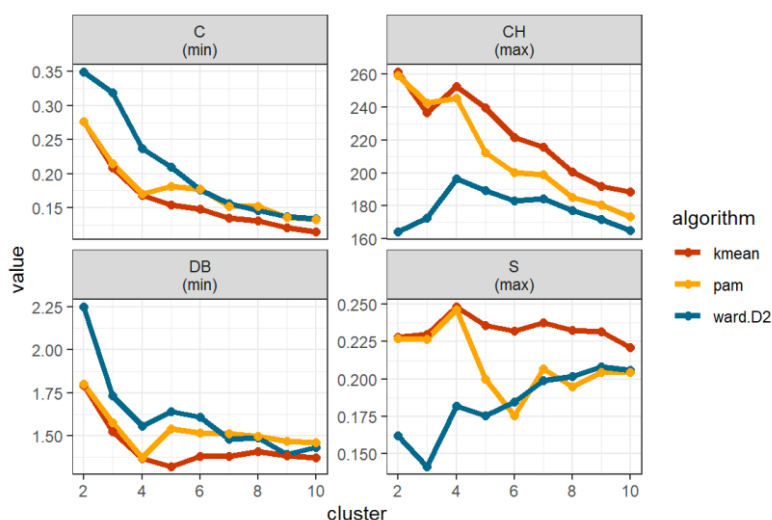*Figure 90. Comparison of cluster algorithms and optimal number of groups; analysis on standardised data. Cluster algorithms: k-means clustering method (kmean), partition around medoids (pam), hierarchical*

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[5] Standardization was done in R using the function "scale", which subtracts the values of each column by the matching the "center" value from the argument.

4.2.3 Statistical tests

Once the two cluster analyses were performed, we tested if a series of socio-economic and demographic variables (country, gender, age, education level and income) differed significantly between the groups by using the Pearson's chi-squared test. We also tested the results of the behavioural cluster analysis with the diet indicators so to draw relevant parallelism between the consumers' behaviours and their nutritional choices.

Finally, we test whether a statistical association exists between the two cluster configurations and a series of variables measuring the urban consumers' propensity to innovate by:

- diversifying the household diet with a new **nutrient-dense food product** (Questions 12 and 13, D2.3).
- buying and including a new **local food product** in the household diet (Question 6, D2.3).

This allowed us to draw conclusions on how to tailor nutritional recommendations for the different groups of urban consumers.

4.3 Results

4.3.1 Dietary quality cluster analysis - cross-country level

The cluster analysis performed on the DQQ variables identified four main groups of urban consumers (Table 71, Figure 91), with different diet profiling:

- Group 1: "*Consumers with unbalanced diets*"
  This group includes 1,556 urban consumers (29.8% of the total). The consumers belonging to this group are characterised by having a diet centred on consuming fruit and vegetable (94.3% of the consumers), ASF (79.9%) and sweet beverages (78.5%). Only 2.4% of them consumes the recommended five food groups (all-5), despite the GDR score is relatively high (average of 10.9), indicating that their diet is overall healthy but extremely unbalanced. Ultra-processed food consumption (NDC-R) is in fact the lowest on average across the four groups (1.2)

- Group 2: "*Consumers with unhealthy diets*"
  This group includes 757 urban consumers (14.5% of the total). The consumers belonging to this group are characterised by having a diet mostly made of fruit and vegetables (97.5%), ASF (95.5%) and a series of unhealthy products as sweet beverages (94.7%), sugar-sweetened drinks (72.5%), sweet foods (81.0%), salty or fried snacks (80.6%), and processed meat products (20%). Their food consumption habits are predominantly unhealthy: ultra-processed food consumption (NDC-R) is the highest on average across the four groups (4.1), and only 19.2% of them consumes the recommended five food groups (all-5). The GDR score is also the lowest on average across the four groups (8.7).

- Group 3: "*Consumers with balanced and healthy diets*"
  This group includes 1,445 urban consumers (27.7%). These consumers show a balanced and healthy diet, with 90.5% of them consuming the five recommended food groups (all-5) and showing an above-average FGDS (7.14) and GDR (12.3). The rate of ultra-processed food consumption is the lowest recorded (1.76). They are characterised by

having a diet made of healthy and recommended products as fruit and vegetables (100%), ASF (96.2%), pulses (89.0%), except for sweet beverage products (85.7%)

- Group 4: "*Consumers with balanced yet unhealthy diets*"
  This group includes 1,468 urban consumers (28.1%). This group is characterised by urban consumers having a higher-than-average balanced and healthy diet, yet characterised by some unhealthy habits (e.g., consumption of ultra-processed food items). The NDC-R score is high (3.7), despite almost all consume the five recommended food groups (95.3%). Their diet comprises several healthy food products as fruit and vegetables (100%), ASF (98.0%), pulses (76.3%), whole grain products (75.1%), and nuts and seeds (79.3%). However, it also includes several unhealthy products as sweet beverages (87.0%), sweet foods (63.5%), salty or fried snacks (76.2%), and processed meat products (19.7%).

Table 71. Cluster distribution according to dietary quality indicators

Group	N	%
1 "Unbalanced diets"	1,556	29.8
2 "Unhealthy diets"	757	14.5
3 "Balanced and healthy diets"	1,445	27.7
4 "Balanced yet unhealthy diets"	1,468	28.1
Total	**5,226**	**100.0**
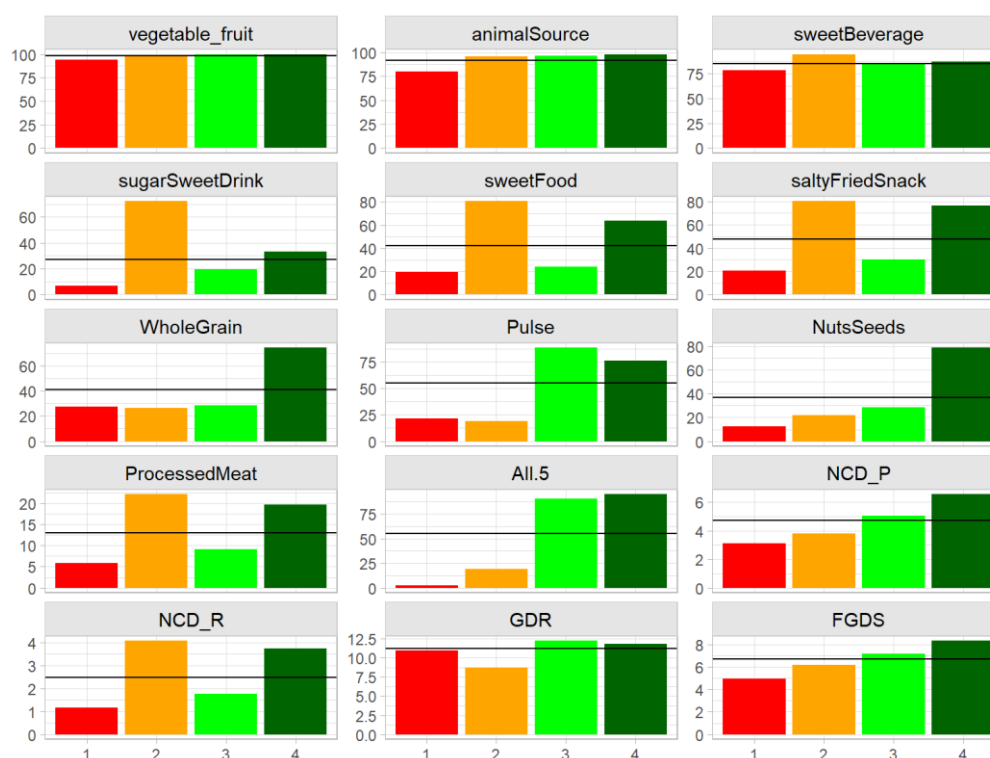
Figure 91. Cluster profiling according to the dietary quality variables considered, lines indicate the average.

4.3.1.1 Dietary quality clusters, socio-economic and demographic variables and propensity to dietary innovation

Figure 92 shows the distributions of a series of socio-economic and demographic variables over the four urban consumer groups, characterised by different diet quality patterns.

- Group 1 ("unbalanced diets") is mostly representative of urban consumer located in Northern African countries (51% of the observations from Morocco and 23.2% from Tunisia are included in this group) and Uganda. It is also mostly described by consumers with older ages (40.3% of consumers above 55 are within this group), no educational qualification, and with income levels which are generally lower than average.

- Group 2 ("unhealthy diets") is equally distributed amongst countries although with a predominance of Tunisian consumers. It is the group with the highest in percentage number of youngest consumers (less or equal to 25 years old), with secondary/more than secondary educational levels and average or somewhat lower income levels.

- Group 3 ("balanced and healthy diets") includes urban consumers mostly from sub-Saharan countries, and predominantly from Tanzania and Kenya. These are consumers mostly between 26 and 45 years old, with primary educational levels, and higher than average income levels.

- Group 4 ("balanced yet unhealthy diets") is mainly represented by Kenyan consumers, and it includes consumers between 36-45 years old with secondary/more than secondary educational levels and about average income levels.

Figure 92. Dietary clusters by socio-economic and demographic variables

In Table 72, we present the results of a chi-square test of independence showing whether clusters and the socio-economic and demographic variables related to each other. Significant relationships were found between the groups and the **country of origin** (*d.f.*=12, *X² value* =

331.95, *p value* <0.001), **the respondent's age** (*d.f.*=12, X^2 *value* = 92.0, *p value* <0.001), the **educational level of the respondent** (*d.f.*=12, X^2 *value* = 192.9, *p value* <0.001), and the **average household income** (*d.f.*=12, X^2 *value* = 130.2, *p value* <0.001).

Table 72. Chi-squared test of differences in clusters according to a series of socio-demographic and demographic variables; cross-country level.

Variable	Test	Statistic	d.f.	p.value	Significance
Country	Chi.squared	331.95	12	9.0e-64	***
Gender	Chi.squared	3.16	3	0.3669	
Age	Chi.squared	92.00	12	2.0e-14	***
Education level	Chi.squared	192.89	12	9.5e-35	***
Household income	Chi.squared	130.15	12	5.8e-22	***

Finally, Table 73, shows the result of a chi-squared test of relationship between the clusters and the consumers' innovation propensity towards food behavioural change (two variables assessed), as well as towards local production (one variable assessed). The results indicate that **a significant relationship occur between all variables and the cluster composition**. When considering question 12 (which includes a risk assessment), consumers associated to Group 4 are those showing the lowest propensity to innovate their diet with a new food rich in nutrients, whereas those in Group 3 the highest propensity. Differently, results from question 13 show that consumers in Group 4 register the highest propensity to innovate. Regarding question 6, Groups 2 and 4 are those that show the highest propensity to include local food products in their diet.

Table 73. Chi-squared test of differences in clusters according to the urban consumers' propensity to innovate their diet.

Variable	Test	Statistic	d.f.	p.value	Significance
Opting for a new nutrient-dense food product (Question 12).	Pearson's Chi-squared test	55.92	3	4.4e-12	***
Opting for a new nutrient-dense food product (Question 13).	Kruskal-Wallis rank sum test	86.81	3	1.1e-18	***
Opting for a new local food product (Question 6).	Kruskal-Wallis rank sum test	22.56	3	5e-05	***

4.3.1.2 Dietary quality clusters analysis - country level

In Appendix 1, we present the results of the cluster analysis reorganised by country (Kenya, Morocco, Tunisia, Tanzania, and Uganda). Significant relationships (10% level) between the groups and the **respondent's age, the respondent's educational level, and the average household income** were found for all countries except for the education level in Tunisia and for the household income in Uganda (Table 74).

Table 74. Chi-squared test of differences in clusters according to a series of socio-demographic and economic variables at country level.

Variable	Country	Statistic	d.f.	p.value	Significance
Age	KE	25.94	12	0.0110	*
	MO	25.51	12	0.0126	*
	TN	41.07	12	4.8e-05	***
	TZ	24.30	12	0.0185	*
	UG	21.18	12	0.0478	*
	Total	92.00	12	2.0e-14	***
Education	KE	26.38	12	0.0095	**
	MO	83.91	12	7.4e-13	***
	TN	15.11	12	0.2357	
	TZ	22.64	12	0.0310	*
	UG	42.03	12	3.3e-05	***
	Total	192.89	12	9.5e-35	***
Income	KE	93.14	12	1.2e-14	***
	MO	63.67	12	4.8e-09	***
	TN	20.10	12	0.0651	.
	TZ	19.27	12	0.0821	.
	UG	13.57	12	0.3292	
	Total	130.15	12	5.8e-22	***

4.3.2 Behavioural cluster analysis - cross-country level

The cluster analysis performed on the behavioural information (e.g., trust, risk, and temporal revealed preferences) collected through the organization of incentivized in-lab behavioural experiment identified four main groups of urban consumers (Table 75, Figure 93), with different behavioural patterns:

- Group 1: "*Patient, risk-averse, and mistrusting consumers*"
  This group includes 259 urban consumers (30.7% of the total). The consumers belonging to this group are characterised by high levels of patience (7.8), high risk aversion (4.0), and low trust levels (an average of 23.1 tokens transfer to the peer receivers / 24.9 to the local NGO / farmers' association)

- Group 2: "*Patient and risk-taking consumers*"
  This group includes 178 urban consumers (21.1% of the total). The consumers belonging to this group are characterised by high levels of patience (8.8), high risk taking level (8.2), and average trust levels (36.0 towards peer receivers; 45.0 towards local NGO / farmers' association)

- Group 3: "*Impatient consumers*"
  This group includes 210 urban consumers (24.9% of the total). The consumers belonging to this group are characterised by being extremely impatient (1.6), while moderately risk averse (4.9) and trustful (38.8 towards peer receivers; 47.6 towards local NGO / farmers' association).

- Group 4: "*Trustful and patient consumers*"
  This group includes 196 urban consumers (24.9% of the total). The consumers belonging to this group are characterised by high levels of patience (7.6), moderately high-risk

aversion (4.5), and high trust levels (58.6 towards peer receivers; 74.5 towards local NGO / farmers' association)

Table 75. Cluster distribution according to behavioural information.

Group	N	%
1 "Patient, risk -averse, and mistrusting"	259	30.7
2 "Patient and risk -taking"	178	21.1
3 "Impatient"	210	24.9
4 "Trustful and patient"	196	23.3
Total	**843**	**100.0**
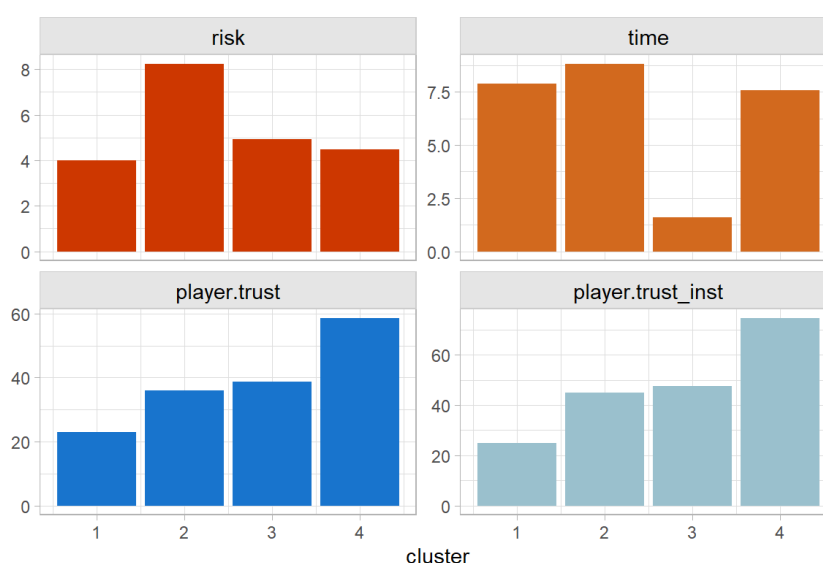
Figure 93. Cluster profiling according to the behavioural variables considered.

4.3.2.1 Behavioural clusters, socio-economic and demographic variables and propensity to dietary innovation

In Table 76, we present the results of a chi-square test of independence showing whether the behavioural clusters and the socio-economic and demographic variables related to each other. Significant relationships were found between the groups and the **country of origin** ($d.f.$=12, X^2 $value$ = 175.5, p $value$ <0.001), **the respondent's age** ($d.f.$=12, X^2 $value$ = 28.5, p $value$ <0.001), and the **respondent's educational level** ($d.f.$=12, X^2 $value$ = 23.2, p $value$ =0.003). Figure 94 indicates how these socio-economic and demographic variables distribute over the four urban consumer groups, characterised by different behavioural patterns.

- Group 1 ("patient, risk-averse, and mistrusting") is mostly representative of urban consumers located in Kenya and Morocco. It is also generally described by consumers with young ages (less or equal to 25 years old) more predominantly males, with secondary educational levels, and income level higher than average.

- Group 2 ("patient and risk-taking") characterises mainly Uganda urban consumers. It includes more female than male consumers (52.2% female consumers), generally between 26-35 years old, with primary education levels.

- Group 3 ("impatient") includes urban consumers predominantly from Tanzania and Morocco. It has a higher-than-average number of consumers older than 55 years old.

- Group 4 ("trustful and patient") is characterised by the prevalence of Tunisian consumers, and it includes consumers between 36-45 years old with more than secondary educational level/other types of education and somewhat higher than average income levels.

Table 76. Chi-squared test of differences in clusters according to the urban consumers' propensity to innovate their diet.

Variable	Test	Statistic	d.f.	p.value	Significance
Country	Chi.squared	175.54	12	<0.001	***
Gender	Chi.squared	3.33	3	0.3431	
Age	Chi.squared	28.52	12	0.0046	**
Education level	Chi.squared	23.17	12	0.0263	*
Household income	Chi.squared	16.18	12	0.1831	
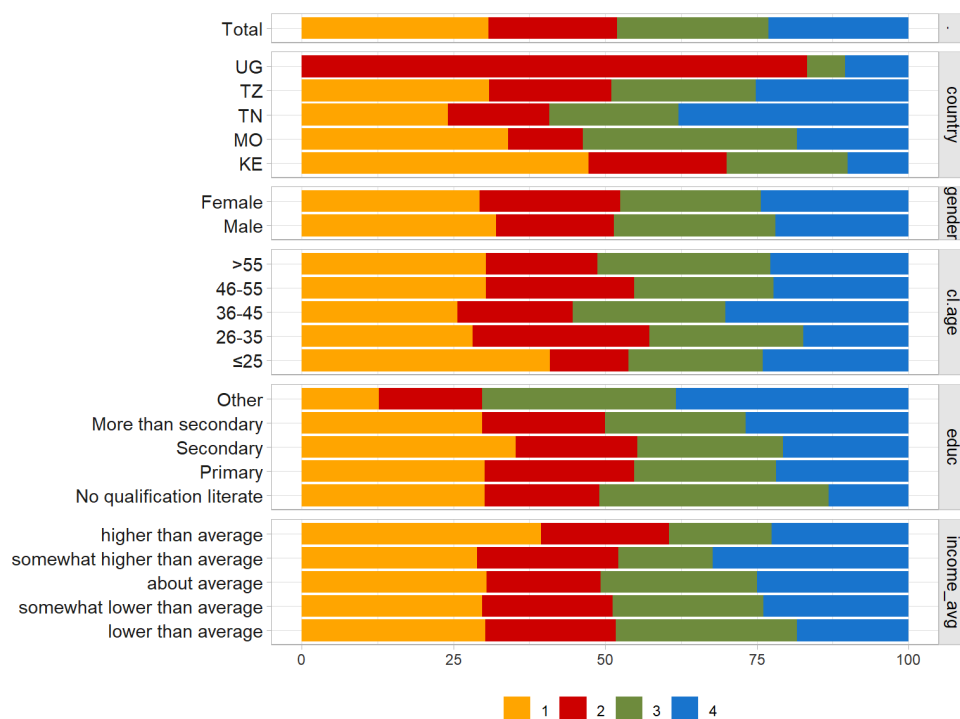
Figure 94. Behavioural clusters by socio-economic and demographic variables

Finally, Table 77 shows the results of a chi-square test of relationship between the clusters and the dietary quality indicators (Section 0), and the urban consumer's propensity towards new local food products, respectively. The results indicate the following significant relationships:

- between the groups and the **food groups dietary diversity score (FGDS)** (0.009), and the **NCD-Protect score** (0.016);
- between the groups and the **urban consumer's propensity to purchase a new local food product** (0.034).

Post hoc comparisons show that urban consumers belonging to Groups 2 and 4 have the highest FGDS, and NCD-P, as well as the highest propensity to purchase local food products.

Table 77. Chi-squared test of differences in clusters according to the urban consumers' propensity to innovate their diet.

Variable	Test	Statistic	d.f.	p.value	Significance
MDD.W	Chi.squared	2.83	3	0.4187	
All.5	Chi.squared	2.64	3	0.4512	
HDDS	Kruskal-Wallis	0.55	3	0.9075	
FGDS	Kruskal-Wallis	11.52	3	0.0092	**
NCD_P	Kruskal-Wallis	10.27	3	0.0164	*
NCD_R	Kruskal-Wallis	0.59	3	0.8981	
GDR	Kruskal-Wallis	4.80	3	0.1871	
Opting for a new nutrient-dense food product (Question 12).	Pearson's Chi-squared test	5.78	3	0.1230	
Opting for a new nutrient-dense food product (Question 13).	Kruskal-Wallis rank sum test	4.77	3	0.1894	
Opting for a new local food product (Question 6).	Kruskal-Wallis rank sum test	8.69	3	0.0338	*

4.3.2.2 Behavioural clusters analysis - country level

In Appendix 2, we present the results of the behavioural cluster analysis reorganised by countries (Kenya, Morocco, Tunisia, Tanzania, and Uganda). Significant relationships between the groups and the **respondent's age** were found only for Tanzania (Table 78).

Table 78. Chi-squared test of differences in clusters according to a series of socio-demographic variables at country level.

Variable	Country	Statistic	d.f.	p.value	Significance
Age	KE	16.28	12	0.1789	
	MO	11.71	12	0.4689	
	TN	10.57	12	0.5657	
	TZ	24.71	12	0.0163	*
	UG	5.68	8	0.6831	

		Total	28.52	12	0.0046	**
Education	KE	13.95	12	0.3041	
	MO	13.15	12	0.3581	
	TN	14.33	12	0.2802	
	TZ	10.66	12	0.5585	
	UG	6.35	8	0.6085	
	Total	23.17	12	0.0263	*

4.4 Conclusions

4.4.1 Conclusions on the Research question

The results highlighted the diversity of behavioural and dietary profiles across urban consumers in the sampled African cities. The identified groups reacted differently also with regard to their stated propensity to enrich the household diet with new nutrient-dense or new local foods. This suggests that research, business, policy, and communication strategies aimed at fighting malnutrition should be shaped by the complexity and heterogeneity of the consumers' food conditions and the deriving objectives and actions be tailored to meet the consumer group-specific preferences and needs.

Specifically, the first cluster analysis identified four groups of urban consumers, linked to different dietary quality patterns. Group 1 indicates low-income consumers (with older ages and no educational qualification) lacking access to basic food groups recommended for healthy diets. Group 3 instead highlights consumers with the most balanced and healthy diet. Groups 2 and 4 consist of middle- and high-income urban consumers with access to a variety of food items but likely to be more exposed to different forms of malnutrition due to the concentration of ultra-processed and unhealthy foods in their diet (a problem which is common in African urban settings due to a fast-growing urbanisation accompanied by rapid changes in food environments; Holdsworth et al., 2020; Reardon et al., 2021). Moreover, consumers from these latter groups appear to be the most propense to innovate both their nutritional intake as well as to buy new local food products. **It can be argued that, on the one hand, actions aimed at enhancing the quality and healthiness of household diets should prioritize these consumers (Groups 2 and 4) by organizing tailored awareness raising campaigns on nutritional recommendations and new healthy foods. On the other hand, interventions aimed at boosting food security and balanced diets should target the consumers belonging to Group 1 by supporting food access and affordability.**

Our second cluster analysis detected a further set of four consumer groups according to their elicited behavioural characteristics. Groups 1, 2 and 4 are made of consumers more prone to bet on long-term (nutritional) benefits, despite those from Group 1 being generally risk averse and mistrusting, while those from Group 2 risk-taking and those from Group 4 generally trustful. Group 3 instead is characterised by consumers reluctant to adopt behaviour changes leading to long-term (nutritional) benefits. Patient consumer groups emerge as those having the highest dietary diversity, suggesting that **time preferences along with trust and risk preferences have direct associations with healthier and more diverse dietary patterns**. Nutritional interventions should then prioritize actions towards urban consumers that are more reluctant to bet on long-term behavioural shift, as they are the ones generally showing poorer diets in term of food quality and healthiness.

4.4.2 Policy and nutritional recommendations

Profiling urban consumers according to their dietary conditions and behavioral traits is essential for developing tailored nutritional-oriented policy interventions. Our results suggest the following recommendations:

- public and private initiatives aiming at fighting malnutrition and enhancing healthiness of diets of African urban consumers should **prioritize consumers facing food security issues and with most unbalanced diet profiles** (e.g., Group 1, cluster analysis 1);
- **transparent and clear interventions showcasing the benefits of adopting diets with healthier nutritional intakes** (and the long term benefits they can bring to consumers) should be carefully designed and **directed towards consumers with highest levels of impatience and unbalanced dietary intakes** (e.g., Group 3, cluster analysis 2);
- policy interventions aimed at improving consumers' diet should include actions devoted to: (i) **enhancing the diversity of the diets** (e.g., promoting neglected and new food items, through support for producers and communication campaigns); (ii) **lowering the consumption of unhealthy foods and beverages** (e.g., developing communication campaigns comparing the nutritional risks of ultra-processed foods to the benefits of healthy foods, supporting the accessibility and affordability of local and nutrition-dense foods, etc.).

4.4.3 Recommendations for the project FoodLAND

These initial findings will be used not only to further refine the project technological innovations – so as to enhance the nutrition-responsiveness of the local food systems – but also as a baseline for developing nutritional recommendations in T2.4 of the FoodLAND project aimed at strengthening balanced, healthy diets and including counselling messages on the frequency of consumption of the different products. Moreover, the presented analyses will be further elaborated, discussed and then submitted as research articles to scientific journals. Finally, the achieved results will feed into T6.4, contributing to the design of consumer awareness raising campaigns, focused on more sustainable and healthier diets, thus contributing to the reduction of different forms of malnutrition.

4.5 References

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Appendix 1: Clusters DQQ by gender, age, education level and income at country level - col %

Country	variable	Levels	Group 1	Group 2	Group 3	Group 4	Total
KE	Total		100.0	100.0	100.0	100.0	100.0
	gender	Male	44.4	39.1	46.1	40.8	42.9
		Female	55.6	60.9	53.9	59.2	57.1
	cl.age	≤25	21.8	28.2	23.1	15.6	20.9
		26-35	28.4	26.7	27.8	30.4	28.7
		36-45	18.4	21.8	22.1	26.0	22.6
		46-55	16.3	12.4	14.6	17.3	15.6
		>55	15.1	10.9	12.5	10.6	12.2
	educ	No qualification literate	7.6	5.4	3.8	4.8	5.2
		Primary	27.8	26.7	34.6	23.3	28.0
		Secondary	38.4	39.1	38.1	41.6	39.5
		More than secondary	25.4	28.7	22.4	29.9	26.5
		Other	0.9	0.0	1.2	0.4	0.7
	income_avg	lower than average	15.4	17.3	7.3	17.0	13.9
		somewhat lower than average	6.9	9.9	6.1	16.0	10.3
		about average	14.5	15.3	13.4	20.2	16.3
		somewhat higher than average	30.5	27.7	28.0	23.5	26.9
		higher than average	32.6	29.7	45.2	23.3	32.6
MO	Total		100.0	100.0	100.0	100.0	100.0
	gender	Male	70.8	64.2	64.8	70.9	68.7
		Female	29.2	35.8	35.2	29.1	31.3
	cl.age	≤25	8.6	17.0	12.0	19.1	12.0
		26-35	21.4	27.4	23.9	22.7	23.0
		36-45	18.0	20.8	18.3	21.8	19.0
		46-55	22.8	18.9	19.7	22.7	21.6
		>55	29.2	16.0	26.1	13.6	24.4
	educ	No qualification literate	27.9	6.6	15.5	2.7	18.6
		Primary	22.3	19.8	23.2	18.2	21.5
		Secondary	27.1	33.0	19.7	27.3	26.5
		More than secondary	19.0	32.1	40.1	44.5	28.9
		Other	3.8	8.5	1.4	7.3	4.5
	income_avg	lower than average	51.2	33.0	36.6	19.1	40.9
		somewhat lower than average	27.9	31.1	28.9	28.2	28.6
		about average	7.0	17.0	12.0	24.5	12.0

Country variable	Levels	Group 1	Group 2	Group 3	Group 4	Total
	somewhat higher than average	8.3	12.3	12.7	12.7	10.4
	higher than average	5.6	6.6	9.9	15.5	8.1
TN	Total		100.0	100.0	100.0	100.0	100.0
	gender	Male	40.4	43.3	47.7	43.4	43.8
		Female	59.6	56.7	52.3	56.6	56.2
	cl.age	≤25	20.2	32.2	13.8	18.3	20.4
		26-35	15.5	25.7	22.5	21.5	21.2
		36-45	20.2	17.5	20.6	25.9	21.5
		46-55	19.7	14.0	20.2	19.1	18.5
		>55	24.4	10.5	22.9	15.1	18.4
	educ	No qualification literate	4.1	2.3	0.9	1.2	2.0
		Primary	17.6	11.1	18.8	12.7	15.1
		Secondary	25.4	27.5	25.7	24.7	25.7
		More than secondary	44.0	49.1	45.0	48.6	46.7
		Other	8.8	9.9	9.6	12.7	10.4
	income_avg	lower than average	12.4	8.8	6.0	4.8	7.7
		somewhat lower than average	35.8	37.4	36.2	32.3	35.2
		about average	27.5	33.9	31.2	31.9	31.1
		somewhat higher than average	18.7	13.5	16.1	21.5	17.8
		higher than average	5.7	6.4	10.6	9.6	8.3
TZ	Total		100.0	100.0	100.0	100.0	100.0
	gender	Male	45.5	37.7	47.4	48.3	46.1
		Female	54.5	62.3	52.6	51.7	53.9
	cl.age	≤25	18.8	23.6	18.5	24.2	20.9
		26-35	32.2	40.6	32.2	36.4	34.4
		36-45	27.2	20.8	28.3	24.5	26.0
		46-55	10.4	12.3	10.6	11.5	11.0
		>55	11.4	2.8	10.3	3.3	7.6
	educ	No qualification literate	0.5	0.9	2.1	1.1	1.3
		Primary	47.5	31.1	42.9	34.9	40.2
		Secondary	28.7	39.6	32.2	43.9	35.8
		More than secondary	20.3	25.5	19.1	17.1	19.5
		Other	3.0	2.8	3.6	3.0	3.2
	income_avg	lower than average	41.6	32.1	35.9	26.8	34.0
		somewhat lower than average	31.7	42.5	38.6	45.0	39.4
		about average	9.9	13.2	10.9	12.3	11.4

Country variable	Levels	Group 1	Group 2	Group 3	Group 4	Total
	somewhat higher than average	6.4	8.5	5.8	7.4	6.7
	higher than average	10.4	3.8	8.8	8.6	8.5
UG Total		100.0	100.0	100.0	100.0	100.0
gender	Male	29.1	37.2	34.7	35.4	33.2
	Female	70.9	62.8	65.3	64.6	66.8
cl.age	≤25	26.5	32.6	25.7	24.1	26.5
	26-35	30.6	40.7	36.3	32.3	33.9
	36-45	22.5	16.3	21.8	24.1	21.9
	46-55	10.7	7.6	9.1	11.9	10.2
	>55	9.6	2.9	7.3	7.5	7.6
educ	No qualification literate	23.9	7.0	12.7	12.9	15.9
	Primary	27.1	30.8	31.1	32.6	30.0
	Secondary	31.1	34.9	32.9	30.4	31.9
	More than secondary	17.5	26.2	21.8	22.6	21.0
	Other	0.4	1.2	1.5	1.6	1.1
income_avg	lower than average	21.2	13.4	15.4	18.2	17.9
	somewhat lower than average	65.0	65.7	65.3	65.8	65.4
	about average	9.4	12.2	12.4	11.0	10.9
	somewhat higher than average	3.3	5.8	4.8	3.8	4.1
	higher than average	1.1	2.9	2.1	1.3	1.6

Appendix 2: Clusters DQQ by gender, age, education level and income at country level - col %

Country	variable	Levels	Group 1	Group 2	Group 3	Group 4	Total
KE	Total		100.0	100.0	100.0	100.0	100.0
	gender	Male	51.9	60.0	36.4	54.5	50.9
		Female	48.1	40.0	63.6	45.5	49.1
	cl.age	≤25	36.5	16.0	31.8	18.2	29.1
		26-35	34.6	48.0	31.8	18.2	35.5
		36-45	13.5	12.0	27.3	45.5	19.1
		46-55	5.8	16.0	4.5	18.2	9.1
		>55	9.6	8.0	4.5	0.0	7.3
	educ	No qualification literate	3.8	4.0	0.0	0.0	2.7
		Primary	28.8	28.0	22.7	54.5	30.0
		Secondary	42.3	28.0	27.3	9.1	32.7

Country	variable	Levels	Group 1	Group 2	Group 3	Group 4	Total
		More than secondary	25.0	32.0	45.5	27.3	30.9
		Other	0.0	8.0	4.5	9.1	3.6
	income_avg	lower than average	1.9	0.0	4.5	0.0	1.8
		somewhat lower than average	13.5	4.0	0.0	9.1	8.2
		about average	17.3	8.0	27.3	9.1	16.4
		somewhat higher than average	26.9	36.0	22.7	45.5	30.0
		higher than average	40.4	52.0	45.5	36.4	43.6
MO	Total		100.0	100.0	100.0	100.0	100.0
	gender	Male	82.1	71.4	72.8	59.5	73.4
		Female	17.9	28.6	27.2	40.5	26.6
	cl.age	≤25	1.3	0.0	2.5	9.5	3.1
		26-35	15.4	14.3	12.3	14.3	14.0
		36-45	16.7	21.4	18.5	23.8	19.2
		46-55	30.8	28.6	23.5	16.7	25.3
		>55	35.9	35.7	43.2	35.7	38.4
	educ	No qualification literate	17.9	7.1	23.5	9.5	17.0
		Primary	26.9	46.4	25.9	28.6	29.3
		Secondary	38.5	39.3	29.6	40.5	35.8
		More than secondary	15.4	7.1	17.3	19.0	15.7
		Other	1.3	0.0	3.7	2.4	2.2
	income_avg	lower than average	47.4	57.1	43.2	45.2	46.7
		somewhat lower than average	32.1	28.6	40.7	28.6	34.1
		about average	16.7	7.1	11.1	14.3	13.1
		somewhat higher than average	1.3	7.1	3.7	7.1	3.9
		higher than average	2.6	0.0	1.2	4.8	2.2
TN	Total		100.0	100.0	100.0	100.0	100.0
	gender	Male	31.0	51.7	45.9	42.4	42.0
		Female	69.0	48.3	54.1	57.6	58.0
	cl.age	≤25	28.6	3.4	27.0	19.7	20.7
		26-35	14.3	24.1	16.2	16.7	17.2
		36-45	23.8	31.0	27.0	21.2	24.7
		46-55	14.3	24.1	18.9	24.2	20.7
		>55	19.0	17.2	10.8	18.2	16.7
	educ	No qualification literate	0.0	10.3	0.0	3.0	2.9

Country	variable	Levels	Group 1	Group 2	Group 3	Group 4	Total
		Primary	11.9	13.8	10.8	10.6	11.5
		Secondary	23.8	17.2	32.4	16.7	21.8
		More than secondary	52.4	48.3	37.8	48.5	47.1
		Other	11.9	10.3	18.9	21.2	16.7
	income_avg	lower than average	4.8	10.3	13.5	9.1	9.2
		somewhat lower than average	45.2	44.8	37.8	36.4	40.2
		about average	28.6	27.6	32.4	25.8	28.2
		somewhat higher than average	14.3	17.2	13.5	21.2	17.2
		higher than average	7.1	0.0	2.7	7.6	5.2
TZ	Total		100.0	100.0	100.0	100.0	100.0
	gender	Male	41.9	33.9	48.5	50.0	43.9
		Female	58.1	66.1	51.5	50.0	56.1
	cl.age	≤25	36.0	19.6	21.2	22.9	25.9
		26-35	27.9	33.9	45.5	24.3	32.4
		36-45	18.6	14.3	19.7	34.3	21.9
		46-55	9.3	14.3	6.1	5.7	8.6
		>55	8.1	17.9	7.6	12.9	11.2
	educ	No qualification literate	0.0	0.0	1.5	0.0	0.4
		Primary	40.7	50.0	40.9	42.9	43.2
		Secondary	40.7	33.9	34.8	35.7	36.7
		More than secondary	18.6	14.3	16.7	18.6	17.3
		Other	0.0	1.8	6.1	2.9	2.5
	income_avg	lower than average	45.3	41.1	56.1	31.4	43.5
		somewhat lower than average	40.7	35.7	33.3	40.0	37.8
		about average	5.8	14.3	9.1	11.4	9.7
		somewhat higher than average	5.8	5.4	1.5	10.0	5.8
		higher than average	2.3	3.6	0.0	7.1	3.2
UG	Total			100.0	100.0	100.0	100.0
	gender	Male		40.0	0.0	40.0	37.5
		Female		60.0	100.0	60.0	62.5
	cl.age	≤25		10.0	33.3	40.0	14.6
		26-35		50.0	33.3	20.0	45.8
		36-45		20.0	33.3	20.0	20.8
		46-55		15.0	0.0	20.0	14.6
		>55		5.0	0.0	0.0	4.2

Country	variable	Levels	Group 1	Group 2	Group 3	Group 4	Total
	educ	No qualification literate		10.0	0.0	20.0	10.4
		Primary		25.0	66.7	0.0	25.0
		Secondary		32.5	33.3	60.0	35.4
		More than secondary		27.5	0.0	20.0	25.0
		Other		5.0	0.0	0.0	4.2
	income_avg	lower than average		35.0	0.0	20.0	31.2
		somewhat lower than average		50.0	100.0	80.0	56.2
		about average		10.0	0.0	0.0	8.3
		somewhat higher than average		5.0	0.0	0.0	4.2
		higher than average		0.0	0.0	0.0	0.0

5. Urban consumers' propensity for innovation

5.1 The influence of social capital on the urban consumers' propensity to include new local food products in their diet.

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5.1.1 Introduction

The demand and consumption of local food is growing among urban consumers due to an increasing request for more ethical and environmental friendly food products (Holloway et al., 2007). Food demand and consumption are driven by ethical aspects, monetary reasons, hedonism, social norm, and attitude (Vermeir & Verbeke, 2006). Regarding the local food consumption determinants, a literature review from Feldmann & Hamm (2015), based on the Alphabet Theory from Zepeda & Deal (2009), proposed the following categories: demographics, information, seeking/knowledge, context, attitude, behaviour. From their literature review, a lack of focus on how personal and social norms can influence the choice of local food products emerged. Other scholars focus their attention on whether the consumption of local food products is influenced by self- or others-oriented motivations. Birch et al. (2018), reported that selfish motivations such as worries about personal health are predictors of local food consumption, while surprisingly altruistic motivations like environmental consciousness are not influencing consumers choices. Still, both Feldmann & Hamm (2015) and Birch et al. (2018), only partially explored the linkages between local food and contextual factors such as the value-chain actors and the social capital. Other scholars identified the cultural identity and solidarity towards local food actors as determinants of consumers' preferences towards local products (Aprile et al., 2016). Evidence from a case study on palm oil and mango producers in Colombia and Peru showed that smallholder farmers inclusion into local agri-food clusters is influenced by social capital dynamics and social networks (Ramirez et al., 2018). This is also confirmed by the works analysing social capital influence on the innovation adoption from farmers' perspective (Monge et al., 2008; Thuo et al., 2014). Even though the literature explores the role of social capital in connecting farmers with existing networks and food system actors, little has been explored on the extent to which the local community social capital, influences their choices towards local food products. A case study based on cider consumers preferences, reported that consumers' social capital influences their preference towards local products (Farris et al., 2019). The work from Farris et al., (2019) particularly focused on the physical proximity and showed that local products' preference was influenced by the attachment to the local territory. It is needed to specify that this work, based on the four "social capital motives" from Robison et al., (2012), found that an attachment value is significantly influencing consumers' choice for local products (Farris et al., 2019). Other scholars have used a different approach to social capital that entails the multidimensional aspects of the social capital. Building on Nahapiet & Ghoshal (1998), Camps & Marques (2014) explored the innovation propensities in Small and Medium-sized Enterprises based on three social capital dimensions: Structural, Cognitive, and Relational Capital. The work from Camps & Marques focuses on the cognitive and relational capital, since most of the existing literature only focuses on structural capital (Camps & Marques, 2014). The results showed that cognitive factors like shared visions, mutual understanding, narratives and codes play an important role on individuals well-being and exerts an influence on relational capital (Lee, 2009; Chang & Hsu, 2016). On the other hand, other scholars report that relational capital elements like trust, competence reliability

are addressed in the literature as key factors for the successfulness of enterprises and businesses (Paoloni et al., 2019). The role of Relational Capital is then also observed in the food sector, and it is reported as an intangible resource that is influencing small enterprises success in the agri-food system (Cosentino et al., 2020). However, the way through which these intangible resources are influencing consumers' choices, still needs to be explored.

Despite **the lack of empirical evidence of how relational and cognitive capital are influencing consumer behaviours towards local food,** literature suggest that **cognitive and relational capital can be key elements in describing the dynamics in consumer choices**. In particular, regarding those food products towards which consumers recognize themselves as culturally and locally close. Thus, the present work analyses urban consumers' buying propensity towards innovative local food, in relation with their cognitive and relational capital. To this end, the present work answers the following research question: **does cognitive and relational social capital influence the propensity of consumers to include a new local food product in their diet?**

Looking at the literature on preferences towards local food system, we can expect that attitudinal elements reported both in the cognitive and relational capitals, such as personal values and beliefs, can influence consumers' choice (Feldmann & Hamm, 2015). Values like trust emerge as a key element regarding the local products as they are considered wealthier and safer by the consumers (Birch et al., 2018). To this end, trust towards local products and local producer can be considered another key element of the relational capital influence on consumers' choice. Further aspects that we can expect, based on the extant literature, are the attachment to local culture, territory and local food actors can play a role as part of both relational and cognitive capital (Aprile et al., 2016; Ramirez et al., 2018). Finally, the analysis of the linkages between these two dimensions of social capital, revealed that a higher cognitive capital can also correspond to a higher relational capital (Chang & Hsu, 2016).

5.1.2 Methodology

5.1.2.1 Data collection procedures and tools

Primary data from 5,924 urban consumers located in 12 cities from five countries (Kenya, Morocco, Tanzania, Tunisia, and Uganda) was collected in 2022 through surveys targeting responsible for food shopping within the household.

The survey gathered information on:

1. Food purchasing habits and decisions.
2. Consumer preferences towards local and more nutritious food (innovation)
3. Individual dietary quality (DQQ)
4. Household diet diversity (HDDS)
5. Socio-economic and demographic household information
6. Consumer setbacks and worries
7. Social capital, trust, and risk attitudes (stated preferences)

These surveys were combined with incentivized behavioural experiments conducted in-lab with the same consumers from five of the abovementioned cities so to compare their stated and revealed preferences. 2,511 valid observations were collected overall (further information on the methodological approach and the data collection process available in Marini Govigli et al., 2022; D2.3).

5.1.2.2 Dependent variable

In this analysis we aimed at assessing the role of cognitive and relational social capital in influencing the propensity of consumers to include a new local food product in their diet. Our outcome of interest is **the urban consumers propensity to include in their household diet a new local product** (i.e., foods or ingredients only produced within a short distance). This was identified through a survey question where respondents were asked to evaluate on a 1-5 Likert scale their propensity to buy local-based food products (Figure 95). In the econometric analysis that follows, the variable is treated as a continuous variable. The distribution of the variable at country and cross-country level is provided in Figure 96 and Figure 97.

6. **If you were given the option to include in your household diet a new local food product (foods or ingredients only produced within a short distance), to what extent would you be interested in buying this new local food product?**
   Rate your opinion using the following 1-5 scale (from 1: **not at all interested**; to 5: **extremely-interested**). Tick √ the chosen answer.

1	2	3	4	5

Figure 95. The survey question in English used as dependent variable.

Q6 Interested in buying new local food product - distribution of values by country
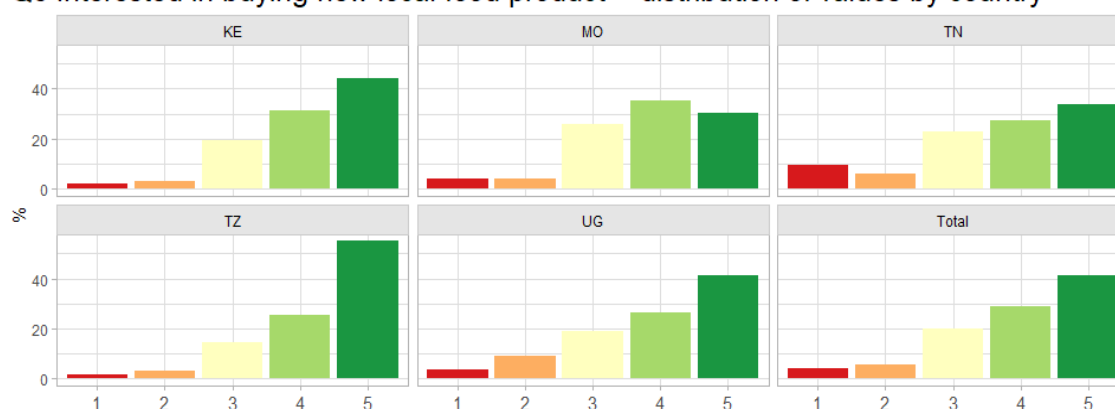
Figure 96. Consumer average answer by country to the question: If you were given the option to include in your household diet a new local food product (foods or ingredients only produced within a short distance), to what extent would you be interested in buying this new local food product?
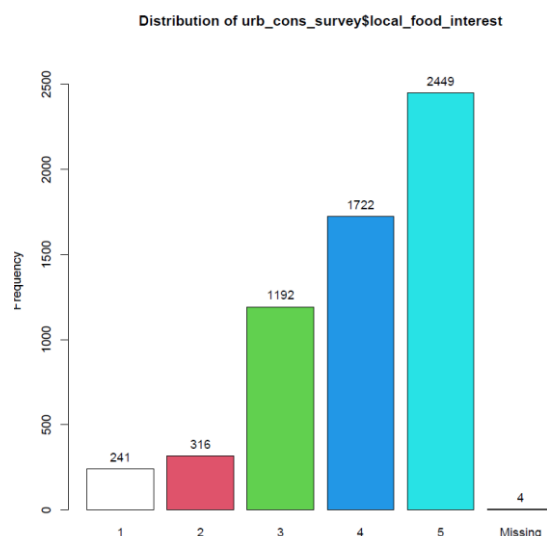
Figure 97. Urban consumers propensity to include in their household diet a new local product. Frequency histogram at cross-country level.

5.1.2.3 Independent variables

Our regressors of interests are a series of **proxies measuring the urban consumers cognitive and relational social capital** (Table 79). In particular, (i) the consumer attachment towards peers and their local community, (ii) the consumer trust towards peers and actors of the food value chain. These indicators were built using both data collected through surveys (stated preferences) and measurements from the incentivised experiments (revealed preferences). This so to include in the analysis measurements of the consumers' behavioural precursors and elicit possible biases (de Corte et al., 2021). The revealed preferences methods employed in this analysis were:

- A **Public Good Game** to assess the participant's willingness to cooperate by providing a monetary contribution to a common pool. The round of PGG was executed after the conduction of a pre-exercise, where participants in group of four were asked to collaborate in joining words within a sentence. The aim of this pre-task was to strengthen the group identity. The average contribution to the common pool was used as proxy of **revealed cognitive social capital**, as it relates to the relations that consumers build in a cooperative setting.

- A **Trust Game** to measure trust in economic decisions. Two rounds of the Trust Game were executed. During the first round, urban consumers were paired anonymously. The consumer designed as "sender" was asked to transfer to the "receiver" a fix amount of token (0,25,50,75,100), which was then going to be tripled before it was passed on to the Receiver. The Receiver could decide to send back some, all, or none of this amount to the Sender. In the second round each consumer was paired with a local NGO or farmers' association that took part in the game as the Receiver[6]. The amount of the endowment sent by senders to the receivers in both rounds, as well as the token returned by the receivers were used as proxy of **revealed relational social capital**, as they relate to the trust consumers build amongst peers and with actors of the food value chain.

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[6] One institution played asynchronously with all consumers from each country.

These two sets of measurements allowed us to estimate the cognitive and relational aspect of social capital considering both stated and revealed preferences of the participants. These are two of the three main dimensions of social capital commonly employed in the literature (Figure 98). No information was instead available to assess the impact of structural social capital on the urban consumer propensity to include new local food products in their diet.

Table 79. Variables of interest from both the survey and the incentivized experiments used to measure cognitive and relational social capital of urban consumers (stated and revealed preferences).

Social capital domain	Preferences	Variable name	Survey question	Measurement
Cognitive social capital (e.g., shared understanding, values, attitudes, and beliefs)	Stated	Attachment peers	To what extent do you feel attached to your peers (your local community)?	Likert scale (1-5)
		Attachment territory	To what extent do you feel attached to your local territory (your city and its surroundings)?	Likert scale (1-5)
	Revealed	PGG	Participant's contribution to the Public Good game (round 2 –with pre-exercise to strengthen the group identity)	Numeric
Relational social capital (Trust, trustworthiness, norms)	Stated	Trust towards peers	Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with them?	Stated preferences three level scale (most people can be trusted, It depends, Once cannot be too careful)
		Trust towards community	How much do you trust your community (neighbours in the district)?	Stated preferences through Likert scale (1-5)
		Trust towards consumer associations	How much do you trust consumers' associations/organizations	Stated preferences through Likert scale (1-5)
		Trust towards farmers	How much do you trust farmers	Stated preferences through Likert scale (1-5)
		Trust towards food processors	How much do you trust your food processors	Stated preferences through Likert scale (1-5)
		Trust towards street vendors	How much do you trust food street vendors	Stated preferences through Likert scale (1-5)
		Trust towards market vendors	How much do you trust food vendors in the market or small grocery storers	Stated preferences through Likert scale (1-5)
		Trust towards supermarket vendors	How much do you trust food vendors in the supermarket	Stated preferences through Likert scale (1-5)
		Trust towards public authorities	How much do you trust public authorities	Stated preferences through Likert scale (1-5)
	Revealed	TG_1	How much of your endowment of 100 tokens do you send to the Receiver?	Bounded Integer (0 = 0 tokens; 1 = 25 tokens; 2 =

		50 tokens; 3 = 75 tokens; 4 = 100 tokens)
TG_2	How much of your endowment of 100 tokens do you send to the Local association/NGO?	Bounded Integer (0 = 0 tokens; 1 = 25 tokens; 2 = 50 tokens; 3 = 75 tokens; 4 = 100 tokens)
Token_trust_1	tokens returned for trust level 1 (=25 tokens from the senders)	Numeric
Token_trust_2	tokens returned for trust level 2 (=50 tokens from the senders)	Numeric
Token_trust_3	tokens returned for trust level 3 (= 75 tokens from the senders)	Numeric
Token_trust_4	tokens returned for trust level 4 (= 100 tokens from the senders)	Numeric

Figure 98. The three interconnected dimensions of social capital. From: Nahapiet and Goshal (1998).

Finally, our model considers a series of sociodemographic controls as well as measurements of the consumer purchasing habits, food access and diet.

5.1.3.4 Modelling framework

To test our RQ, we estimated the following OLS regression model:

$$Y_{ic} = \alpha + C'_{i(c,s)}\beta + R'_{i(c,s)}\gamma + P'_{i(c,s)}\theta + S'_{i(c,s)}\vartheta + \rho_{c,s} + \partial_s + \epsilon_{i(c,s)}$$

where Y_{ic} is the consumer propensity to consume locally sourced food product, the regressors of interest are measurements of Cognitive ($C'_{i(c,s)}$) and Relational ($R'_{i(c,s)}$,) social capital identified through survey-based questions or incentivized behavioral experiments. The model also considers consumer purchasing choices (consumer purchasing frequency of local products; main reasons of buying local products, food purchasing location; $P'_{i(c,s)}$), and a series of socio-demographic controls $S'_{i(c,s)}$ (consumer age, education, gender, income, and number of children within the household). Finally, the models include a country fixed effect ($\rho_{c,s}$) and an experimental

session fixed effect (∂_s) to control for time invariant country and session heterogeneity. All models were tested for multicollinearity. Robust standard errors were employed to control for heteroscedasticity.

5.1.3 Results

5.1.3.1 Descriptive statistics

Generally speaking, most of the consumers have high level of cognitive social capital, measured as the place attachment to their local territory (Figure 99; 3.67 on a scale to 5) and their peers (Figure 100; 3.76), with the lowest level recorded in Kisumu (KE – 2.70). With regards to relational social capital, consumer trust level emerged from the survey are rather low. Only 20.5% of the sample on average believes that most people can be trusted. The lowest level recorded are in Meknes (MA) (6.8%) Kalerwe (UG), and Sousse (12%) (Figure 101). The highest level of trust is towards farmers (3.75 on a scale to 5), small grocery storers (3.50), and food vendors in the supermarket (3.49) (Figure 102).

Q27 To what extent do you feel attached to your local territory?
average value on a scale from 1: Not at all attached; to 5: Extremely attached
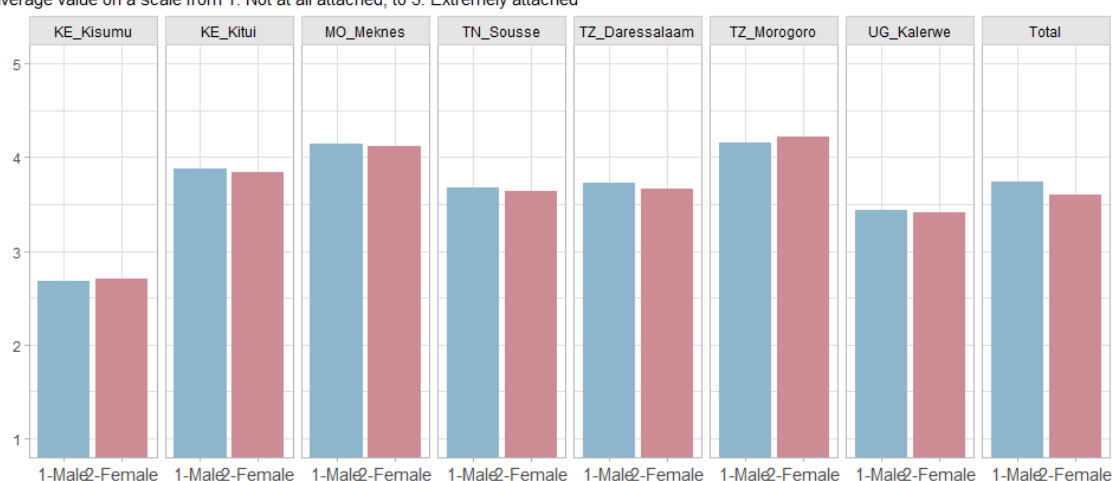
Figure 99. Consumer's attachment to its local territory (Q27). Question asked in cities only where in-lab experiments were performed.

Q28 Attachement to your peers (your local community)

average value on a scale from 1: Not at all attached; to 5: Extremely attached

Figure 100. Consumer's attachment to peers (Q28). Question asked in cities only where in-lab experiments were performed.

Q29 Trust in people
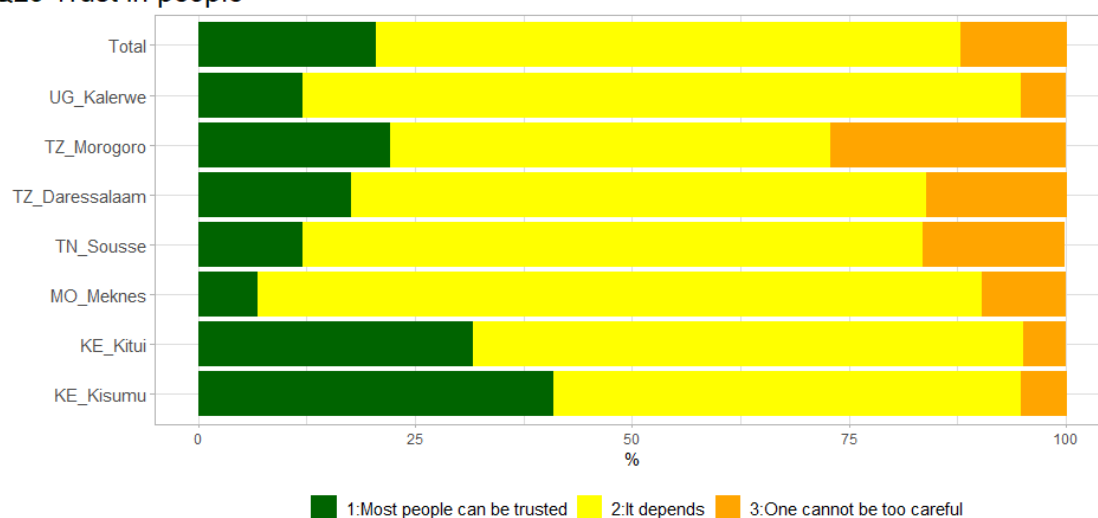
Figure 101. Consumer's trust level in people (Q29). Question asked in cities only where in-lab experiments were performed.

199
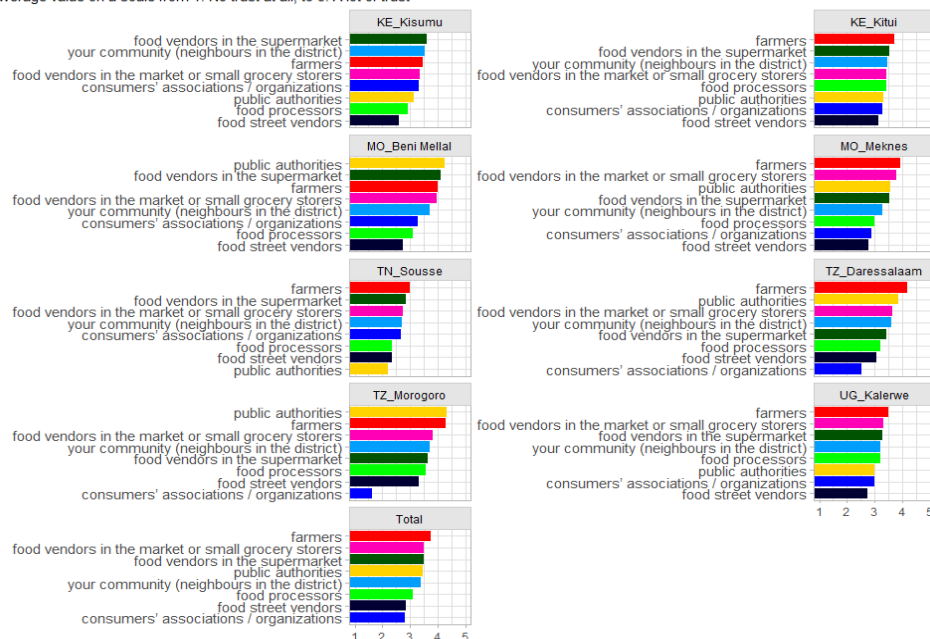
Figure 102. Consumer's trust towards actors of the local food value chain (Q30). Question asked in cities only where in-lab experiments were performed.

5.1.3.2 Econometric analysis

Table 80 reports the results from the analyses. Column 1 is the baseline that includes only regressors estimating cognitive and relational social capital measured through the survey tool (stated preferences). From this specification results show the **significant effect of both cognitive and relational social capital on innovation propensity of purchasing local food**. Urban consumers that feel more attached to their peers have a significant higher propensity to include a new local food product in their diet. Also, urban consumers with higher trust levels towards food street vendors, and public authorities while less trustworthy towards peers are more propense to buy an innovative local food product. These results are maintained also when we progressively add new controls (Columns 2 and 3), except trust versus peers which is captured by the controls. Beside these regressors, we found a significant effect of a series of socio-demographic and purchasing habit variables. Urban consumers are more propense to include a new local food product in their diet when:

- They already purchase local food.
- They rate as important (ii) the household diet diversification, the inclusion of food locally produced in the household diet, the willingness to be "good providers" and the product's availability.
- They purchase most of their products from supermarkets.
- They wish to make the household diet environmentally friendlier, they are concerned about product's affordability, easiness to find, and they wish to help local farmers.
- They have a lower household income level.

In column 4 we finally test the model including also revealed measurements of cognitive and relational social capital. **Revealed trust level towards the food value chain emerges as a**

significant predictor of the urban consumer propensity of purchasing local food products. Surprisingly the impact of this regressor grasps the impact of all the other variables, which in the previous specifications of the model had a significant statistical impact.

Table 80. OLS results coefficients (SE in parentheses)

	Variables of interests	(1)	(2)	(3)	(4)
Cognitive social capital	Attachment peers	**0.100 ***** (0.019)	**0.056**** (0.018)	**0.057 **** (0.018)	0.021 (0.026)
	Attachment territory	0.005 (0.016)	-0.005 (0.015)	-0.002 (0.015)	0.021 (0.024)
	PGG	-	-	-	-0.001 (1.285)
Relational social capital	Trust towards peers	**-0.108 ***** (0.033)	-0.036 (0.031)	-0.043 (0.031)	0.014 (0.044)
	Trust towards community	-0.011 (0.019)	-0.018 (0.018)	-0.017 (0.018)	0.012 (0.025)
	Trust towards consumer associations	-0.021 (0.014)	-0.012 (0.014)	-0.016 (0.014)	0.000 (0.021)
	Trust towards farmers	0.028 (0.020)	0.025 (0.019)	0.024 (0.019)	-0.025 (0.026)
	Trust towards food processors	0.032 (0.018)	0.008 (0.017)	0.007 (0.017)	-0.009 (0.024)
	Trust towards street vendors	**0.066 ***** (0.017)	**0.039*** (0.016)	**0.038*** (0.016)	-0.015 (0.022)
	Trust towards market vendors	-0.041 (0.021)	-0.035 (0.019)	-0.034 (0.02)	0.024 (0.027)
	Trust towards supermarket vendors	0.003 (0.016)	-0.015 (0.016)	-0.011 (0.016)	-0.008 (0.021)
	Trust towards public authorities	**0.045**** (0.017)	**0.040*** (0.016)	**0.039*** **(0.016)**	0.029 (0.022)
	TG_1	-	-	-	-0.044 (0.028)
	TG_2	-	-	-	**0.089***** (0.026)
	Token_trust_1	-	-	-	-0.001 (0.002)
	Token_trust_2	-	-	-	-0.002 (0.001)
	Token_trust_3	-	-	-	0.001 (0.001)
	Token_trust_4	-	-	-	0.000 (0.001)
	Purchasing decision variables	NO	YES	YES	YES

Socio-demographic controls	NO	NO	YES	YES
Revealed preferences (experiments)	NO	NO	NO	YES
Observations	3,426	3,292	3,256	1,327
Country FE	YES	YES	YES	YES
Session FE	NO	NO	NO	YES
R^2	0.078	0.242	0.243	0.352
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1				

5.1.4 Conclusions

5.1.4.1 Conclusions on the Research question

Our results confirm the **significant effect of cognitive and relational social capital on the urban consumer propensity to purchase new food sourced locally**, along with a series of other relevant predictors. Specifically, consumers that feel more attached to their peers, with higher trust towards food vendors and public authorities, have a higher significant propensity to include a new local food product in their diet. This is confirmed also by the literature on consumers' preferences towards local products. In particular, the attachment towards local actors and culture is extensively reported in the literature as an element influencing consumers' propensity towards local products (Aprile et al., 2016). The trust towards local farmers emerges as a determining factor in the literature, particularly when looking at consumers trust towards local products since they are considered healthier and safer (Ramirez et al., 2018). Furthermore, revealed preferences (trust towards the food value chain) emerge as a significant predictor. This shows the importance of assessing revealed preferences when the aims are detecting the consumers' motivations and understanding their decision-making. Finally, the present work showed that lower income levels correspond to a higher willingness to buy local food products, which is partially contrasting with what emerged from previous studies but coherent with the general idea that local food is perceived as less expensive (Feldmann & Hamm, 2015; Zepeda & Deal, 2009).

5.1.4.2 Policy recommendations

Considering the key role that trust towards the producers and attachment to peers play in consumers' propensity to buy locally, some policy recommendations may be drawn.

Interventions aimed at increasing the stable presence of local products and local farmers in the urban markets, or either strengthening the connection between peri-urban and urban areas, may serve as a major driver of change. Getting seasonal, fresh local products that can be traced to known farmer and manufacturer has advantages for both producers and customers. From the perspective of the producers, selling agricultural products directly to consumers allows them to keep a larger portion of the market value through the elimination of intermediaries, which may result in an increase in income. Consumers would be able to link the farming process to the food they consume and increase trust in the producers. Overall, encouraging the rural producers to be directly involved in the peri-urban and urban areas and in stable markets would boost confidence in consumers, other than allowing them to access fresh and nutritious food regardless of their income.

From a public authority perspective, or a consortium of public-private actors interested in promoting local products (such as a Food Hub), this recommendation implies investments in infrastructures and facilities that allow farmers to reach the market (road, transport means, facilities) and properly store the products to guarantee shelf-life. Usually, this kind of arrangement is up to the local authorities or municipalities. The power to successfully support such instances largely depends on the number and variety of stakeholders involved: the coalition embedded in a Food Hub may speed up the process. In some cases, a Municipal Food Council might help to identify the most relevant counterpart of the dialogue. Food Hubs may also work to create the appropriate organizational structure to access loans. Therefore, both sustaining Food Hubs and promoting Municipal Food Councils may indirectly support a policy strategy aimed at improving the consumption of local food products.

5.1.4.3 Recommendations for the project FoodLAND

The results from this work are extremely relevant for the FoodLAND project, which aims at implementing and validating innovations to strengthen food diversity and healthier diets. The importance of social capital in shaping the urban consumer propensity in purchasing local products indicates that the **adoption of innovations (i.e., new local food items) by group of consumers can directly be influenced by activities aimed at enhancing social capital and human capital skills** (e.g., trust and transparency building, clearer communication amongst actors, etc.). This is a relevant implication for the project that, through the implementation of local Food Hubs and clear recommendations aimed at enhancing the transparencies of African local food value chains (e.g., communication and promotion campaigns) can boost the adoption of innovations by urban consumers, focusing on locally sourced and less environmentally impacting food products.

5.1.5 References

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5.2 Consumers' propensity to purchase new nutrient-dense food products: insights from 5 African countries.

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5.2.1 Introduction

Malnutrition is a major issue affecting people in both developing and developed countries (Kramer & Allen, 2015; Puntis, 2010). The most vulnerable subjects to malnutrition problems are pregnant women and newborn child, since poor and unhealthy diets during the pregnancy and in the early phase of a newborn can lead to sever neurocognitive development dysfunctions (Baleanu et al., 2018; Monk et al., 2013). To this end, **nutritional choices made at the household level are extremely important to prevent malnutrition related diseases and dysfunctions**. Nutritional solutions have been addressed during the last decades for tackling malnutrition. These solutions can range from concrete policy interventions for modifying dietary habits, to new products introduction in the market (Augustus et al., 2022; Cheli & Baldi, 2011; Curtain & Grafenauer, 2019). The actions based on new products aim to introduce food with high content and bioavailability of micronutrients in individuals' diets, thus implying a change in peoples' dietary habits (Gibson & Hotz, 2001). Scholars widely explored how certain cognitive aspects that have to do with the knowledge of the products, cost, perceived food functionality, and health impact food habits (Asioli et al., 2017; Sobal & Bisogni, 2009). Studies on nutritional enriched food (e.g.: functional food) assert that people can decide to consume a novel food, if they can clearly understand the derived benefits (Frewer et al., 2003; Roberts & Ho, 1996). However, more recent studies highlighted that nutritionally enriched food products consumption is determined by other elements linked to the acceptance and perception of food products, in terms of phobia towards new food products, and trust in the food industry (Bruschi et al., 2015; Siegrist et al., 2015) Other scholars have shown how trust elements like transparency in information provisioning is crucial for the adoption of novel food with health and dietary benefits (Poínhos et al., 2014). The lack of confidence is not only an issue that concerns actors in the value chain, but it can be an hindering element for food system transformation (Macready et al., 2020). Thus, **understanding which is the role of trust in influencing consumers' perception is crucial, especially in contexts where a shift towards malnutrition problems can be tackled with a shift of the food habits and a change in the food system** (Aytekin Sahin & Gul, 2023). Literature evidences show that trust towards the actors of the value chain is a complex topic and varies according to the typology of actor and local contexts (Wu et al., 2021). Depending on the context, farmers can be considered as particularly trustworthy, especially when the distances between farmers and consumers are shorter (Giampietri et al., 2018; Henderson et al., 2011). Lower levels of trust are generally associated to other actors of the value chain, like food processors and processing technologies (Augustus et al., 2022; Meijer et al., 2021). Trust towards retailers and supermarket is influenced by other aspects linked to marketing ability, communicational strategies, and customers characteristics that affect trust towards retailers in general and openness to retailers' innovativeness (Konuk, 2019; Ladwein & Sánchez Romero, 2021; Richards et al., 2011). In addition to trust towards the food value chain, scholars have found that trust towards community, social capital and individuals' networks, influence consumer habits and attitude towards novel food (Matsaganis & Wilkin, 2015; Moxley et al., 2011).

The role of trust in determining food choices, particularly regarding novel food and nutrient-dense solutions, is then twofold and composed by trust towards the value chain actors and trust towards

the peers. Trust towards peers can be separate into trust into trust towards community and trust towards other consumers (horizontal trust) (Earle, 2010; Roosen et al., 2015). Another typology of trust that can be referred as trust towards the value chain actors, is the institutional (or vertical) trust which is more vertically oriented, and it refers to the trust towards institutions and actors operating in a specific value chain (e.g.: farmers, vendors, public authorities) (Yue et al., 2015).

Although literature extensively discussed on the role of both vertical and horizontal trust components in influencing consumer decision to purchase nutrient-dense food products in North America, Europe and Asia, **little has been explored about vertical and horizontal trust influence on the acceptance of nutrient enriched food products**. Most of the literature on food choices in Africa focused its attention on nutritional perceptions, psychological, and sociocultural factors(Karanja et al., 2022). Evidence from the literature showed that these products have a potential niche market and they are constantly spreading (Amagloh et al., 2021). However, a lack of policy measures and limited assessments of consumers' perception still hinder the diffusion of new food products that can ensure more balanced diets (Mpofu et al., 2014). To this end, this study analyses the factors affecting the consumers' food behavioural change by addressing the following research question: **do consumers' trust influences their propensity to introduce a new nutrient-dense food product in the household diet**?

Evidence from North America and Europe suggests that trust, consumer habits and sociodemographic factors can influence consumers' propensity to introduce new food products in their diets. Accordingly, we expect that consumers with higher levels of vertical and horizontal trust, with healthy consumption habits and with higher income will show more propensity to introduce these novel products in their diets (Bruschi et al., 2015; Roosen et al., 2015; Siegrist et al., 2015). We also expect that food value chain actors like farmers to be the most trusted, while actors acting in the processing might have lower trust levels (Augustus et al., 2022; Meijer et al., 2021; Giampietri et al., 2018; Henderson et al., 2011).

5.2.2 Methodology

5.2.2.1 Data collection procedures and tools

Primary data from 5,924 urban consumers located in 12 cities from five countries (Kenya, Morocco, Tanzania, Tunisia, and Uganda) were collected in 2022 through surveys targeting responsible for food shopping within the household.

The survey gathered information on:

8. Food purchasing habits and decisions.
9. Consumer preferences towards new local and more nutritious food
10. Individual dietary quality (DQQ)
11. Household diet diversity (HDDS)
12. Socio-economic and demographic household variables
13. Consumer setbacks and worries
14. Social capital, trust, and risk attitudes (stated preferences)

These surveys were combined with incentivized behavioural experiments conducted in-lab with the same consumers from five of the abovementioned cities to elicit their revealed preferences. 2,511 valid observations were collected overall (further information on the methodological approach and the data collection process available in Marini Govigli et al., 2022; D2.3).

5.2.2.2 Dependent variables

This study aimed at assessing whether the **urban consumers' trust on the local food operators influences their propensity to choose new healthy / nutrient-dense food products** (i.e., any new food product with augmented nutrient content that could complement or enrich the consumer's household diet). Two different dependent variables were selected to measure the consumers' propensity towards food behavioural change and derive two related regression models to detect the determinants:

1. A binary variable that rates the respondents' **propensity to include in their diet a new iron-rich flour under two different frames compared to the status quo: (1.) reducing the likelihood of getting an infection and (2.) reinforcing the immunity to infections**. Each option included information concerning the food cost (no additional costs if consumers opted for maintaining their current diet; an increased but indefinite cost if the new product was going to be adopted), and about the likelihood of getting an infection (60% of probability if opted for maintaining their current diet; 40% if the new product is adopted) and of being protected from an infection (40% of probability of being protected in the status quo; 60% of probability if instead the new product was going to be adopted). Two versions of the same question were crafted so to mitigate the impact of wording effect on the responses (i.e., to ensure that participants were not being affected or influenced by the wording chosen). Participants were randomly assigned one of the two versions (Figure 95).

2. An ordinal variable assessing the **urban consumers' propensity to buy a nutrient-dense food product that could complement their household diet** (Figure 95). In the econometric analysis that follows, the variable is treated as a continuous variable.

12. **[Block 1] Think about a new food product – such as a new iron-fortified flour – that can reduce the likelihood of having an infection. What would you choose between:** Tick √ the chosen answer

☐ **A. not including the new blended** flour in your diet that implies for you:	☐ **B. including the new blended** flour in your diet that implies for you:
• **no additional food costs and**	• **some additional food cost now and**
• **60% of probability of getting an infection at the end of next year.**	• **40% of probability of getting an infection at the end of next year.**

[Block 2] Think about a new food product – such as a new iron-fortified flour – that is likely to reinforce your immunity to infections. What would you choose between: Tick √ the chosen answer

☐ **A. not including the new blended** flour in your diet that implies for you:	☐ **B. including the new blended** flour in your diet that implies for you:
• **no additional food costs and**	• **some additional food cost now and**
• **40% of probability of being protected from an infection at the end of next year.**	• **60% of probability of being protected from an infection at the end of next year.**

13. **If you were given the option to include in your household diet a new food product with augmented nutrient content (e.g., naturally improved bean with high levels of proteins and minerals) that could complement your current household diet, to what extent would you be interested in buying this new nutrient-dense food product?**
Rate your opinion using the following 1-5 scale (from 1: **Not at all interested**; to 5: **Extremely interested**). Tick √ the chosen answer.

1	2	3	4	5

Figure 103. Stated propensity to buy a new, nutrient-dense food product

Given the different structure of these two dependent variables (binary and continuous), their determinants were detected by implementing two separate econometric models (logistic and linear regressions, respectively)..

The distribution of the variables at country and cross-country level is provided in Figure 96, Figure 105, and Table 81.
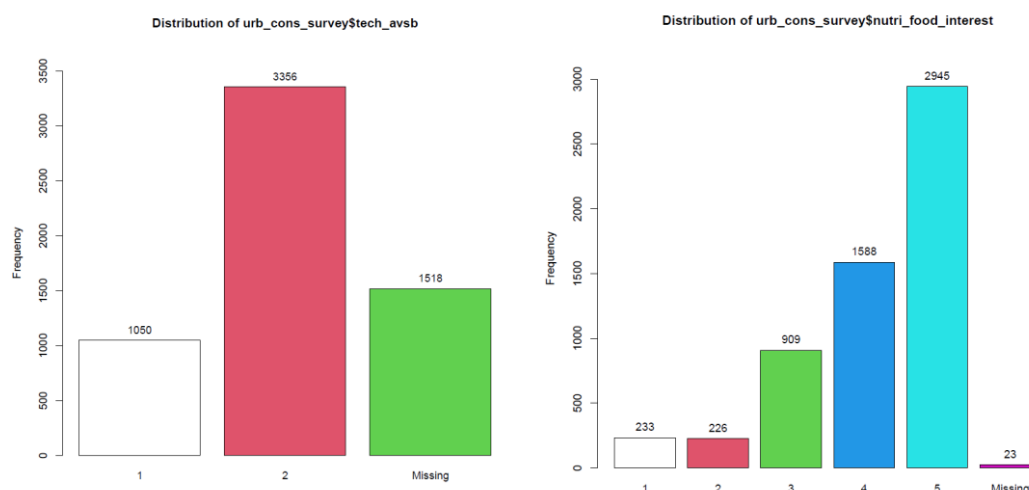
Figure 104. Frequency histogram at cross-country level of the dependent variables. Graph on the left:: binary question asking to urban consumers to rate their propensity to include a new food product aiming at reducing the likelihood of getting an infection compared to the status quo. Graph on the right: answers to the question "If you were given the option to include in your household diet a new food product with augmented nutrient content (e.g., naturally improved bean with high levels of proteins and minerals) that could complement your current household diet, to what extent would you be interested in buying this new nutrient-dense food product?"

Table 81. Consumers' average answer by city to question number 12.* (percentage)

City	A-C	B-D
KE_Kisumu	51.1	48.9
KE_Kitui	14.6	85.4
KE_Nyeri	18.8	81.3
MA_BeniMellal	36	64
MA_Meknes	25.4	74.6
TN_Sousse	21	79
TZ_Daressalaam	20.2	79.8
TZ_Morogoro	11.2	88.8
UG_Kalerwe	15.4	84.6
Total	**21.2**	**78.8**

A=no additional food costs and 60% of probability of getting an infection at the end of next year

C=no additional food costs and 40% of probability of being protected from an infection at the end of next year
B=some additional food cost now and 40% of probability of getting an infection at the end of next year
D=some additional food cost now and 60% of probability of being protected from an infection at the end of next year

*this question was mandatory for cities foreseeing behavioral experiments (Kitui, Meknes, Sousse, Morogoro, Kalerwe). Other cities participated to the survey as well (Kisumu, Nyeri, Beni Mellal, Dar es Salaam).

Q13 Interest for a new nutrient dense food product

average value on a scale from 1: Not at all interested; to 5: Extremely interested
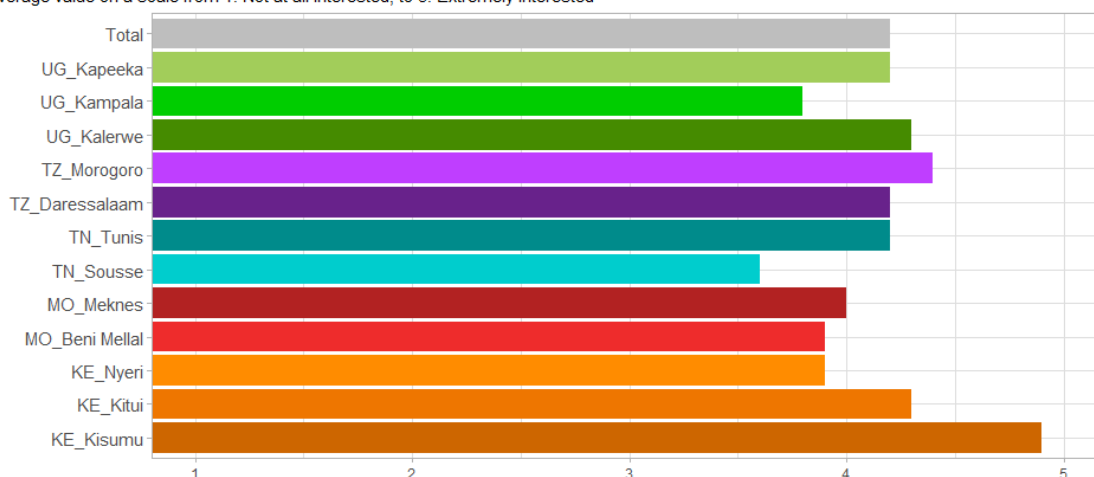
Figure 105. Consumers average answer to question number 13.

A Point-Biserial Correlation analysis was conducted to measure the strength of the association between the two response variables. Results show that a positive and significant correlation exists between them (correlation coefficient equal to 0.10, *p value*: <0.001).

5.2.2.3 Independent variables

Our independent variables used for both the models are a series of **observations measuring the urban consumers' trust on the local food operators** (Table 82). These variables were obtained from survey and experimental data (stated and revealed trust) (a description of the Trust game is provided in Chapter 5.1). Moreover, both models also consider the following variables:

1. Individual and household food access (measured by the diet diversity scores: Diet Quality Questionnaire- DQQ and Household Dietary Diversity Score - HDDS, respectively; more information in Marini Govigli et al., 2022; D2.3 and Chapter 2).
2. Consumers' assessment of healthiness of their household diet, (measured on a 1-5 Likert scale and based on the following provided definition" A healthy diet is one that provides adequacy of nutrients, without health-harming sub-stances and excess of nutrients", UN Food Systems Summit, 2021).
3. A series of sociodemographic variables (consumer age, education, gender, income, income spent on purchasing food, and number of children within the household).
4. Measurements of the consumer purchasing habits.

Table 82. Independent variables derived from both the survey andexperimental data.

Preferences	Variable	Survey question	Measurement

	Trust towards peers	Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with them?	Stated preferences three level scale (most people can be trusted, It depends, Once cannot be too careful)
	Trust towards community	How much do you trust your community (neighbours in the district)?	Stated preferences through Likert scale (1-5)
	Trust towards consumer associations	How much do you trust consumers' associations/organizations	Stated preferences through Likert scale (1-5)
	Trust towards farmers	How much do you trust farmers	Stated preferences through Likert scale (1-5)
Stated	Trust towards food processors	How much do you trust your food processors	Stated preferences through Likert scale (1-5)
	Trust towards street vendors	How much do you trust food street vendors	Stated preferences through Likert scale (1-5)
	Trust towards market vendors	How much do you trust food vendors in the market or small grocery storers	Stated preferences through Likert scale (1-5)
	Trust towards supermarket vendors	How much do you trust food vendors in the supermarket	Stated preferences through Likert scale (1-5)
	Trust towards public authorities	How much do you trust public authorities	Stated preferences through Likert scale (1-5)
	TG_1	How much of your endowment of 100 tokens do you send to the Receiver?	Bounded Integer (0 = 0 tokens; 1 = 25 tokens; 2 = 50 tokens; 3 = 75 tokens; 4 = 100 tokens)
	TG_2	How much of your endowment of 100 tokens do you send to the Local association/NGO?	Bounded Integer (0 = 0 tokens; 1 = 25 tokens; 2 = 50 tokens; 3 = 75 tokens; 4 = 100 tokens)
Revealed	Token_trust_1	tokens returned for trust level 1 (=25 tokens from the senders)	Numeric
	Token_trust_2	tokens returned for trust level 2 (=50 tokens from the senders)	Numeric
	Token_trust_3	tokens returned for trust level 3 (= 75 tokens from the senders)	Numeric
	Token_trust_4	tokens returned for trust level 4 (= 100 tokens from the senders)	Numeric

5.2.2.4 Modelling framework

To test our research question, we estimated the following OLS regression model:

$$Y_{ic} = \alpha + '_{i(c,s)}\beta + F'_{i(c,s)}\gamma + h'_{i(c,s)}\mu + P'_{i(c,s)}\theta + S'_{i(c,s)}\vartheta + \rho_{c,s} + \partial_s + \epsilon_{i(c,s)}$$

where Y_{ic} is the consumer propensity to buy innovative food products with high nutritional contents (either in the binary or continuous format); **the regressors of interest are measures of trust over the food operators (**$T'_{i(c,s)}$**)** identified through survey-based questions or incentivized behavioural experiments; food access (diet diversity, $F'_{i(c,s)}$), the consumer self-perception of diet healthiness ($h'_{i(c,s)}$); consumer purchasing choices (main reasons and obstacles of purchasing

more nutritious food products; $P'_{i(c,s)}$), and a series of socio-demographic controls (consumer age, education, gender, income, income spent on food, and number of children within the household, $S'_{i(c,s)}$()). Finally, the models include a country fixed effect ($\rho_{c,s}$) and an experimental session fixed effect (∂_s) to control for time invariant country and session heterogeneity. All models were tested for multicollinearity. Robust standard errors were employed to control for heteroscedasticity. Model results were compared and discussed.

5.2.3 Results

5.2.3.1 Descriptive statistics

Figure 106 reports the urban consumers' level of trust registered in the five countries. Respondents from Tanzania reach the highest level of trust on the value chain actors (global average: 3.49 on a scale to 5). On the contrary, the sample of consumers from Tunisia show the lowest recorded levels of trust. The overall highest level of trust is towards farmers (3.76 on a scale to 5; highest value recorded in Tanzania: 4.23), followed by market vendors (3.50; highest value recorded in Tanzania: 3.20), and food vendors in the supermarket (3.49 highest value recorded in Morocco: 3.87).

Figure 106. Consumers' trust towards local food operators (average).

5.2.3.2 Econometric analysis

Table 80 reports in columns 1-4 and 5-8 the results obtained from the logistic and linear regressions, respectively, having as dependent variable the consumers' propensity to buy a new, healthy food product. Results from both models consistently show the **significant role that both the horizontal trust** (trust amongst peers) **and vertical trust** (trust on operators along the food value chains) play in explaining the variations in **the consumers' food behaviors.** Yet, the directionality of some of these effects differs between the two models.

Horizontal trust: In the logistic regressions, an increase of the consumers' trust towards peers **reduces** the odds that consumers opt for a nutrient-dense product over the status quo, *ceteris paribus.* This effect has the same directionality in the linear regressions, where consistently urban consumers with higher levels of trust towards peers have a **negative** and significant propensity to buy innovative food products with higher nutritional contents.

This indicates that **the higher the consumers' horizontal trust, the less likely the consumers show a propensity to include a new healthy product in the household diet.**

Vertical trust: In the logistic regressions an increase of the consumers' trust towards (i) the community, (ii) consumer associations, (iii) market vendors, and (iv) supermarket vendors emerge as **reducing** the odds that consumers opt for a nutrient-dense product over the status quo, ceteris *paribus.* The effect of these variables is either not significant or with opposite directionality in the linear regressions (e.g., urban consumers with higher levels of trusts towards supermarket vendors are associated with a **slightly positive** and significant propensity to buy innovative food products with higher nutritional contents.)

Moreover, in the logistic regressions, an increase of the trust levels towards (i) food processors, and (ii) street vendors, **increases** the odds that consumers opt for a nutrient-dense product over the status quo, ceteris *paribus.* These variables show no significant effect in the linear regression models, where additionally trust versus farmers and public authorities are associated with a **slightly positive** and significant propensity to buy innovative food products with higher nutritional contents.)

This indicates that **despite vertical trust has a significant effect on the consumers' propensity of adopting nutritious-based diets, its effect varies among the models considered**.

In both the specifications, the revealed trust measured through the incentivized behavioral experiments shows no significant effect.

Table 83. Results from the logistic (odd ratios and confident intervals in parentheses) and linear regressions (coefficients and SE in parentheses).

	Dependent variable: propensity to buy a new, nutrient-dense product							
	Logistic regression models				Linear regression models			
Explanatory variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Trust towards peers	0.68*** [0.58 – 0.80]	0.73*** [0.61 – 0.87]	0.75*** [0.62 – 0.89]	0.77*** [0.64 – 0.92]	-0.059* (0.031)	0.043 (0.031)	-0.057* (0.031)	-0.064** (0.031)
Trust towards community	0.86*** [0.78 – 0.94]	0.87*** [0.79 – 0.95]	0.88*** [0.80 – 0.97]	0.87*** [0.79 – 0.96]	0.001 (0.018)	0.002 (0.018)	-0.002 (0.018)	0.002 (0.018)
Trust towards consumer associations	0.87*** [0.81 – 0.94]	0.91** [0.84 – 0.99]	0.92** [0.85 – 0.99]	0.92** [0.85 – 1.00]	0.012 (0.014)	0.019 (0.014)	0.016 (0.014)	0.017 (0.014)
Trust towards farmers	0.91** [0.83 – 1.00]	0.91* [0.83 – 1.01]	0.93 [0.84 – 1.02]	0.94 [0.85 – 1.03]	0.065*** (0.019)	0.054*** (0.019)	0.043** (0.019)	0.039** (0.019)
Trust towards food processors	1.27*** [1.16 – 1.38]	1.2*** [1.10 – 1.32]	1.2*** [1.10 – 1.32]	1.21*** [1.10 – 1.33]	0.036** (0.017)	0.019 (0.017)	0.021 (0.017)	0.020 (0.017)
Trust towards street vendors	1.29*** [1.19 – 1.40]	1.21*** [1.11 – 1.32]	1.2*** [1.10 – 1.30]	1.2*** [1.10 – 1.31]	-0.006 (0.017)	-0.005 (0.017)	0.005 (0.017)	0.000 (0.017)
Trust towards market vendors	0.83*** [0.75 – 0.91]	0.87*** [0.78 – 0.96]	0.87*** [0.79 – 0.96]	0.87*** [0.78 – 0.96]	-0.032 (0.02)	-0.028 (0.019)	-0.032 (0.019)	-0.028 (0.019)
Trust towards supermarket vendors	0.88*** [0.81 – 0.95]	0.9** [0.83 – 0.98]	0.91** [0.84 – 0.99]	0.91** [0.84 – 0.99]	0.061*** (0.015)	0.045*** (0.015)	0.036** (0.015)	0.047*** (0.015)
Trust towards public authorities	0.99 [0.92 – 1.08]	0.97 [0.89 – 1.05]	0.97 [0.90 – 1.06]	0.98 [0.90 – 1.07]	0.041** (0.016)	0.038** (0.016)	0.03* (0.016)	0.025 (0.016)
Diet healthiness	-	-	0.84*** [0.76 – 0.92]	0.82*** [0.75 – 0.91]	-	-	0.104*** (0.017)	0.111*** (0.017)
Purchasing decision variables	NO	YES	YES	YES	NO	YES	YES	YES
Food access and diet diversity	NO	NO	YES	YES	NO	NO	YES	YES
Socio-demographic controls	NO	NO	NO	YES	NO	NO	NO	YES
Observations	3,427	3,310	3,302	3,269	3,426	3,310	3,302	3,269
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
R^2	0.092	0.180	0.187	0.204	0.136	0.202	0.215	0.227

Standard errors in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$; Tjur's R^2 used for the logistic regressions (columns 1-4); Adjusted R^2 for the linear regressions (columns 5-8)

Beside these regressors, we found a significant effect for a series of socio-demographic and purchasing habit variables, as reported in the table below. Some of these effects are aligned across both models:

- urban consumers assigning higher importance to (i) the product availability, (ii) the household diet diversification, (iii) the possibility of being good food providers for the rest of the household members, (iv) environmental awareness, and (v) the enhancement of the household social status are **more propense to include a new, more nutritious food in the household diet;**
- whereas consumers who are generally reluctant to change their food practices **are less propense to include new, more nutritious foods in the household diet.**

Other regressors have instead opposite directionalities across regression models, namely:

- The importance assigned by consumers to the product price.
- The importance assigned by consumers to achieving a healthier household diet.
- The consumer's perception of the healthiness of the household diet.
- The household average monthly income.

Interestingly, the linear regression models show a negative effect of income and a positive effect of product price over the consumers' propensity to purchase a new, more nutritious product, whereas the opposite is found for the logistic regressions. Similarly, in the linear regressions the level of healthiness of the household diet shows a positive effect over the consumers' propensity to purchase a new more nutritious product, compared to the logistic regressions where the effect is negative.

This can be explained by looking at what the two questions were detecting (Q12; Q13). Q12 was explicitly mentioning a benefit on the long term linked to a higher price on food purchase. The higher price might be an obstacle for lower income populations, this can explain the influence of price in adopting nutrient-dense innovation in the logistic regression. On the other hand, Q13 asked the willingness to introduce new nutrient enriched products without specifying any increasing cost. The linear regression does not reveal any strong correlation between product price, income level and willingness to adopt nutrient-dense food.

Table 84. Results from the regression models for the additional regressors.

Dependent variable: propensity to buy a new, nutrient-dense product			
Explanatory variables	**Logistic regression models**	**Linear regression models**	**Directionality of the effect**
Purchasing decision variables (Q2, Q14, and Q15)	perception of: **(1) Product availability** **(2) Household diet diversification** **(3) Consumer wishing to be a "good" provider.** **(4) Environmental awareness** **(5) Consumer wishing to enhance the household social status.** (6) Product affordability	perception of: **(1) Product availability** **(2) Household diet diversification** **(3) Consumer wishing to be a "good" provider.** **(4) Environmental awareness** **(5) Consumer wishing to enhance the household social status** (6) Product price (7) Inclusion of food locally produced in the household diet.	Positive: Urban consumers are more propense to include a new, more nutritious food

	(7) Willingness to compare its price with those of other products.	(8) Product characteristics, such as taste, aroma, color, shape. (9) Achieving a healthier household diet	
Purchasing decision variables (Q2, Q14, and Q15)	perception of: **(1) Consumers not willing to change their food practices.** (2) Product price (3) Achieving a healthier household diet (4) Product in line with consumer lifestyle and culture (5) Trusting doctor's recommendations (6) Consumers lacking time for food preparation. (7) Lack of consumer's acquaintance in using the food product.	perception of: **(8) Consumers not willing to change their food practices.** (9) trust towards Farmer/seller	Negative: Urban consumers are less propense to include a new, more nutritious food
Consumer's perception of the healthiness of the household diet (Q11)		perception	Positive: Urban consumers are more propense to include a new, more nutritious food
Consumer's perception of the healthiness of the household diet (Q11)	perception		Negative: Urban consumers are less propense to include a new, more nutritious food
Socio-demographic variables (Q3, Q18, Q19, Q21)	: (1) Household average monthly income	: (1) Number of children within the household	Positive: Urban consumers are more propense to include a new, more nutritious food
Socio-demographic variables (Q3, Q18, Q19, Q21)	: (1) Consumer literacy (education)	: (1) Household average monthly income	Negative: Urban consumers are less propense to include a new, more nutritious food

5.2.4 Conclusions

5.2.4.1 Conclusions on the Research question

Our results confirm the **significant effect of both horizontal and vertical trust on the urban consumers' propensity to purchase new foods with augmented nutritious components**, along with a series of other relevant predictors. Specifically, **the higher is the consumers' horizontal trust, the less likely consumers are oriented to include more nutrient-dense diets**. These results are not confirmed by the literature, since most of the literature reported that trust towards peers and feeling food chain actors as their peers, positive influences the individuals' attitude towards new products (Siegrist et al., 2015). Further literature review will be needed to interpret these results. On the other hand, the negative correlation between horizontal trust and propensity to integrate nutrient-dense products in the linear regression, can be interpreted as an indicator of people's attachment to peers and to traditional values, thus making less attractive for

part of the population to adopt new food products (Guiné et al., 2021). Regarding vertical trusts, the effect is more ambiguous as the directionality varies across the models considered. We can generally affirm that **trust towards the food value chain actors plays a role in the logistic regression, while the linear regression confirmed the influence of trust towards farmers, supermarket vendors and public authorities, in positively influencing consumers' attitude towards nutritious-based products**. This confirms what emerged in similar studies (Henderson et al., 2011; Ladwein & Sánchez Romero, 2021; Richards et al., 2011). Further research should be done to disambiguate this effect, to understand whether the framing of the baseline questions influenced the urban consumers' responses, with relevant methodological implications. Several elements like the risk attitude, public good game, and potential biases that might influence stated preference and real behaviours, should be taken into consideration.

Finally, this study adopted a generic definition of nutrient-dense product since its objectives were to focus on the consumers' propensity towards a new food, thus excluding possible variations triggered by the product specificities (e.g., components, accessibility, availability, …), and to detect and compare the determinants across different contexts. Nevertheless, literature clearly states that the consumers' food behaviours depend on the food characteristics (Bruschi et al., 2015). Future work focusing on organising experiments and surveys testing the propensity to introduce nutrient based food starting from a base product can support in improving the reliability of respondents' answers.

5.2.4.2 Policy recommendations

Building on the main results, some policy recommendations can be derived. In the African context the novel food products, like the nutrition-dense foods, are spreading and becoming more important for consumers' diets. This implies that policy actions should be designed to exploit the potentiality of these innovations in improving food security and citizens' wellbeing. In particular, case studies show that one of the main barriers to introduction of these products relies in the existing regulatory framework (Amagloh et al., 2021; Mpofu et al., 2014). Thus, **mutual dialogue between producers, actors acting in the transformation phase, consumers' associations and local authorities should be implemented to tailor these innovations to the existing legal framework.** Suitable policy arenas, able to support this dialogue, already exist in some cases, such as Food Policy Councils and Urban Agendas: for instance, Nairobi has an active Urban Food Policy that might encourage a similar dialogue and it could scale it up to a national and international level through its networks. Similarly, this can be the role of Food Hubs that are foreseen in FoodLAND project.

Furthermore, the results show some elements from which guidelines and policy recommendations can be derived. First of all, since the horizontal trust is indicating a propensity to keep the status quo and not to deviate from the tradition, strategies aiming to reduce consumers' scepticism towards new healthier foods should **increase people's knowledge of the benefits related to nutrient-dense products, and integrate these products within traditional diets**. This might encourage consumers to choose a new product despite their linkage with their community. A second element that needs to be considered is the trust towards the value chain. **Consumer trust towards farmers, vendors and public authorities positively influence consumers' attitude towards innovative products. This is a key element that should be consider by policymakers when introducing and distributing new nutrient-dense product.**

Finally, income has a dual influence on the propensity towards new products. In the logistic regression price and income represents obstacles for lower income populations. On the other hand, the results from the linear regression showed that lower income classes are more willing to adopt nutrient-dense products. This means that **economic subsidies together with awareness**

raising campaign should be targeted towards these urban dwellers who are more in need of nutrient-dense food.

5.2.4.3 Recommendations for FoodLAND activities

The role of trust towards the food operators across the value chain in shaping the innovation adoptions of African urban consumer has a series of implications for the FoodLAND project, including:

- Enhancing the role of the multi-actor governance approach developed in the project Food Hubs, with the aim of matching the consumers' needs with the technologies developing nutrient-dense products.
- producing policy recommendations which promote the whole value chain with the aim of increasing knowledge flows and trust towards food producers and processors. This intervention can increase consumer acceptance of innovation.
- Urban consumers might be more incentivized in adopting nutrient-dense food innovations when these are targeted to their individual well-being. This product characteristic should be highlighted through tailored consumer awareness raising campaigns.

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6. Results from the experimental auction and biometric tests

6.1 Integrating experimental economics and biometric methods to improve understanding of consumers' decision making: A novel protocol and its application to the case of olive oil in Tunisia and Morocco

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6.1.1 Introduction

Recent advances in the field of behavioural and experimental economics have been characterized by an evolution of the understanding of consumers' behaviour as being explained by more than just rationality and utility maximisation (Huseynov et al., 2019). Insights from psychological studies and neurophysiological studies, for example, have led to the consideration of both conscious and unconscious factors.

Conscious factors such as values and preferences can be approached through the attributes of the product being evaluated, or the socio-demographic characteristics of the participants. Attributes of the product can be categorized as search, credence and experience attributes (Behaghel, 2012; Chen et al., 2015). These are communicated to consumers through visual cues (such as labels, packaging). Unconscious factors, on the other hand, can be revealed through emotions and recorded thanks to technologies such as eye-tracking and facial emotions recognition that generate biometric data. Eye-tracking is an increasingly popular tool for understanding underlying behaviour guiding economic decisions, and incorporating visual attention measures, for example, has shown to improve the efficiency of econometric models (Chen et al., 2015). Indeed, there is evidence that subjects who spend more time on the area of interest bearing specific product information value the products or information more (Chen et al., 2015).

Most of the literature incorporating economic and biometric data so far, has done so in the context of choice experiments, a stated preference approach. Although stated preferences are very useful to explore consumers' decision-making processes in a range of situations, including hypothetical situations, their findings are limited to participants' statements. Little has been done using revealed preferences methods. The value added of these latter methods is that they are good indicators of what happens in the field (Levitt and List, 2007; Lusk and Fox, 2003). Economic experiments and eye-tracking technology are easily compatible approaches as eye-tracking does not modify the behaviour or decision-making processes of the participants to an economic experiment (Kee et al., 2020). Here, we aim to combine the strengths of both types of approaches. We introduce a protocol for a laboratory experiment that aims to understand consumers' preferences for labelled extra virgin olive oil and the impact of information about the health benefits of olive oil on their willingness to pay (WTP). Indeed, there is evidence that consumers are willing to pay for different nutritional standards mainly for consideration of their impact on their health (Ran et al., 2017). We ought to go beyond that understanding by highlighting the role of other, primarily unconscious factors, in consumers valuation.

Our protocol builds upon the protocol developed by Lange et al. (2002) and adopted by Bougherara and Combris (2009) and Barlagne et al. (2015). The protocol combines an auction mechanism known as the Becker–DeGroot–Marschak (BDM) procedure (Becker and DeGroot, 1974) with the measurement of biometric data using an eye-tracker (Clement, 2007; Clement et

al., 2013). Several biometric features are measured, such as fixation duration and fixation counts but also facial expression.

Our research hypotheses are the following:

H1: Integrating biometric measurement in the specifications of WTP models increases the performance of the models.

H2: Negative emotions and lower attention / fixation time are negatively related to WTP, and positive emotions and higher attention / fixation time are positively related to WTP.

H3: Emotions and fixation time and count explain a significant share of the variability in WTP for the same product across different evaluation occasions.

We compare different consumer choice models based on different sets on factors and discuss their goodness of fit. We use a baseline tobit model to explain consumers' WTP for olive oil, that we compare with more complex mixed models incorporating biometric data. While the tobit model deriving consumers' WTP for olive oil allows good prediction of consumers' behaviour, the mixed models incorporating biometric data have a better goodness of fit.

6.1.2 Methodology

6.1.2.1 Subjects and recruitment

To test our protocol, we recruited samples of urban consumers in the cities of Meknes (Morocco) and Sousse (Tunisia). To collect WTP and biometric data, we used the iMotions software, where we embedded two questionnaires developed in Qualtrics: one for the initial explanation of the auction, and one for collecting socio-demographic and other variables and for implementing the auctions. The order of the oils was randomised on a daily basis to avoid order effects. Testing one person took up to 30 minutes including the questionnaires and the tasting of the oils. The data was collected in September 2022 in Meknes and in October-November 2022 in Sousse.

The samples are representative of the cities' populations in terms of age groups and gender. The final sample sizes are 230 in Meknes and 208 in Sousse, resulting in 4,600 and 4,160 observations across all olive oils and stages of the protocol, respectively. However, due to poor calibration or similar issues, the number of observations for the biometric variables is smaller (4,565 for emotions and 3,878 for fixation in Meknes, and 4,158 and 3,460 in Sousse). In Meknes 48.3% of the participants were female and the age ranged between 18 and 77 (median 47); in Sousse, 52.9% were female and the age ranged between 20 and 75 (median 41.5).

6.1.2.2 Experimental procedure

Our innovative protocol was developed building upon a protocol by Lange et al. (2002) and adopted by Bougherara et al. (2009) and Barlagne et al. (2015). Participants were asked to evaluate four different types of olive oil that differed by their origin and their health benefit, reflected by different pungency levels (themselves due to different polyphenol contents).

The different products and attributes are presented in Table 85 below for Morocco and Tunisia respectively. All the olive oils tested in each of the countries were produced within the country, and were preliminarily tested for being extra virgin (i.e., with no sensory defects) by the team that developed the experiment.

Table 85 Olive oil types as described per their attributes in Morocco and Tunisia

Morocco	Tunisia	Origin	Pungency
Volubilia	Newman's Own	local	high
Meissara	Ruspina	local	low
Ouad Ourika	Tesoro del Rio	national	high

El Mallalia	Safir	national	low

Data was recorded partly using the iMotions software, which tracks consumers' eye and facial movements and registered their WTP, and partly using Qualtrics to record participants answers to the questionnaires.

Participants were asked to evaluate the products at five stages according to Table 86 below. At each stage, the consumers were receiving additional information about the oils, or were given the opportunity to link together information pieces previously received separately.

Table 86. The different stages of the protocol: product conditions and information delivered to the participants

Stage 1: *Tasting*	Consumers do not see the bottles on the screen but only a X (for preparation) and then a O (for tasting). They taste and evaluate the oils from each bottle following the same sequence while looking at the computer screen.
Stage 2: *Bottles with combination of origin and polyphenol content*	Consumers see bottles on the screen with information about origin (local/national) and polyphenol contents (low/high). The bottles are not linked to the oils tasted in stage 1.
Stage 3: *Information about health benefits*	First, consumers see the following text on the screen: "*A pungent or bitter taste of olive oil indicates a higher content of polyphenols. Olive oil polyphenols are good for your health. Therefore, healthier olive oils are likely to be bitterer and more pungent.*" Then, they see bottles with information about origin and polyphenol content.
Stage 4: *Tasting, labels, and information about health benefits*	Consumers see bottles on the screen with information about origin and polyphenol content, and taste the oils at the same time. The oils being tasted correspond to the bottle displayed
Stage 5: *Disclosure of the brands*	Consumers see the real bottles on the screen.

At each stage of the evaluation process, participants' eye movement were recorded using a 19'' computer screen with the 60-Hz REDtracker. Participants were welcomed and placed in front of the tracker which recorded fixation duration and fixation counts amongst other variables. Emotions were also recorded using the web camera, and facial expression was analyzed using the Affectiva algorithm (facial expression analysis engine).

6.1.2.3 Modeling framework

To assess the performance of WTP models with and without biometric variables, we estimate the following empirical models:

1) For WTP: $WTP_{i,s,o} = \beta_0 + \beta_1 o_2 + \beta_2 o_3 + \beta_3 o_4 + \beta_4 s_2 + \beta_5 s_3 + \beta_6 s_4 + \beta_7 s_5 + \beta_8 o_2 s_2 + \beta_9 o_2 s_3 + \beta_{10} o_2 s_4 + \beta_{11} o_2 s_5 + \beta_{12} o_3 s_2 + \beta_{13} o_3 s_3 + \beta_{14} o_3 s_4 + \beta_{15} o_3 s_5 + \beta_{16} o_4 s_2 + \beta_{17} o_4 s_3 + \beta_{18} o_4 s_4 + \beta_{19} o_4 s_5 + \beta_{20} c + \beta_{21} t + \beta_{22} g_i + \beta_{23} a_i + \beta_{24} y_i + \alpha + \varepsilon$

2) For variation in the WTP: $\sigma_{WTP_{i,o}} = \beta_0 + \beta_e e_{i,s,o} + \beta_1 o_2 + \beta_2 o_3 + \beta_3 o_4 + \beta_{20} c + \beta_{21} t + \beta_{22} g_i + \beta_{23} a_i + \beta_{24} y + \alpha + \varepsilon$

where $WTP_{i,s,o}$ is the WTP of consumer i at stage s_j for olive oil o_j, and $\sigma_{WTP_{i,o}}$ the standard deviation of WTP for oil o_j and consumer i across stages. Therefore, o_j and s_j are binary variables indicating respectively the oil and the stage; c is a dummy indicating the computer (out of two used), and thus the room context; t is a vector of dummies indicating the order in which the oil was shown; g_i is i's gender, a_i is i's age; y is a vector of income levels; and α and ε are unobserved individual effects and an independently and identically distributed error term. Oil o_1 and stage s_1 are the baseline oil and stage.[7]

The above models do not include biometric variables. Overall, we recorded 17 biometric measures, of which 15 indicate emotions based on face response (anger, sadness, disgust, joy, surprise, fear, contempt, engagement, attention, sentimentality, confusion, positive, negative, and neutral), and two are based on eye-tracking (total fixation duration and fixation counts). For each of these variables, we have one value per olive oil and per stage (up to 20 per consumer). The emotions are expressed in terms of percentage of time in which the specific emotion was detected (out of the total duration of each stimulus: 6,000 milliseconds if not tasting, open-ended otherwise). Fixation duration is the share of time that the gaze stops on any area of interest, fixation count the times the gaze stops. Nine emotions (anger, sadness, disgust, joy, surprise, fear, contempt, sentimentality, and confusion) had a very skewed distribution (most consumers, oils and stages recorded zero value); therefore, they were turned into dummies. We used these biometric measures $e_{i,s,o}$ as additional explanatory variables: in a first specification, they are not interacted with other variables, thus the models become:

1) For WTP: $WTP_{i,s,o} = \beta_0 + \beta_1 o_2 + \beta_2 o_3 + \beta_3 o_4 + \beta_4 s_2 + \beta_5 s_3 + \beta_6 s_4 + \beta_7 s_5 + \beta_8 o_2 s_2 + \beta_9 o_2 s_3 + \beta_{10} o_2 s_4 + \beta_{11} o_2 s_5 + \beta_{12} o_3 s_2 + \beta_{13} o_3 s_3 + \beta_{14} o_3 s_4 + \beta_{15} o_3 s_5 + \beta_{16} o_4 s_2 + \beta_{17} o_4 s_3 + \beta_{18} o_4 s_4 + \beta_{19} o_4 s_5 + \beta_{20} c + \beta_{21} t + \beta_{22} g_i + \beta_{23} a_i + \beta_{24} y_i + \beta_{25} e_{i,s,o} + \alpha + \varepsilon$

2) For variation in the WTP: $\sigma_{WTP_{i,o}} = \beta_0 + \beta_e e_{i,s,o} + \beta_1 o_2 + \beta_2 o_3 + \beta_3 o_4 + \beta_{20} c + \beta_{21} t + \beta_{22} g_i + \beta_{23} a_i + \beta_{24} y + \beta_{25} e_{i,s,o} + \alpha + \varepsilon$.

In a second specification, we also included the interactions between $e_{i,s,o}$ and respectively each of the stage-oil interactions $o_j s_j$ (for WTP) or each of the oils o_j (for its standard deviation) – on top of the separate variables. Therefore, called β a vector of coefficients, the models become:

1) For WTP: $WTP_{i,s,o} = \beta_0 + \beta e_{i,s,o}*(o_2 + o_3 + o_4 + s_2 + s_3 + s_4 + s_5 + o_2 s_2 + o_2 s_3 + o_2 s_4 + o_2 s_5 + o_3 s_2 + o_3 s_3 + o_3 s_4 + o_3 s_5 + o_4 s_2 + o_4 s_3 + o_4 s_4 + o_4 s_5) + \beta_{20} c + \beta_{21} t + \beta_{22} g_i + \beta_{23} a_i + \beta_{24} y_i + \beta_{25} e_{i,s,o} + \alpha + \varepsilon$

2) For variation in the WTP: $\sigma_{WTP_{i,o}} = \beta_0 + \beta e_{i,s,o}*(o_2 + o_3 + o_4) + \beta_{20} c + \beta_{21} t + \beta_{22} g_i + \beta_{23} a_i + \beta_{24} y + \beta_{25} e_{i,s,o} + \alpha + \varepsilon$.

We estimated the models separately for Tunisia and Morocco. Since both the WTP and its standard deviation are censored at zero, we used a random-effect tobit model (Godfrey, 1964),

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[7] The same models could be expressed by replacing the oils with two binary variables for the attributes (origin and pungency) and their interactions; here, we use this specification because it is more parsimonious and we are not discussing the coefficients associated to the attributes.

which is estimated using maximum likelihood. The inclusion of socio-demographics and other control variables such as the computer reduced observed individual heterogeneity. Since no one in Morocco declared zero WTP, the models for Morocco are equivalent to OLS models. To assess the performance of the models, we report the Bayesian Information Criterion (BIC) (Schwarz, 1978) and the Akaike Information Criterion (AIC) (Findley and Parzen, 1995), which are based on the likelihood function and penalise models with more parameters. Lower values indicate preferable models.

6.1.3 Results and discussions

Table 87 and Table 88 report the coefficients associated with the biometric variables and the AIC and BIC for both the baseline model and the models with biometric variables integrated. It should be noted that the relative rather than the absolute size of the coefficients should be observed, since the WTP is expressed in the local currency, and 1 MAD is equal to around 0.30 TND. Second, the models for Tunisia have lower AIC and BIC values because they perform relatively better already in their baseline form compared to those for Morocco. Although not reported, in Tunisia the WTP in all the evaluation stages differ significantly compared to stage 1 (while only stage 5 stands out in Morocco); at least one oil brand attracts a significantly lower WTP ceteris paribus (none in Morocco); and some oils attract a significantly different WTP also in stages 2 and 5, while in Morocco this happens only in stages 3 and 4. In turn, in Morocco the control variables – computer, order of the oil, gender, and income – seem to matter more. However, discussing the results in terms of attribute coefficients is out of the scope of this article.

Our hypothesis H1 is only partially verified; indeed, some of the biometric variables, once included, improve the performance of the models, while others do not. As shown in Table 87, more variables have a positive impact in Morocco than in Tunisia – probably due to the poorer performance of the baseline model in the former. Fixation duration and fixation count significantly improve the performance of the models for both countries and both with and without interaction effects. Among the emotions, engagement, attention, positive, negative and neutral generate the most improvement (models with and without interactions in Morocco, only models with interactions in Tunisia). Some improvement according to the AIC but not the BIC is generated by anger and sadness (Tunisia, interactions), joy and disgust (Morocco, no interactions), fear (Tunisia, no interactions), sentimentality and confusion (Morocco, both). These results suggest that by accounting for how engaged and focalised people are on the task they are performing (as measured by engagement, attention and fixation parameters), we can derive more precise estimates of what drives WTP – regardless of the direction of the effect and the significance of the resulting coefficients. Those results are in line with Huseynov et al. (Huseynov et al., 2019) who compared a baseline model based on conventional data to an eye-tracking, an emotion and a brain model incorporating different types of biometric data in the context of a non-hypothetical purchasing task. The eye-tracking model outperformed the base model while the emotion and brain models were as good as the baseline. Moreover, mix models resulting from combinations of the three aforementioned models had higher predictive power than any of the individual ones.

Our hypothesis H2 is partially verified. Only in few cases the face responses and fixation variables generate statistically significant coefficients; nevertheless, their sign is mostly in line with our hypothesis: when no interactions are included, the fixation count is positively related to WTP in both countries, and the fixation duration in Morocco. This is coherent with Ballco et al. (2019), who find that the presence of nutritional claim (NC) increases fixation count which in turn is linked to an increased likelihood of affecting purchasing decision of NC labelled products. Joy, sentimentality, and positive face expression are positively related to WTP in at least one model; anger, sadness, and neutral face expression, negatively. Unexpectedly, confusion is positively related to WTP in both Moroccan models. While the coefficients associated to the oil brands, stages and control variables are not reported here, they are mostly in line with the baseline model: in no cases we observe a change in the direction of the coefficients which were significant in the baseline, the only changes referring to their relative size and to some of them becoming non-

significant – meaning that the variability is rather explained by the biometric variable or the interaction term. This latter dynamic deserves further attention. For example, in Tunisia the presence of sadness, disgust or fear is associated with significantly lower WTP for one low-polyphenol oil in stage 2 (when information about polyphenols is provided for the first time), the presence of joy with significantly higher WTP. This is in line with Ibanez and Roussel (2021) in the field of environmental valuation, who found that negative emotions significantly reduce average individual amount of donation made to environmental NGOs while the impact of positive emotions depended upon the characteristics of the informants in the context of an incentivized modified dictator game. Furthermore, the inclusion of interactions with attention, neutral and fixation count reduces the number of significant coefficients by a large amount while improving the performance of the model – suggesting that these elements attract much of the variability.

Finally, our hypothesis **H3 is also verified only in part**. As shown in Table 88, attention, engagement, fixation duration and fixation count, but also positive, improve the performance of all the four models explaining the standard deviation of WTP. Negative and neutral have a beneficial impact on three models; disgust, joy, fear, sentimentality, confusion – on two; sadness, surprise, contempt – on one. Overall, more models improve thanks to biometric variables than in Table 87. However, we have not enough evidence to sustain that these explain a significant share of the variability: in Tunisia the presence of sadness is related to lower variability; surprise and fixation count – to higher. In Morocco, disgust, joy, surprise and positive entail significantly less variability; sentimentality, confusion and (unexpectedly) attention – more. In the models without interaction terms, the sign, relative size, and level of significance of significant coefficients do not change, apart from Tunisia where gender (female) becomes a significant predictor of more variability in some instances. With interactions terms, the dynamics are more complex, but we observe that most of the variability in the WTP for pungent oils (which see more variation between stages due to the progressive introduction of new information) is mediated by biometric variables: disgust, surprise, fear, sentimentality, confusion, positive, fixation duration and fixation count are associated to more variability in at least one country, joy, attention and neutral – to less. This mediation effect is generally more pronounced in Morocco.

Table 87. Comparison of models for the willingness to pay

Biometric variable included	Country	Tunisia						Morocco					
	Model type	no interactions			interactions			no interactions			interactions		
	Parameters	coeff.	AIC	BIC	coeff.	AIC	BIC	coeff.	AIC	BIC	coeff.	AIC	BIC
baseline (no biometric v.)		n.a.	21858.28	22060.89	n.a.	21858.28	22060.89	n.a.	47612.31	47818.06	n.a.	47612.31	47818.06
anger		-0.459**	21875.65	22204.89	0.243	21854.08	22063.02	-1.475	47640.45	47974.79	3.382	47613.95	47826.13
sadness		-0.400***	21876.11	22205.35	-0.493	21852.68	22061.62	-0.643	47633.23	47967.57	6.034	47614.20	47826.38
disgust		0.010	21864.79	22194.03	0.654	21860.27	22069.22	0.605	47521.54	47855.88	2.217	47614.23	47826.41
joy		0.185	21870.24	22199.48	0.858*	21858.59	22067.53	2.362	47576.35	47910.70	9.588	47612.98	47825.16
surprise		-0.026	21872.35	22201.59	0.349	21860.26	22069.20	1.888	47641.11	47975.45	11.399	47613.79	47825.97

Biometric variable	coeff.	AIC	BIC	coeff.	AIC	BIC	coeff.	AIC	BIC	coeff.	AIC	BIC
fear	0.101	21857.80	22187.05	0.684	21859.97	22068.91	0.880	47647.26	47981.60	6.609	47614.23	47826.41
contempt	0.182	21878.70	22207.94	-0.118	21858.53	22067.47	-0.982	47639.24	47973.59	0.778	47613.99	47826.17
engagement	-0.001	21877.71	22206.93	0.006	21850.20	22059.13	0.020	47309.58	47643.53	-0.030	47282.49	47494.42
attention	-0.001	21880.14	22209.36	-0.010	21850.41	22059.34	-0.008	47288.91	47622.86	-0.090	47282.86	47494.79
sentimentality	-0.177	21870.76	22200.00	0.152	21858.86	22067.80	3.815*	47484.82	47819.17	4.260	47610.64	47822.82
confusion	-0.195	21876.39	22205.63	0.071	21858.60	22067.55	3.899**	47570.10	47904.45	10.898*	47610.37	47822.54
positive	-0.002	21867.66	22196.88	0.015	21850.35	22059.28	0.114*	47299.77	47633.71	-0.094	47279.07	47491.00
negative	-0.008	21881.26	22210.48	-0.006	21848.80	22057.73	-0.087	47311.76	47645.71	-0.277	47281.76	47493.68
neutral	0.005	21875.44	22204.66	-0.001	21849.20	22058.13	-0.086*	47250.07	47584.02	-0.038	47279.58	47491.51
fixation duration	0.139	18433.81	18753.49	-0.817	18413.87	18616.75	10.394**	40402.21	40727.37	12.826	40378.89	40585.24
fixation count	0.011*	18423.14	18742.83	-0.008	18411.20	18614.08	0.134*	40405.31	40730.47	0.031	40380.22	40586.56

Notes: The models performing better than the baseline are highlighted in green; Significance levels: *** 0.01; ** 0.05; * 0.10.

Table 88. Comparison of models for the standard deviation of the willingness to pay

Biometric variable included	Country	Tunisia						Morocco					
	Model type	no interactions			interactions			no interactions			interactions		
	Parameters	coeff.	AIC	BIC	coeff.	AIC	BIC	coeff.	AIC	BIC	coeff.	AIC	BIC
baseline (no biometric v.)		n.a.	14504.97	14606.30	n.a.	14504.97	14606.30	n.a.	41643.99	41746.93	n.a.	41643.99	41746.93
anger		-0.098	14508.98	14635.64	-0.127	14505.25	14612.92	0.594	41649.64	41778.31	2.233	41645.80	41755.18
sadness		0.117**	14507.85	14634.52	0.086	14502.84	14610.50	-0.558	41649.83	41778.51	0.195	41645.72	41755.10
disgust		0.004	14505.91	14632.57	-0.007	14506.97	14614.63	1.906	41595.24	41723.91	5.228**	41643.31	41752.68
joy		-0.077	14506.72	14633.39	0.045	14505.17	14612.83	1.831	41599.05	41727.73	-4.900**	41643.32	41752.70

surprise	0.068	14501.87	14628.54	-0.220*	14506.07	14613.73	-1.981	41644.98	41773.66	-5.556**	41644.11	41753.48
fear	0.108	14495.27	14621.94	-0.189	14504.85	14612.52	-0.962	41648.17	41776.85	0.190	41645.70	41755.07
contempt	0.023	14506.98	14633.64	0.022	14506.78	14614.45	1.305	41647.32	41776.00	1.311	41643.82	41753.20
engagement	-0.001	14504.77	14631.43	0.000	14500.83	14608.49	0.013	41361.84	41490.36	0.007	41358.71	41467.95
attention	0.002	14504.17	14630.83	0.002	14500.17	14607.82	-0.009	41317.59	41446.12	0.061*	41359.14	41468.39
sentimentality	-0.003	14510.99	14637.65	0.032	14506.97	14614.63	1.926*	41612.37	41741.04	-1.702	41642.66	41752.03
confusion	0.050	14510.76	14637.43	-0.059	14506.25	14613.92	1.738*	41635.23	41763.90	1.566	41643.23	41752.60
positive	-0.001	14501.41	14628.06	0.000	14501.30	14608.96	-0.001	41361.10	41489.63	-0.102*	41359.26	41468.50
negative	0.000	14505.44	14632.09	0.001	14501.61	14609.27	0.013	41363.83	41492.36	0.052	41359.18	41468.43
neutral	0.001	14505.03	14631.68	0.000	14501.47	14609.13	-0.022	41292.20	41420.72	0.097***	41358.56	41467.81
fixation duration	-0.058	12352.91	12475.89	-0.176	12358.95	12463.48	2.364	35518.28	35643.44	2.676	35514.54	35620.92
fixation count	0.001	12354.19	12477.17	-0.009**	12358.91	12463.44	0.021	35519.27	35644.43	0.015	35515.34	35621.72

Notes: The models performing better than the baseline are highlighted in green; Significance levels: *** 0.01; ** 0.05; * 0.10.

6.1.4 Conclusions

6.1.4.1 Conclusions on the Research question

Recent advances in the field of experimental economics have witnessed the inclusion of biometric data to account for unconscious factors in consumers' decision-making processes. We have introduced a novel protocol that combines an auction-based laboratory experiment and eye-tracking and have used it to understand consumers' valuation of olive oil in Tunisia and Morocco. We have compared a baseline model of consumers' WTP for olive oil that incorporates conventional data with mixed models incorporating biometric data such as fixation and emotions. We find that **incorporating biometric variables into econometric models partially improves their performances**. In particular, **attention, engagement, fixation duration and fixation count as the most successful predictors of WTP and its variation**. Our results highlight the interest of including biometric data in econometric models to better understand the role of unconscious factors in consumers' decision-making process. Further research and models specifications are needed given the richness of biometric data collected.

6.1.4.2 Recommendations for the project FoodLAND

From a policy perspective as well as from the FOODLAND project perspective those results highlight the **importance of implementing targeted communication, i.e. on the basis of a good knowledge of consumers' behaviour, developing and tailoring information to the**

characteristics and interest of the consumers. Information has to be attractive, clear, easy to understand and meaningful to the consumers. In addition, our results have shown that emotional engagement with the message being displayed has an influence on consumers' choices, therefore, finding the right emotional triggers for consumers to engage with and consider novel nutritious food is a key lever to improve food and nutrition security.

6.1.5 References

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6.2 How does health-related information impact willingness to pay for olive oil? Insights from an incentivised lab experiment among Moroccan and Tunisian consumers

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6.2.1 Introduction

Olives, and thus olive oil, are a key agri-food products in Southern Mediterranean countries, including the FoodLAND countries of Tunisia and Morocco. Table 89 shows that almost all the farmers in the Chebika (Tunisia) and Beni Mellal (Morocco) Food Hubs, and significant numbers in Meknes (Morocco) and Jendouba (Tunisia) grow olives. The average value of olive production is almost or over 10,000 $PPP in three Food Hubs, and a significant share of this product is sold (over 80% in Chebika). Except for Meknes, where vegetables play an important role too, olives represent on average over 70% of the value of farm production, and over two thirds of the value of farm sales. Hence, they contribute significantly to the livelihoods of local farmers, and olive oil is a relevant product in the local diets.

Table 89. Importance of olive production in the FoodLAND Food Hubs of Tunisia and Morocco.

Food Hubs	Growers (%)	Area (ha)	Product (kg)	Sales (kg)	Production ($PPP)	Share sold (%)[1]	Share of prod. (%)[2]	Share of sales (%)[3]
Beni Mellal	88.8	2.61	5,397.13	4,230.47	9,908.30	65.6%	76.4%	66.5%
Chebika	86.1	3.80	9,140.31	8,455.26	12,981.74	80.2%	73.4%	73.7%
Jendouba	4.8	0.61	575.83	354.17	1,405.00	41.5%	86.1%	68.8%
Meknes	14.0	1.51	4,704.14	3,172.86	10,621.06	49.0%	31.4%	33.0%

Notes: All the values are averages among producers. [1] Share of produced quantity that is sold. [2] Olives as a share of the value of total farm production. [3] Olives and a share of the value of total farm sales.

Nevertheless, discussion among FoodLAND partners highlighted a need to improve the quality of local olive oil production, and to increase consumers' awareness of what characterises a good-quality olive oil. Moreover, in Tunisia there is a need to stimulate olive oil consumption, since in the past this product has been targeted for export, and has thus been replaced by lower quality seed oils in the national diet. The objective of the FoodLAND project is to promote more nutritious, healthier and more diverse diets among urban consumers in Africa by linking them with local producing regions. Hence, addressing the above challenges is in line with the project's goals. Increased understanding of consumers' preferences can help local producers improve their product, and market it more effectively; in parallel, increased awareness can help consumers make more informed choices.

Given the above premises, we **analyse consumers' preferences for different attributes of olive oils, and the impact of labelling and provision of information on these preferences**. Product labelling is one way to signal the characteristics of a product to consumers, in particular when there is a mismatch between consumers' sensory perception of a product and its quality. Indeed, olive oil appreciation faces a challenge: healthier olive oils contain a higher quantity of polyphenols which results in a bitterer taste and more pungent mouthfeel sensation. Based on the extant literature, which focuses mostly on the Global North, bitter and pungent are disliked by

most consumers (Barbieri et al., 2015; Vitaglione et al., 2015; Delgado and Guinard, 2011). While we would expect consumers to prefer healthier products *ceteris paribus* (Ran et al., 2017), differently from sensory attributes healthiness is not communicated by the product itself. Therefore, if consumers' choices are based exclusively on sensory characteristics (in the absence of a label), they tend to prefer sweet oils, and miss the opportunity to consume healthier oils.[8] Finally, besides taste and healthiness, there is literature and anecdotal evidence that national, and local origin ('*terroir*') are assessed positively by consumers (Dekhili et al., 2011).

To make purchase decisions, consumers utilise quality cues about the product, such as its grade, safety, origin and price. However, recent advances in behavioural and experimental economics have deviated from the understanding of consumers' decisions as simply explained by rationality and utility maximisation (Huseynov et al., 2019). For instance, psychological and neurophysiological studies have highlighted the role of both conscious and unconscious factors. The former can be approached through the attributes of the products being evaluated, or consumers' socio-demographic characteristics. Attributes of the product are communicated to consumers through visual cues (such as labels, packaging). Unconscious factors, on the other hand, are revealed through emotions, and recorded thanks to technologies such as eye-tracking or facial recognition to generate biometric data. Eye-tracking is an increasingly popular tool for understanding underlying behaviours guiding economic decisions (Chen et al., 2015).

Although stated preferences are very useful to explore consumers' decision-making processes in a range of situations, including hypothetical ones, their findings are limited to participants' statements, which may be subject to hypothetical and social desirability biases. Rather than relying on stated preferences, we elicit consumers' real preferences through an experimental auction. The value added of revealed preference methods is that the preferences measured are a better proxy of what would happen in real life situations (Levitt and List, 2007; Lusk and Fox, 2003). Moreover, we complement auction data with biometric variables detected using an eye-tracker. Economic experiments and eye-tracking are easily compatible approaches as eye-tracking does not modify the decision-making process of experimental participants (Kee et al., 2021). A more detailed description of our protocol is provided in the next section of this article.

As a proxy of consumers' preferences, we use their Willingness To Pay (WTP), i.e., a form of valuation related to perception which represents the maximum amount of money they would pay for a product described by a given set of attributes. The extant literature shows that consumers are willing to pay for different nutritional standards (Ran et al., 2017) as well as for the origin of a product (Barlagne et al., 2015). There is some evidence that in Tunisia the region of origin of olive oil does not matter for consumers (Mtimet et al., 2013). However, in the following we assume that the impact of local origin is in line with the bulk of literature, which supports the opposite. Indeed, not only the above study applies stated preference methods but also evaluates extra virgin, virgin and pomace oils jointly, while we consider them to be different products which cannot be compared directly. We only focus on 'extra virgin' olive oil (the best quality product), also checking consumers' awareness of its difference with 'virgin' olive oil.

Given the discrepancy between consumers' preferences for the sensory characteristics of olive oil and its actual health benefits, we focus our experiment and this article on how labelling about origin, polyphenol content and related health benefits impacts their WTP. In particular, we formulate the following hypotheses.

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[8] This discrepancy between consumers' sensory appreciation of olive oil and its actual health benefits makes the polyphenol content more interesting to test than, for example, the content of saturated fats, on which there is more widespread awareness of the negative relationship with health and no direct linkage with taste.

H1: Consumers dislike pungent/bitter olive oil, and have lower WTP for it before being informed about its polyphenol content and related health benefits.

H2: Introducing labels about origin increases consumers' WTP for local olive oils relative to national oils (**H2a**), while a label about polyphenol content has no significant impact on consumers' WTP (**H2b**).

H3: Providing additional textual information about the relationship between polyphenol content, pungent/bitter and related health benefits increases consumers' WTP for pungent olive oils relative to non-pungent ones.

H4: The increase in WTP for high-polyphenol oils relative to low-polyphenol ones persists even if consumers face the bitter taste / pungent sensation, but the gap in WTP becomes smaller.

To validate our hypotheses, we test statistically the difference in WTP across olive oil profiles and consumers' characteristics (awareness of health benefits and preferences for bitter/pungent), and we estimate random-effect tobit models. The rest of the article is structured as follows. The next section illustrates our experimental protocol. Then, we describe the data collection procedure, the theoretical model, and the estimation strategy. Afterwards, we present and discuss the results. The last section concludes, and derives implications relevant for the FoodLAND project.

6.2.2 Methodology
6.2.2.1 Experimental procedure

To test our hypotheses, we apply a novel protocol that builds upon the approach by Lange et al. (2002), as adopted by Barlagne et al. (2015) and Bougherara and Combis (2009). The protocol combines an auction mechanism known as 'Becker–DeGroot–Marschak (BDM) procedure' (Becker and DeGroot, 1974) with the measurement of biometric data using an eye-tracker (Clement et al., 2013; Clement, 2007) in a laboratory experiment. In the BDM procedure, participants are asked to evaluate different product profiles along multiple stages, and to state their WTP for each of them at each stage. At each stage, new information is disclosed, with the aim of testing its impact on WTP. To avoid the hypothetical bias, an auction is implemented at the end of the procedure: a product profile, a stage and a price are extracted, and if the WTP of the consumer for the extracted product is equal or greater than the extracted price, they have to purchase that product at the extracted price using part of their show-up fee; otherwise, they are paid the full fee. In our experiment, the consumers were asked to evaluate four brands of extra virgin olive oil along five stages. To ensure that the evaluations at each single stage were independent, the order of the oils was changed at each stage; to prevent order effects, four different randomisation plans were created, and repeated in subsequent days until achieving the required sample size. We deviated from the standard protocol inasmuch the oil sold each day was predefined. However, it was not revealed to the consumer until the end of the process: the preselection was done for logistical reasons. The WTP was recorded in the local currency, and for one litre of olive oil. The price was extracted by the computer, and was never higher than the show-up fees. During this whole procedure, and particularly during the five evaluation stages, the consumers were eye-tracked, and their facial movements were recorded. However, in this article we only focus on WTP values as well as on consumers' characteristics and oil brands' attributes, discussing biometric variables only marginally.

Two binary attributes were selected to characterise the olive oils in order to allow a full factorial design with only four oils: **(a)** origin (local *vs* non-local); **(b)** polyphenol content (low *vs* high). 'Local' was defined as coming from the region where the experiment would be implemented; 'non-local,' as coming from the country in general rather than from another region which could be associated to region-specific perceptions. Polyphenol content is relevant because of its

collinearity with **(c)** pungent/bitter (oils with high polyphenol content are more pungent/bitter), and with **(d)** healthiness (high-polyphenol oils are healthier). According to our hypotheses, these attributes are likely to impact WTP in opposite directions. By releasing additional information at different stages, we can test which of these collinear elements affects consumers' preferences more.

All the olive oils tested in each of the countries were produced within that country. Local researchers selected a preliminary list of ten olive oils which were tested for being extra virgin (i.e., with no sensory defects) and for bitter taste / pungent mouthfeel sensation by the Professional Committee for the Sensory Analysis of Virgin Olive Oils of the Department of Agricultural and Food Sciences of the University of Bologna, recognized by the Italian Ministry of Agriculture in 2006. The Committee also selected the four oils per country to be used in the experiment.

The extra virgin olive oils selected for Tunisia and Morocco and their attributes, are presented in Table 90. According to the EU indication (Commission delegated regulation (EU) 2022/2104 of 29 July 2022), positive attributes (fruity, bitter, and pungent) can be characterised according to the intensity of perception as 'robust', 'medium', or 'delicate'. Based on the panel's assessment, our oils were either 'delicate' – which we described as 'low' polyphenol content – or 'medium' – described as 'high content.'

Table 90. Olive oils selected for the experiments in Tunisia and Morocco, and their characteristics.

Tunisian oils	Moroccan oils	Origin	Polyphenol content	Profile (symbol)
Safir	El Mallalia	national	low	Nat. & Low oil (o_1)
Tesoro del Rio	Ouad Ourika	national	high	Nat. & High oil (o_2)
Ruspina	Meissara	local	low	Loc. & Low oil (o_3)
Newman's Own	Volubilia	local	high	Loc. & High oil (o_4)

Consumers were asked to evaluate the oils along the stages described in Table 86 below. At each stage, they received additional information about the oils, or were given the opportunity to link together information pieces previously received separately, e.g., sensory characteristics and healthiness. The full process was implemented with consumers looking at the screen of a computer linked to an eye-tracker.

Table 91. Stages of the protocol: product conditions and information delivered to the participants.

Stage	Description of the stage
Stage 1: Tasting	Consumers do not see bottles on the screen. They taste and evaluate each oil in turn.
Stage 2: Bottles with combination of origin and polyphenol content	Consumers see bottles on the screen with information about origin (local/national) and polyphenol content (low/high). The bottles are not linked to the oils tasted at stage 1.
Stage 3: Information about health benefits	First, consumers see the following text on the screen: '*A pungent or bitter taste of olive oil indicates a higher content of polyphenols. Olive oil polyphenols are good for your health. Therefore, healthier olive oils are likely to be bitterer and more pungent.*'[9]

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[9] The EU health claim usually reported on olive oil bottles reads: '*Olive oil polyphenols. Olive oil polyphenols contribute to the protection of blood lipids from oxidative stress. Health relationship: protection of LDL particles from oxidative*

	Then, they see bottles with information about origin and polyphenol content.
Stage 4: Tasting, bottles, and information about health benefits	Consumers see bottles with information about origin and polyphenol content, and taste the oils at the same time. The oils tasted correspond to the bottle shown.
Stage 5: Disclosure of the brands	Consumers see the real bottles on the screen.

The WTP declared by the consumers at each stage and the difference between stages would allow to test our hypotheses. For example, if **H1** is true, we should observe lower WTP for bitter/pungent olive oils at stage 1. **H2** can be tested by looking at stage 2 and at the differences with previous WTP values. Health-related information is introduced at stage 3, thus allowing the testing of **H3**. Finally, bitter taste and pungent sensation are linked explicitly with the rest of information at stage 4, allowing to test **H4**. Stage 5 was added to assess the impact of brands regardless of other information, and is not discussed in this article.

6.2.2.2 Data collection, empirical model and estimation strategy

We recruited samples of urban consumers in the cities of Meknes (Morocco) and Sousse (Tunisia). The samples are representative of the cities' populations in terms of age groups and gender. The respondents were filtered according to four criteria: having no allergy to olive oil, consuming olive oil regularly, being involved in grocery shopping at least from time to time, and knowing the price of one litre of olive oil with good approximation.

Data were recorded partly using the iMotions software, which tracked consumers' facial and eye movements and registered their WTP, and partly in Qualtrics, which recorded their responses to two questionnaires: one for the initial explanation of the auction, and one for collecting socio-demographic and other variables and implementing the auction. The experiment took place in September 2022 in Meknes, and in October-November 2022 in Sousse. Testing one consumer took up to 30 minutes including the questionnaires and the tasting of the oils; two consumers were tested at a time, in different rooms.

The final sample sizes are 230 in Meknes and 208 in Sousse, resulting in 4,600 and 4,160 observations across all the oils and stages, respectively. The WTP for each olive oil at each stage, $WTP_{i,s,o}$, was collected in local currency. However, to facilitate comparison between countries, before analysing the results, the values were converted in $PPP using the most recent available exchange rate (2021).

As a first step, we use the results of the survey to discuss consumers' purchasing habits, knowledge of health and other issues, and stated preferences for olive oil. We use *t*-tests to assess when the differences are statistically significant. As a second step, we test the difference in WTP across rounds of the protocol, polyphenol content, declared appreciation for pungent/bitter olive oil, declared knowledge of the relationship between pungent/bitter and healthiness, and combination of these variables. As a third and last step, we estimate WTP models whose empirical form is described in the following.

To account for the consumers' prior expectations, we present models for both absolute ($WTP_{i,s,o}$) and relative WTP ($rWTP_{i,s,o}$), obtained dividing $WTP_{i,s,o}$ by the price usually paid by consumer i for one litre of olive oil, declared during recruitment phase. Finally, we exclude from the analysis the values relative to the consumers who stated to be 'extremely uncertain' of the WTP declared (17 in Tunisia and 11 in Morocco) as well as three WTP values which represent outliers, visually identified (one in Tunisia, and two in Morocco). Before estimating our models, we also exclude the WTP values at stage 5, when the consumers were shown the actual bottles of the oils. The reason is that all the information had been already disclosed by stage 4, and the images were not

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damage.' The research team opted for a more concise, layperson's message that was linking polyphenol content, taste and healthiness.

large enough for consumers to detect information about origin, polyphenol content and health benefits and link to their previous assessments; therefore, this stage cannot be considered as providing additional information about the same oils, but presents a logical gap. Still, the data collected at this stage provide valuable insights into the impact on WTP of a full label and of bottle shapes.

We estimate two model typologies: (1) with the four olive oil profiles (brands) as explanatory variables; (2) with the profiles replaced by two binary variables for the attributes (origin and pungency) and their interactions. These models are mathematically equivalent but allow to make different considerations; the model with the olive oil profiles is slightly more parsimonious. Their empirical form is:

$$
\begin{aligned}
\mathrm{WTP}_{i,s,o} = {} & \beta_0 + \beta_1 o_2 + \beta_2 o_3 + \beta_3 o_4 + \beta_4 s_2 + \beta_5 s_3 + \beta_6 s_4 + \beta_7 o_2 s_2 + \beta_8 o_2 s_3 + \beta_9 o_2 s_4 + \beta_{10} o_3 s_2 \\
& + \beta_{11} o_3 s_3 + \beta_{12} o_3 s_4 + \beta_{13} o_4 s_2 + \beta_{14} o_4 s_3 + \beta_{15} o_4 s_4 + \beta_{27} c + \beta_{28} t + \beta_{29} g_i \\
& + \beta_{30} a_i + \beta_{31} y_i + \alpha + \varepsilon
\end{aligned} \quad (1)
$$

$$
\begin{aligned}
\mathrm{WTP}_{i,s,o} = {} & \beta_0 + \beta_4 s_2 + \beta_5 s_3 + \beta_6 s_4 + \beta_8 r_1 + \beta_{16} r_1 s_2 + \beta_{17} r_1 s_3 + \beta_{18} r_1 s_4 + \beta_{19} p_1 + \beta_{20} p_1 s_2 \\
& + \beta_{21} p_1 s_3 + \beta_{22} p_1 s_4 + \beta_{23} p_1 r_1 + \beta_{24} p_1 r_1 s_2 + \beta_{25} p_1 r_1 s_3 + \beta_{26} p_1 r_1 s_4 + \beta_{27} c \\
& + \beta_{28} t + \beta_{29} g_i + \beta_{30} a_i + \beta_{31} y_i + \alpha + \varepsilon
\end{aligned} \quad (2)
$$

The same models are estimated with $\mathrm{rWTP}_{i,s,o}$ as dependent variable. $\mathrm{WTP}_{i,s,o}$ is the WTP of consumer i at stage s_k for olive oil o_j. Therefore, o_k and s_j are binary variables indicating respectively the oil and the stage; r is a binary variable for the origin (local or national); p, a binary variable for the polyphenol content (low or high). Concerning the control variables, c is a dummy indicating the computer (out of two) and thus the 'room context'; t is a vector of dummies indicating the order in which each oil was shown; g_i is i's gender, a_i is i's age; y is a vector of income levels; and α and ε are unobserved individual effects and an independently and identically distributed error term, respectively. Oil o_1 and stage s_1 are the baseline oil and stage. The baseline attribute levels are national origin, r_0, and low polyphenol content, p_0. β's are the models' coefficients, or vectors of coefficients: where the same subscript is used, they correspond between the two specifications.

The models (1) and (2) do not include biometric variables. Overall, we recorded 17 biometric measures, of which 15 indicate emotions based on face response, and two are based on eye-tracking (total fixation duration and fixation counts). For each of these variables, we have one value per olive oil and per stage (up to 20 per consumer). The emotions are expressed in terms of percentage of time when the specific emotion was detected (out of the total duration of each stimulus). We do not include biometric variables in the current models; however, we test if the presence of 'disgust' as an emotion varies depending on high or low level of polyphenol content. Future model developments could include the identification of latent classes of emotions to assess if they are related to different decision-making patterns.

We estimate the models separately for Tunisia and Morocco. Since the WTP is censored at zero, we use random-effect tobit models (Goldberger, 1964), which are estimated using maximum likelihood. Since no one in Morocco declared zero WTP (compared to one zero in Tunisia), the models for Morocco are equivalent to OLS models. The relative WTP is a continuous non-censored variable; therefore, it is estimated using OLS. To account for correlation between the observations for the same consumers across rounds and oils, we cluster the standard errors at the level of individuals. Moreover, inclusion of socio-demographics and other control variables, such as the computer, reduces observed individual heterogeneity. To assess the performance of the models, we report the Bayesian Information Criterion (BIC; Schwarz, 1978) and the Akaike Information Criterion (AIC; Findley and Parzen, 1998), which penalise models with more parameters: lower values indicate preferable models.

6.2.3 Results and discussions

In Meknes 48.3% of the participants were female and the age ranged from 18 to 77 years (median 47); in Sousse, 52.9% were female and the age ranged from 20 to 75 (median 41.5). A large majority of the respondents consume olive oil every day (78.4% in Tunisia and 70.4% in Morocco), or more than once per week (15.9% and 23.5%). However, the frequency of purchase differs, since in Tunisia 49.0% purchase it once a year (during the production season) and 38.0% a few times per week, while in Morocco 80.4% purchase it once a year. The form in which the oil is purchased is similar: 84.6% of the Tunisians and 81.3% of the Moroccans rely exclusively on bulk oil, and only 4.8% and 6.1% exclusively on bottled oil. This is one more reason we exclude data from stage 5 of the protocol from our WTP models: consumers are not used to purchase olive oil in bottle, and thus to assess its value, while the elements at stages 1-4, including the 'generic' bottles used as stimuli, can be easily associated to the bulk purchase of one litre of olive oil. It is also worth mentioning that almost two thirds of the Tunisians (65.9%) and 38.7% of the Moroccans produce their own oil, and around three fourths in either countries (75.0% in Tunisia and 72.6% in Morocco) receive oil from friends or relatives. Hence, over 90% of the Tunisians and more than 82% of the Moroccans can rely on at least one of these supply sources.

The oils were tested by a professional Committee for the sensory analysis of virgin olive oils, to ensure that they could all be classified as 'extra virgin.' Meanwhile, respondents were asked if they knew the difference between 'virgin' and 'extra virgin' olive oil: 44.2% in Tunisia and 53.9% in Morocco answered that they did, but when they were subsequently asked to indicate the difference, only 14.4% and 41.3% selected the right one. This is a large gap between countries, and points to the importance of providing more information for consumers.

Two other questions relevant with respect to our research hypotheses concern consumers' stated preferences for pungent/bitter olive oil, and whether they were aware of the relationship between pungent and healthiness before the auction. Partly opposite to **H1**, only 11.1% in Tunisia and 17.0% in Morocco answered that they prefer their oils to be not pungent/bitter at all; 47.6% and 49.1% liked them slightly pungent/bitter; 39.9% and 32.6% bitter/pungent or very bitter/pungent. Also, 79.3% of the consumers in Tunisia and 83.0% in Morocco declared that they were aware of the relationship between pungency and healthiness before the auction. A Chi-squared test suggests that there is no significant correlation between these two variables in Tunisia (p 0.208), while monodirectional t-tests implemented after excluding consumers unsure of their preferences for pungent/bitter suggests a marginally higher preference among those knowing the relationship (p 0.060). In turn, this correlation is strongly significant in Morocco (p 0.000 with both tests). We also find that 'disgust' (assessed via facial response) is not significantly higher when consumers are confronted with pungent olive oils (p 0.455 in a monodirectional t-test in Morocco, p 0.110 in Tunisia). A marginally significant difference is detected for Tunisia if comparing the facial reactions exclusively at stage 4, when the oils were tasted (p 0.064). However, it must be noted that, across all the stimuli, disgust is only detected for 0.4% of the time duration on average.

Besides pungent/bitter, we asked the consumers to rate the importance of a number of attributes for their appreciation of olive oil. The results, reported in Table 92, show that the ranking is similar in both countries with some exceptions, but the values differ significantly for all the attributes, being generally higher for Morocco, with only 'trust for the producer' obtaining a similar average score. Taste, related to the sensory attribute assessed at stages 1 and 4 of the experiment, is deemed the most important element in both countries; trust for the producer is the second one in Tunisia and the third in Morocco, where packaging occupies the second position. The price is ranked fourth in both countries, being preceded by the colour of the oil in Tunisia, and followed by it in Morocco. Advertisement and other consumers' choices are among the *least* important elements in both countries, like proximity to the production area, which seems to contradict our

H2b. To confirm this consideration, origin is the fourth least important attribute in Tunisia, and the sixth least important in Morocco.

Table 92. Importance of different elements for consumers' appreciation of olive oil.

Country	Tunisia	Morocco	p-value
Taste	4.67	4.80	0.011
Trust	4.48	4.42	0.419
Colour	4.24	4.38	0.066
Price	4.22	4.41	0.018
Own milling	4.00	4.32	0.002
Olives	3.95	4.28	0.002
Seller	3.93	3.49	0.000
Labels	3.84	3.18	0.000
Packaging	3.83	4.49	0.000
Fluidity	3.75	4.30	0.000
Origin	3.68	3.97	0.005
Proximity	3.36	3.57	0.045
What others do	3.05	3.37	0.004
Advertisement	2.81	2.30	0.000

Notes: Importance assessed on a scale from 1 = 'not important at all' to 5 = 'very important'. The *p*-values refer to a bidirectional *t*-test.

We now discuss WTP results considering \$PPP values. It is worth mentioning that the fact of purchasing olive oil in bulk is unlikely to bias consumers' choices: their WTP does not differ significantly depending on the way they purchase olive oil (p 0.245 in Tunisia and p 0.546 in Morocco). On average, those who purchase their oil in bulk declare higher WTP than those purchasing it in bottle; but those purchasing both, declare the highest WTP on average in both countries. Based on the BIC and AIC, the models for Tunisia present a better goodness-of-fit than those for Morocco. Those for relative WTP show a better goodness-of-fit than those for absolute WTP, although no significant differences in the signs and relative sizes of the coefficients are recorded. The models (1) in Table 87 and (2) in Table 88 are mathematically equivalent, therefore their AIC and BIC values do not change.

We have already highlighted, based on stated preferences, that our **H1** is **not verified**: consumers seem to prefer pungent olive oils in both countries. WTP figures confirm this finding: the averages across all stages are 13.98 \$PPP for non-pungent oils and 15.55 \$PPP for pungent ones in Tunisia, and 24.78 \$PPP and 27.59 \$PPP in Morocco. This pattern is still true if we consider the WTP difference among the consumers who declare not to like pungent/bitter oil (or to like it only slightly pungent/bitter) as well as if considering only those who did not know the relationship between this sensory attribute and health. The models presented in Table 87 suggest that *ceteris paribus* the oil with local origin and low polyphenol content attracts significantly lower WTP compared to the low and local baseline in Tunisia, but the high pungency ones do not differ significantly from the baseline. In Morocco instead, only the oil with local origin and high-

polyphenol content attracts a significantly higher WTP. Table 88, where the attributes are included as explanatory variables, shows that high-polyphenol content has no significant impact *ceteris paribus*; however, it has a significant positive impact when interacted with the stage (i.e., compared to stage 1 as a baseline) in both countries, and also when interacted with 'local' in Tunisia.

To test our **H2**, we need to look at stage-specific values of the WTP. Indeed, the labels about polyphenol content and origin are introduced at stage 2. The estimates in Table 87 suggest that at stage 2, compared to stage 1, WTP increases significantly for all the oils in Tunisia, but only for the non-local oil with high polyphenol content in Morocco. In Table 88, we observe a significant and negative impact of local origin across all the stages, and a significantly positive impact at stage 2 in Tunisia, but no significant impacts in Morocco. Further *t*-tests reported in Appendix suggest that WTP increases significantly for both non-local and local olive oils in Tunisia and for none of them in Morocco, but the difference in WTP between the local and non-local oils remains non-significant at both stages for both countries. Hence, our **H2a** is **not verified**: local origin does not attract higher WTP. Our results confirm what found by Mtimet et al. (2013) for Tunisia using stated preferences methods. Further, in Morocco at stage 2 we observe a significantly higher WTP for the *non-local* oil with high-polyphenol content (this is the case for all the oils in Tunisia).

In Table 88, high polyphenols alone has no significant impact in either countries *ceteris paribus*, but the WTP registers a positive and significant increase at stage 2 for the oils with high-polyphenol content in both countries. Further *t*-tests (reported in the Appendix) show that between stage 1 and stage 2, the WTP for oils with low polyphenol content increases significantly for Tunisia but not for Morocco. And for oils with high polyphenol content, the increase is significant in both countries. Interestingly, for the consumers *not aware* of the linkage with health, WTP increases significantly regardless of polyphenol content (although the increase is larger for oils with high-polyphenol content in Morocco and for those with low-polyphenol content in Tunisia). Among *aware* consumers, we observe a marginally significant decrease in the WTP for low-polyphenol oils in Morocco, and a significant increase in the WTP for high-polyphenol oils in Tunisia. All these results suggest that **H2b** is **not verified** either: introducing a label about 'polyphenol content' affects WTP positively in most instances. The reason is not clear, especially for consumers unaware of the linkage with healthiness, while for aware ones the label may have increased the saliency – a bitter taste perceived at stage 1 could not be enough for this purpose.

To test **H3**, we focus on the difference in WTP between stages 2 and 3, when consumers were provided information about the linkage between polyphenols and health. The estimates in Table 87 show that, at stage 3, the WTP for all the olive oils in Tunisia, and for high-polyphenol (healthy) olive oils in Morocco increases significantly compared to the baseline (stage 1 and low polyphenol oil). This increase is much larger than at other stages. This is confirmed by the models in Table 88, where the interaction between stage 3 and high-polyphenol content generates the largest positive coefficient in Tunisia and the second largest in Morocco, where the impact seems to persist and even increase at stage 4. The additional *t*-tests reported in the Appendix reveal a significant decrease in the WTP for low polyphenol oils in both countries, and a significant and larger increase in the WTP for high-polyphenol oils. If we split the consumers based on their declared knowledge of the linkage between pungency and health benefits, we observe, as expected, that the increase in WTP for high-polyphenol oils is larger for previously unaware consumers: 1.7 times in Tunisia and 2.4 times in Morocco. In turn, the decrease in WTP for low-polyphenol oils is non-significant in the case of previously unaware consumers in Morocco, and similar regardless of awareness in Tunisia. The (positive) difference in WTP between high and low-polyphenol oils increases from around 1 \$PPP to more than 3 \$PPP in Tunisia, and from less than 2 \$PPP to more than 5 \$PPP in Morocco. Hence, our **H3 finds strong support**: providing

information about healthiness increases WTP for pungent olive oils, and the impact is particularly strong among previously unaware consumers.

Finally, we test our **H4** by focusing on the difference in WTP between stages 3 and 4, when consumers tasted again the oils and were provided information on the attributes at the same time. Table 87 shows that all the oils in Tunisia, and the pungent ones in Morocco, register an increase in WTP compared to the baseline of stage 1. In Tunisia, the size of the coefficients is smaller compared to stage 3, suggesting that there is a decrease, while in Morocco the WTP for pungent olive oils increases further. Such patterns are confirmed by the coefficients associated to the interaction between stage 4 and high-polyphenol content in Table 88: they are positive and significant, but smaller than for stage 3 in Tunisia, and slightly larger in Morocco. In Tunisia even the interaction between stage 4 and local origin yields a significant and positive coefficient, smaller than for stage 3. The additional *t*-tests in Appendix show that the WTP for non-pungent olive oils increases significantly between stage 3 and 4 in both countries, but the WTP for the pungent oils decreases significantly (although to a lesser extent) in Tunisia and does not change significantly in Morocco – this is the outcome of a further increase among previously aware people, and a decrease among the others. Overall, the difference in favour of pungent olive oils shrinks from more than 3 $PPP to around 2.50 $PPP in Tunisia, and from more to less than 5 $PPP in Morocco: this is still much larger than before providing the health-related information. Hence, **H4 is confirmed**: the impact of the information persists, despite a slight rebound effect.

Beside our hypotheses, the models in Table 87 and Table 88 reveal interesting, often country-specific patterns concerning the control variables. First, in neither country the age of the consumers is significantly related to their WTP for olive oil, while in Morocco (not in Tunisia) female consumers are willing to pay much more than male consumers (+8.74 $PPP on average). Income also matters: in Tunisia, the better off the household, the *lower* the WTP of the consumer; instead, in Morocco, mid-low income consumers – but not other income groups – show a marginally higher WTP *ceteris paribus*. Such results suggest that bottled oils may be perceived as a 'positional good' by poorer consumers, who declared a higher WTP. If relative WTP is considered, all the income groups declared higher WTP compared to low-income households, and the differences between groups are smaller than for absolute WTP. Finally, the coefficients for the order in which the oils were presented to the consumers reveal a significant progressive increase, with the fourth oil attracting the highest WTP. This result confirms the importance of changing the order each day. In Morocco we also detect a significant computer (room) effect.

Table 93. Models for WTP in Morocco and Tunisia, using the oil profiles as explanatory variables.

Variables	Tunisia		Morocco	
	WTP	Relative WTP	WTP	Relative WTP
Stage 2	0.374	0.032	-0.484	-0.037
Stage 3	-0.538*	-0.033*	-0.248	-0.012
Stage 4	0.226	0.023	0.599	0.063
Nat. & High oil	-0.068	-0.003	0.134	0.021
Loc. & Low oil	-1.163***	-0.074***	0.807	0.076
Loc. & High oil	0.309	0.026	1.599**	0.135**
Stage 2 # Nat. & High oil	0.986**	0.072**	2.395***	0.191***
Stage 2 # Loc. & Low oil	1.191***	0.077***	0.126	0.003
Stage 2 # Loc. & High oil	0.938***	0.068***	0.555	0.042
Stage 3 # Nat. & High oil	3.415***	0.245***	4.843***	0.358***
Stage 3 # Loc. & Low oil	1.517***	0.102***	-1.096	-0.101*
Stage 3 # Loc. & High oil	3.440***	0.251***	3.150***	0.233***
Stage 4 # Nat. & High oil	2.292***	0.165***	4.947***	0.365***

Variables				
Stage 4 # Loc. & Low oil	0.758**	0.049**	-0.790	-0.082
Stage 4 # Loc. & High oil	2.365***	0.165***	3.225***	0.241***
Computer 2	-0.223	0.016	3.042*	0.282**
Oil order 2	-0.085	-0.004	0.228	0.020
Oil order 3	0.261*	0.019	0.671*	0.058*
Oil order 4	0.411**	0.029**	1.320***	0.109***
Gender (female)	0.543	0.046	8.736***	0.518***
Age	0.015	0.000	0.098	0.007
Mid-low income	-1.564	0.330***	3.803*	0.243
Middle income	-1.581**	0.339***	3.894	0.235
Mid-high income	-2.965***	0.273***	1.731	0.034
High income	-3.543***	0.251***	0.755	0.034
Constant term	14.691***	0.621***	10.698***	0.966***
var(e.will_to_pay_ppp)	25.296***		189.952***	
N	3,052	3,052	3,485	3,485
R^2		0.068		0.084
Log likelihood	-9.3e+03	-1.5e+03	-1.4e+04	-5.5e+03
AIC	1.9e+04	3122.608	2.8e+04	1.1e+04
BIC	1.9e+04	3273.197	2.8e+04	1.1e+04

Table 94. Models for WTP in Morocco and Tunisia, using the attributes as explanatory variables.

Variables	Tunisia		Morocco	
	WTP	Relative WTP	WTP	Relative WTP
Stage 2	0.374	0.032	-0.484	-0.037
Stage 3	-0.538*	-0.033*	-0.248	-0.012
Stage 4	0.226	0.023	0.599	0.063
Local origin	-1.163***	-0.074***	0.807	0.076
Stage 2 # Local	1.191***	0.077***	0.126	0.003
Stage 3 # Local	1.517***	0.102***	-1.096	-0.101*
Stage 4 # Local	0.758**	0.049**	-0.790	-0.082
High polyphenols	-0.068	-0.003	0.134	0.021
Stage 2 # High	0.986**	0.072**	2.395***	0.191***
Stage 3 # High	3.415***	0.245***	4.843***	0.358***
Stage 4 # High	2.292***	0.165***	4.947***	0.365***
Local # High	1.540***	0.103***	0.658	0.038
Stage 2 # Local # High	-1.239***	-0.081**	-1.966*	-0.152*
Stage 3 # Local # High	-1.492***	-0.096***	-0.597	-0.024
Stage 4 # Local # High	-0.685*	-0.049	-0.932	-0.042
Computer 2	-0.223	0.016	3.042*	0.282**
Oil order 2	-0.085	-0.004	0.228	0.020
Oil order 3	0.261*	0.019	0.671*	0.058*
Oil order 4	0.411**	0.029**	1.320***	0.109***
Gender (female)	0.543	0.046	8.736***	0.518***
Age	0.015	0.000	0.098	0.007
Mid-low income	-1.564	0.330***	3.803*	0.243
Middle income	-1.581**	0.339***	3.894	0.235

Mid-high income	-2.965***	0.273***	1.731	0.034
High income	-3.543***	0.251***	0.755	0.034
Constant term	14.691***	0.621***	10.698***	0.966***
var(e.will~p)	25.296***		189.952***	
N	3,052	3,052	3,485	3,485
R^2		0.068		0.084
Log likelihood	-9.3e+03	-1.5e+03	-1.4e+04	-5.5e+03
AIC	1.9e+04	3122.608	2.8e+04	1.1e+04
BIC	1.9e+04	3273.197	2.8e+04	1.1e+04

6.2.4 Conclusions

6.2.4.1 Conclusions on the Research question

We have presented the results of an experimental auction aimed at detecting consumers' preferences for national olive oils with different characteristics. We gathered and analysed data from Meknes (Morocco) and Sousse (Tunisia). In particular, we tested whether the provision of concise information about health benefits resulted in higher WTP for healthy products even if the sensory characteristics associated to healthy products are usually disliked. We found that, contrary to our expectations, consumers tend to **prefer pungent/bitter oils** and are willing to pay more for these oils compared to delicate ones even before receiving additional information. We also found that a label about **local origin** did not result in higher WTP, while a label about **high polyphenol content** did, regardless of consumers' awareness of health benefits. Furthermore, a concise **message about health benefits** increased consumers' WTP for healthier oils relative to others. This was driven more by the increase in absolute WTP for the former, than by a decrease in the latter. This impact **persists**, net of a small rebound effect, even when consumers experience again the sensory attributes (pungent/bitter) of healthier and less healthy oils. These patterns are similar in both Tunisia and Morocco, with the exception that in Morocco no rebound effect is observed but rather a consolidation of the trend.

Our research presents some limitations. First of all, even if the consumers were filtered based on their knowledge of the price of one litre of olive oil, most of them use to purchase olive oil in bulk; therefore, they might not purchase bottled olive oil in real life. Nevertheless, our protocol allowed to reduce the hypothetical bias that may characterised stated choice experiments. Second, due to the need of identifying actual olive oils, we had to limit the number of attributes and their levels, meaning that we may have missed additional attributes that could influence consumers' choices. Third, to avoid overwhelming participants, we decided to introduce more than one piece of information at the same stages (e.g., origin and polyphenol content). Among others, future research could increase the number of rounds or introduce a new tasting while consumers observe the real bottles. Despite such limitations, to the best of our knowledge this is the first research to test the link between sensory preferences and the impact of health information for olive oils using a non-hypothetical experiment, and the first one to do so by applying the same protocol in two Northern African countries. The results are promising.

6.2.4.2 Recommendations for the project FoodLAND

Our results allow to draw recommendations for the promotion of healthier and more diverse local diets among urban consumers in FoodLAND's cities and countries. First, consumers have limited **awareness** of what constitutes a 'good' olive oil when this is discussed in theoretical terms (i.e., definition of 'extra virgin'), particularly in Tunisia; however, they are able to **appreciate** quality when tasting the products, as shown by their higher WTP for pungent/bitter olive oils. This is a solid basis to build upon to advertise novel food. Second, '**localness**' does not seem to be a value added, at least for olive oils and in the cities considered. Even if we did not compare national with imported oils, 'national' origin was appreciated in the same measure of 'local origin.' This can be

a challenge if trying to link the local Food Hubs with their closer urban market but also suggests that consumers may equally appreciate products from other Food Hubs in their country. Third, a **concise message about health benefits** is effective in driving consumers' preferences, and the impact persists even after the consumers are confronted with additional (sensory) information that could push in the opposite direction. We chose not to use the official health claim of the EU, which may have limited or no meaning to a layperson: we suggest that the same approach is followed in FoodLAND. Finally, '**trust**' emerges as a key element for appreciation of olive oil; therefore, innovators and NGOs should work to building trust between producers and consumers: this is even more relevant given that many consumers produce their own oil, or can get oil from friends and relatives. These recommendations apply to both countries, but slightly more efforts are probably needed in **Tunisia**, were WTP is lower on average, and the impact of health information less persistent.

6.2.5 References

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6.2.6 Appendix

Table 95. WTP and difference between rounds for oils with low and high polyphenol content and for consumers unaware and aware of the link with health, in Tunisia.

Group	Sample size	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Low polyphenol oils	415-416	12.75	13.88	13.08	13.40	16.79
			1.142***	-0.803***	0.323**	3.383***
High polyphenol oils	413-416	13.52	14.89	16.35	15.93	17.06
			1.367***	1.458***	-0.404***	1.147***
Low polyphenol oils + not aware consumers	86	13.73	15.11	14.27	14.53	18.23
			1.377***	-0.836**	0.258	3.700***
High polyphenol oils + not aware consumers	85-86	14.45	15.12	17.25	16.45	17.79
			0.676*	2.127***	-0.799**	1.381***
Low polyphenol oils + aware consumers	329-330	12.49	13.56	12.76	13.10	16.41
			1.080	-0.794***	0.340**	3.300***
High polyphenol oils + aware consumers	328-330	13.28	14.83	16.12	15.80	16.87
			1.547***	1.283***	-0.300*	1.086***

Notes: The sample size indicates the number of observations per round, which may vary between rounds. The first line reports the average WTP in that round for the oils and consumers specified. The second line reports the average difference between that round and the previous one, and the significance level (*** 0.01, ** 0.05, * 0.10) in a monodirectional or bidirectional *t*-test (Pr(T < 0), Pr(|T| > 0), Pr(T > 0)).

Table 96. WTP and difference between rounds for oils with low and high polyphenol content and for consumers unaware and aware of the link with health, in Morocco.

Group	Sample size	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Low polyphenol oils	454-460	24.02	23.69	23.32	24.30	28.52
			-0.181	-0.424*	0.925***	4.214***
High polyphenol oils	453-460	24.31	25.43	28.44	29.18	30.58
			1.146***	3.210***	0.461	1.482***
Low polyphenol oils + not aware consumers	78	18.70	21.64	21.79	21.73	25.20
			2.943**	0.149	-0.056	3.461***
High polyphenol oils + not aware consumers	78	17.67	21.85	28.04	26.34	30.29
			4.179***	6.182***	-1.694*	3.953***
Low polyphenol oils + aware consumers	376-382	25.11	24.12	23.63	24.83	29.20
			-0.825*	-0.543*	1.129***	4.367***
High polyphenol oils + aware consumers	375-382	25.67	26.17	28.52	29.76	30.64
			0.523	2.592***	0.909**	0.975**

Notes: The sample size indicates the number of observations per round, which may vary between rounds. The first line reports the average WTP in that round for the oils and consumers specified. The second line reports the average difference between that round and the previous one, and the significance level (*** 0.01, ** 0.05, * 0.10) in a monodirectional or bidirectional *t*-test (Pr(T < 0), Pr(|T| > 0), Pr(T > 0)).

Table 97. WTP across all rounds and in specific rounds for different sub-samples and groups, in Tunisia.

Sample	Groups	Obs.	All stages	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
All consumers	Low polyphenol oils	2,077	13.98	12.75	13.88	13.08	13.40	16.79
	High polyphenol oils	2,075	15.55	13.52	14.89	16.35	15.93	17.06
	Pr(|T| > |t|)		0.000	0.025	0.004	0.000	0.000	0.542
Consumers not liking pungent	Low polyphenol oils	1,217	13.99	12.92	13.78	13.05	13.37	16.85
	High polyphenol oils	1,218	15.36	13.48	14.83	16.05	15.54	16.91
	Pr(|T| > |t|)		0.000	0.244	0.021	0.000	0.000	0.905
Consumers liking pungent	Low polyphenol oils	830	13.96	12.43	14.04	13.15	13.46	16.73
	High polyphenol oils	827	15.80	13.55	14.92	16.79	16.47	17.32
	Pr(|T| > |t|)		0.000	0.022	0.126	0.000	0.000	0.439
High polyphenol oils	Consumers not liking pungent	1,218	15.36	13.48	14.83	16.05	15.54	16.91
	Consumers liking pungent	827	15.80	13.55	14.92	16.79	16.47	17.32
	Pr(|T| > |t|)		0.085	0.885	0.858	0.207	0.110	0.532

Low polyphenol oils	Consumers not liking pungent	1,217	13.99	12.92	13.78	13.05	13.37	16.85
	Consumers liking pungent	830	13.96	12.43	14.04	13.15	13.46	16.73
	Pr(|T| > |t|)		0.909	0.335	0.630	0.841	0.845	0.857
Not aware consumers	Low polyphenol oils	430	15.18	13.73	15.11	14.27	14.53	18.23
	High polyphenol oils	429	16.21	14.45	15.12	17.25	16.45	17.79
	Pr(|T| > |t|)		0.021	0.459	0.990	0.003	0.049	0.673
Aware consumers	Low polyphenol oils	1,647	13.67	12.49	13.56	12.76	13.10	16.41
	High polyphenol oils	1,646	15.38	13.28	14.83	16.12	15.80	16.87
	Pr(|T| > |t|)		0.000	0.025	0.001	0.000	0.000	0.342
High polyphenol oils	Not aware consumers	429	16.21	14.45	15.12	17.25	16.45	17.79
	Aware consumers	1,646	15.38	13.28	14.83	16.12	15.80	16.87
	Pr(|T| > |t|)		0.007	0.049	0.620	0.108	0.347	0.235
Low polyphenol oils	Not aware consumers	430	15.18	13.73	15.11	14.27	14.53	18.23
	Aware consumers	1,647	13.67	12.49	13.56	12.76	13.10	16.41
	Pr(|T| > |t|)		0.000	0.040	0.013	0.012	0.016	0.017

Notes: 'Obs.' indicates the number of observations across all rounds; the number of observations can vary slightly between rounds. For each sample, the first two lines report the average WTP of each group; the third line reports the *p*-values of a bidirectional *t*-test for the difference in the WTP between the groups. Consumers are classified as 'aware' or 'not aware' based on their previous knowledge of the link between polyphenol content and healthiness.

Table 98. WTP across all rounds and in specific rounds for different sub-samples and groups, in Morocco.

Sample	Groups	Obs.	All stages	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
All consumers	Low polyphenol oils	2,290	24.78	24.02	23.69	23.32	24.30	28.52
	High polyphenol oils	2,289	27.59	24.31	25.43	28.44	29.18	30.58
	Pr(|T| > |t|)		0.000	0.750	0.045	0.000	0.000	0.061
Consumers not liking pungent	Low polyphenol oils	1,514	24.12	23.59	23.51	23.03	23.57	26.90
	High polyphenol oils	1,513	26.54	22.99	24.35	27.66	28.21	29.50
	Pr(|T| > |t|)		0.000	0.591	0.417	0.000	0.000	0.039
Consumers liking pungent	Low polyphenol oils	746	26.58	25.31	24.51	24.34	26.28	32.40
	High polyphenol oils	746	30.28	27.44	28.16	30.65	31.76	33.38
	Pr(|T| > |t|)		0.000	0.194	0.023	0.001	0.004	0.648
High polyphenol oils	Consumers not liking pungent	1,513	26.54	22.99	24.35	27.66	28.21	29.50
	Consumers liking pungent	746	30.28	27.44	28.16	30.65	31.76	33.38

		Obs.						
	Pr(|T| > |t|)		0.000	0.001	0.005	0.085	0.036	0.025
Low polyphenol oils	Consumers not liking pungent	1,514	24.12	23.59	23.51	23.03	23.57	26.90
	Consumers liking pungent	746	26.58	25.31	24.51	24.34	26.28	32.40
	Pr(|T| > |t|)		0.000	0.243	0.435	0.325	0.061	0.001
Not aware consumers	Low polyphenol oils	390	21.81	18.70	21.64	21.79	21.73	25.20
	High polyphenol oils	390	24.84	17.67	21.85	28.04	26.34	30.29
	Pr(|T| > |t|)		0.017	0.522	0.924	0.053	0.158	0.115
Aware consumers	Low polyphenol oils	1,900	25.38	25.11	24.12	23.63	24.83	29.20
	High polyphenol oils	1,899	28.15	25.67	26.17	28.52	29.76	30.64
	Pr(|T| > |t|)		0.000	0.585	0.029	0.000	0.000	0.210
High polyphenol oils	Not aware consumers	390	24.84	17.67	21.85	28.04	26.34	30.29
	Aware consumers	1,899	28.15	25.67	26.17	28.52	29.76	30.64
	Pr(|T| > |t|)		0.000	0.000	0.010	0.820	0.105	0.872
Low polyphenol oils	Not aware consumers	390	21.81	18.70	21.64	21.79	21.73	25.20
	Aware consumers	1,900	25.38	25.11	24.12	23.63	24.83	29.20
	Pr(|T| > |t|)		0.000	0.000	0.118	0.264	0.086	0.044

Notes: 'Obs.' indicates the number of observations across all rounds; the number of observations can vary slightly between rounds. For each sample, the first two lines report the average WTP of each group across all rounds or in a specific round. The third line reports the *p*-values of a bidirectional *t*-test for the difference in the WTP between the groups. Consumers are classified as 'aware' or 'not aware' based on their previous knowledge of the link between polyphenol content and healthiness.

6.3 Biometric testing of the relationship between taste, origin, and consumers' willingness to pay (WTP) for olive oil in Morocco and Tunisia

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6.3.1 Introduction

There is a need to understand the relation between the subjective perceived quality of a food product and specific product characteristics such as localness and healthiness. The perceived quality is influenced by the way consumers see and interpret product information, which is given through product labelling. The personal experience comes on the hand when tasting the food, and there could be a situation with a mismatch between the sensory perception of a product and the quality claimed through the label.

Marketing of olive oil faces such challenge, as information about healthiness might not align with the taste experience. Healthier olive oils contain a higher quantity of polyphenols, which results in a bitterer taste and a more pungent mouthfeel sensation. Further can information about where the olive oil is produced influence the overall quality evaluation (Barlagne et al., 2015) and not least consumers' willingness to pay (Ran et al., 2017).

The relations between a willingness to pay and a subjective interpretation of product information and combined with tasting the product, is not straight forward to investigate. Both taste and information processing are influenced by non-conscious processes that makes is difficult for people to put words on (De Wijk et al., 2012). The aim for this study is therefore twofold; **to gain insights into consumers' conscious and non-conscious decision processes to see how it will influence the willingness to pay, and to develop a research protocol for similar testing on other food products.**

6.3.1.1. Scope and Objectives

Having the FoodLAND the aim of improving the quality of local produced food products, this study focuses on olive oil production in the countries of Tunisia and Morocco. Further objective of the study is to gain insights into the drivers among urban consumers' when they make a choice for a healthy food product. Increased insights into consumers' preferences can help local producers to tailor their product, to market the product and in the end, it can help consumers making healthier choices.

Olives, and thus olive oil, are a key agri-food products in Tunisia and Morocco. The value of olive production plays a significant role for the involved Food Hubs with over two thirds of the value of farm sales. For Tunisia the study might even help changing the view on high quality olive oil, as these products have for year been targeted for export, and local available olive oil has thus been produced by lower quality seed oils.

6.3.1.2 The Taste of Healthy Olive Oil

Literature show that consumers are frequently caught between conflicting values such as between the good taste versus a health option (Connors et al., 2001, Hauser et al., 2011). It can therefore be expected that consumers will dislike bitter food, and in the case of an olive oil they will dislike the healthy olive oil due to the high level of polyphenols. Consumers, who tend to opt for a healthy product might respond stronger emotionally when they experience such a cognitive dissonance between taste and preference (Ong, Frewer & Chan, 2017). This type of dissonance is described as a mental discomfort arising from an intended optimal choice conflicting with tasting a product that is not likable. The consumer might try to reduce the cognitive dissonance by searching for alternatives or consider the value of the specific product (in this case the olive oil),

but in any cases it results in an increased involvement of cognitive load and emotional activity. In other words, in a situation with cognitive dissonance, the consumer justifies the final evaluation of a decision in a way that involves more cognitive and emotional load compared to the easy non-conflicting situation.

6.3.1.3 Product Information and Visual Attention

Differently from the taste, information about health and place of production is given through the printed label on the product packaging. Looking at product information and getting the full meaning out of text and illustration, is not a straight-forward visual attention process. Literature describes how people's information search is influenced by a high degree of routine and acknowledges that such routine might be interrupted and influenced by competing types of visual stimuli (Clement et al., 2017), which might give rise to misinterpretations.

Interrupting stimuli can arise spontaneously and leave very little memory in the consumer's mind. Several types of information are given on an olive oil, but it is difficult to identify them ex post, as people will not have a clear memory on how the different stimuli influenced the mental process and a final evaluation of the product. Further, people will not be able to explain the interplay between personal preferences and emotions evoked by the stimulus gazed at. In other words, people will not be able to justify how these non-conscious processes might have influenced the evaluation and final decision towards the product.

6.3.1.4 Understand Localness

Several studies have found evidence that branded nationality or localness are assessed positively by consumers (Dekhili et al., 2011). The literature also finds uncertainty in consumers' perception of what characterizes a local food product or what constitutes these values (Larsen & Österlund-Pötsch 2015). Even a comprehensive labeling might not give the needed insight, as packaging design is often overwhelmed labels and consumers are having difficulties interpreting labels correctly (Clement et al., 2017).

6.3.2 Methodology

6.3.2.1 Protocol development

From a neoclassical economic perspective food production is seen as profit maximizing entities, and thus view innovation as a rational cost-benefit calculation. However, this view rarely holds in real world situations, where human beings are subject to non-conscious biases such as time inconsistency, risk aversion, and simple heuristic cues (Kahneman, 2003). This is described as the gap between stated and revealed preferences, and within the field of behavioral economics the behavior is seen as more than rationality and utility maximization (Huseynov et al., 2019). Ong, Frewer & Chan (2017) argue for a new way to investigate the cognitive dissonance in food choice with health-related information, which includes a focus on conscious and non-conscious factors.

Conscious factors are values and preferences build up over timer and are characteristic for a person. These can be approached through research techniques like surveys and observations. Non-conscious factors are related to emotions and bodily reaction in a specific moment of time. Research within the field of neuromarketing have proven the value in utilizing the bio-metric techniques such as eye-tracking and facial recordings, to measure consumers' emotional and spontaneous reactions in a non-intrusive way (Stasi et al., 2018; Clement et al., 2013). Eye-tracking techniques have revealed the complex correlation between visual attention and choice (Orquin and Loose, 2013), showing that people who spend more gaze time on a specific product information also value it higher (Chen et al., 2015).

Taking the behavioral economics approach to a food choice (in this case the olive oil) it will provide insights into both cognitive and emotional stimuli, which in this case will be the tase of a specific olive oil, general health information about olive oil, and information about where the specific olive oil is produced. Having full control of these independent variables, it enables us to formulate hypotheses on the willingness to pay (WTP), which is the dependent variable.

The applied protocol combines an auction mechanism used by Barlagne et al. (2015), which is also known as 'Becker–DeGroot–Marschak (BDM) procedure' (Becker & DeGroot, 1974), with eye-tracking and face recording (Spence, 2016). Within the auction procedure, participants are asked to indicate their willingness to pay (WTP) along multiple stages where new stimuli are given. Each stage includes four types of olive oil, and after each exposure the participants will indicate the WTP for the specific olive oil. If the indicated WTP is equal or greater than the price sat for the specific product, the participant must purchase the product by the end of the test, using part of the payment for participating. Otherwise, the participant would not be able to purchase the product.

6.3.2.2 Study setting and procedures

The study was conducted under controlled lab conditions at the local university partners (Meknes, Morocco, and Sousse, Tunisia). Incentivized lab-studies ensure that participants are motivated and fully committed to the tasks they are asked to perform, thus revealing their real preferences. Lab studies have been widely used and testing peoples' behaviors in a lab have been proven to be a good indicator for real-world behaviors.

In this study, the consumers were asked to evaluate four brands of extra virgin olive oils along six stages. The four oils were characterized by a combination of two binary attributes: (1) low polyphenol vs. high polyphenol and (2) local produced vs. not-local produced. The 'local' was characterized as coming from the same region where the experiment was conducted. As for the polyphenol content, an olive oil with high level of polyphenol is found healthier but does also have a more bitter taste. The study combined the tasting of the oil, the healthy information, the origin information, and the packaging design in the order shown in Figure 107.
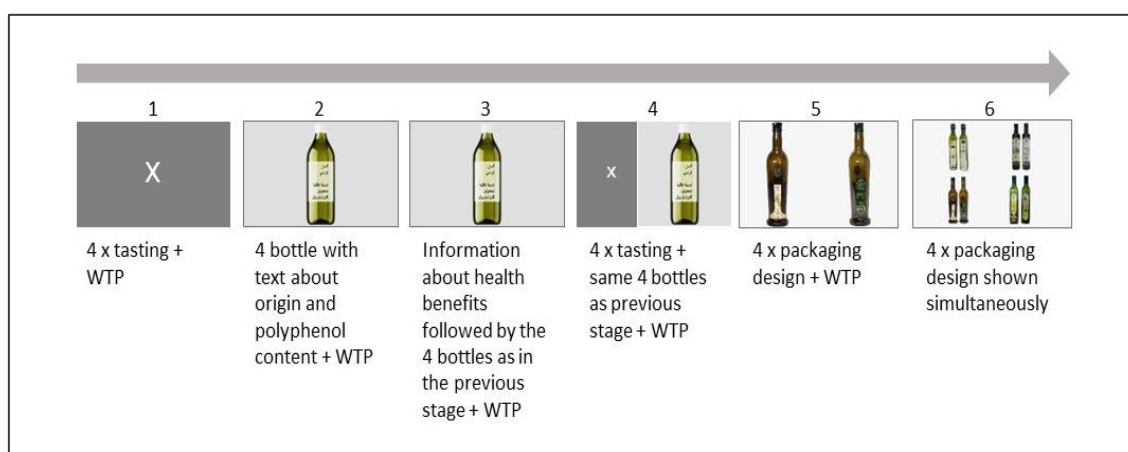
Figure 107. Stages in the study design. The health information given in stage 3 has the text: "A pungent or bitter taste of olive oil indicates a higher content of polyphenols. Olive oil polyphenols are good for your health. Therefore, healthier olive oils are likely to be bitterer and more pungent".

The four olive oils in each stage were exposed to the participants in a randomized order. The WTP was recorded in the local currency, and for one liter of olive oil. Due to logistical reasons, the olive oil being in target for the auction was predefined, but it was not revealed to the participants until the end of the process. The price was extracted by the computer and was never

higher than the payment for participating in the study. During this whole procedure, and particularly during the six stages, the consumers were eye-tracked, and their facial responses were recorded.

When participants were involved in the study, each one was informed about the procedure, the technique, and the right to draw back at any time also through ad hoc materials. After data collection each participant was de-briefed to ensure that the participant still accepted the data to be used for research, and finally each participant was be paid. All collected data was anonymized, stored on a server protected by password, and solely used in aggregated form as to ensure the safeguard of the participants' rights.

6.3.2.3 Data collection

The study was conducted in two cities: Meknes in Morocco and Sousse in Tunisia. The samples were representative of the cities' population in terms of age groups, and gender. The respondents were filtered according to four criteria: having no allergy to olive oil, consuming olive oil regularly, being involved in grocery shopping at least from time to time and knowing the price of one litre of olive oil with good approximation.

Figure 108. 4 samples of olive oil in anonymized bowls. Two enumerators were running the test.

A team of local enumerators were trained in running the study and keeping track on the order of taste samples. All text in the questionnaire and text about health and origin were in Arabic. Data were recorded partly using the iMotions software, which tracked consumers' facial and eye movements and registered their WTP, and partly using Qualtrics to record responses to two questionnaires: one for the initial explanation of the auction, and one for collecting socio-demographic and other variables and for implementing the auction. Each session started with a calibration linking the participants eyes and face to the iMotions software. The recording was done with 60 Hz. Illustration 1 shows a test situation.

The experiment took place in September 2022 in Meknes, and in October-November 2022 in Sousse. Testing one participant took up to 30 minutes including the questionnaires and tasting of the oils. The final sizes were 230 in Meknes and 208 in Sousse, resulting in more than 300,000 data observations across stages and stimuli. Collected data was then extracted from iMotions and Qualtrics and analyzed for outliers.

6.3.3 Results and discussions

Differently from the extant literature, the results show that consumers have a **significantly higher willingness to pay for pungent/bitter olive oil before being informed about its health benefits**, especially in Tunisia. Health-related information increases the willingness to pay for pungent/bitter olive oils relative to the non-pungent ones. This effect persists in the following stages, which was a dynamic common for both countries. The highest level of WTP was found in stage five where the actual packaging design is presented one-by-one.

Our findings suggest that **clear and concise information can help to increase the consumption of healthier olive oil.** Further data shows that information and a well-designed packaging can be used by local producers to promote their brands to a relative high price, despite the widespread consumers' practice to purchase olive oil in bulk among local consumers.

6.3.4 Conclusions

6.3.4.1 Recommendations for the project FoodLAND

The objective of the FoodLAND project is to promote more nutritious, healthier, and diverse diets among African urban consumers by linking them with local production regions. Increased understanding of consumers' preferences and non-conscious perceptions can help local producers to tailor their product and market it more effectively. Lastly, an increased awareness can help consumers make better informed choices.

It is in general difficult to generalize results from different societies, and it might be necessary do develop behavioral studies in contexts to the specific society in focus. This study design was developed for Morocco and Tunisia, and it provided a lot of data that can give new insights into local consumers' willingness to pay for quality food. The protocol can and need to be further developed and can then be utilized for other types of products and in other countries, either in or outside of Africa.

6.3.4.2 Further contributions

The new protocol developed for this study was presented as our first contribution in a poster presented at the EuroSense2022 conference in Turku, Finland. The poster outlined the value of combining the auction research design with biometric research design and described the protocol in a step-by-step illustration. This has been further outlined in a paper with data from the study, which will be presented at EAAE 2023, the annual conference in European Association of Agricultural Economics in Rennes, France. The paper further outlines the added value of the combined protocol. In the paper we compare data from the new protocol with data from a conventional protocol, and show that the biometric variables on attention, engagement, fixation duration and fixation counts were able to improve the model and being the most successful predictors for WTP and its variation.

Another paper, with specific focus on the relation between health information, bitter/pungent taste, and level of WTP, is about to be submitted to an academic journal. Further manuscripts based on the collected data from Meknes and Sousse will target topics on biometric variables (facial responses and fixation) and how these can explain consumers' WTP, and how this might differ between Morocco and Tunisia.

Further topics to be investigated should look at the biometric variables and how these can explain consumers' WTP for different olive oil and their design. This would include a focus on biometric data and how these can explain differences between socio-demographic segments and countries. Furter we might be able to identify consumer clusters in terms of preferences for specific olive oil profiles and see how this correlate with emotions and visual attention.

Finally, data might provide insights into consumers' awareness on labels indicating quality, safety, and origin and see how the awareness impacts WTP. This will give insights into label designs/branding affect and how it might influence consumers' WTP for quality olive oil. These data come from stages 5 and 6 and can reveal the value of information processing with limited visual content.

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7. Conclusions

This report integrates the developed research procedures and tools (D2.2, D2.3) and the derived datasets (D2.1, D2.5) with a series of analyses on the consumers' food-related conditions, thus completing the project consumer study. These analyses focus on about 8,500 observations collected in 5 African countries, provide knowledge of consumers' food needs, preferences, and choices and of their socio-demographic and economic drivers, and measure the level of dietary diversity and food security and identify their major determinants. Moving from the necessity not only to explore but also to compare the contextual and individual diversities, this deliverable reports first results emerged from the data analysed at different level of aggregation such as for consumer groups (e.g., individual and household socio-economic profiles and nutritional status) and categories (urban and rural consumers), local communities and areas (12 cities and 12 Food Hubs), and at country and cross-country scale. Therefore, the overall goal of this report is twofold. First, it aims at drawing a comprehensive picture of the surveyed population's food behaviours and nutritional needs, which are to be met in each target city and paired Food Hub also through the generation of tailored nutritional recommendations (D2.6) and the organization of consumer awareness raising campaigns. Second, it aims at providing local researchers and food operators with consumer-oriented insights, thus promoting a food security-shaped culture and enhancing the nutrition-responsiveness of the technological innovations and of the local food supply chains. With these aims, the first findings achieved by FoodLAND provide a series of considerations and recommendations pertaining to the research, policy and project domains.

7.1 Conclusions on research questions

Moving from the complexity that characterizes the urban consumers' food decision making and adopting standard research procedures and tools, the project implemented mixed methodologies (i.e., incorporating surveys with economic experiments as well as bio-metric tests with experimental auctions) with the aim to combine the individuals' behavioural antecedents with the contextual conditions affecting the consumers' choices. The produced data and the achieved first results address a series of preliminary research questions providing not always expected answers, show still unexplored information the models can produce, suggest that a wide range of analyses can be carried out also at different scale, and let emerge further hypotheses to be investigated.

Regarding the measurement of the urban consumers' diet quality, the indicators show a level of diversity of the food groups entered in the individual and household diet much higher than the results obtained by other projects. While this result can be explained by the characteristics of the respondents that were interviewed in the twelve cities out-of-store, thus having access to market facilities, their diet quality shows inadequacies when considering the diversity of food items consumed (within each food group) and their healthiness. Nevertheless, in a number of cities the consumers' self-assessed level of healthiness of the household diet plays a crucial role in explaining the variations of the indicators of diet quality (together with other associated determinants such as age, purchasing behaviours, status concern). This variable suggests that some groups of consumers are well aware of the concepts and linkages between balanced and quality diet, as the positive correlation between messages on health benefits and consumers' WTP indicates from the conducted experimental auctions.

Accordingly, the cluster analysis identified differences across urban consumers both in their dietary profiles and in food behaviours. Specifically, the group of individuals characterised by low-income, older ages and no education qualification are exposed to food insecurity (inadequate access to basic foods), whereas consumers pertaining to the middle- and high-income classes suffer from different forms of malnutrition due to the inclusion of ultra-processed food in their diet, but they have a higher inclination to adapt their habits by buying new local foods. Moreover, the results from the behavioural economic experiments show that more patient consumers' diets are more diversified and healthier. Trust towards the community members (social capital) also contributes to explaining the more diverse dietary patterns as well as the propensity to include new local foods in the diet, but not new nutrient-dense products because of the stronger linkage with peers and traditional values. Trust towards farmers and vendors result positively associated with the consumers' attitude to include new nutrient-dense foods in their diet and WTP.

Results from the rural consumer analysis show that a consistent percentage of the rural women engaged in the five studied areas are illiterate and thus less independent on the responsibilities taken over food purchasing and employment choices. In general women tend to have limited decision-making power over the household, as only a small fraction of them is household head. Most of the women in the rural food hubs are engaged in farming activities, although the main source of income at household level is not related to farming activities. This seems to indicate that households probably diversify their income streams to achieve economic sustainability, engaging in other activities than farming. Rural households in the studied regions are dependent on the market for the purchase of food, as generally the main sources of food supply are local shops or producers located in the village. This indicates an expected incapacity of rural women to secure the dietary requirements of the households if prices rise through, i.e., inflation, as increase of food prices and related income reduction and food shortage are the highest perceived worries by the sampled women.

Regarding the women and children diet quality, results at cross-country level shows percentages which are comparable with previous studies and national estimates. Moreover, we identified a significant association between the women education and her diet quality, again underlining the importance of education of women in rural areas to support women empowerment and dietary diversity. Although the dietary diversity of women seems to be higher than national estimates the consumption of the 5 recommended groups is low among women of reproductive age, thus policies to improve this indicator is encouraged. Concerning children feeding practices, the rates of breastfeeding are high across all countries, but the early initiation of breastfeeding is low and should be considered a priority.

The richness of the collected consumer data as well as of the first achieved results gives the opportunity not only to further analyse the presented studies by specifying new models but also to identify new research questions so as to fully explore the consumers' food behaviours and conditions. Still unexplored lines of study – that could be conducted at different level – include, for instance, the comparison between urban and rural consumers' conditions and diet quality, the detection of the determinants of behavioural biases, the analysis of the rural women's empowerment, and the identification of common factors (e.g., poor living conditions, risk aversion) affecting the consumers and farmers' food-related decision making. More in general, this report underlines how crucial is the generation of quality, disaggregated and scalable data for research projects aimed at consolidating the understanding of different realities and groups of consumers, at providing evidence on the cost-effectiveness of developed innovations, and at implementing and disseminating nutrition-sensitive innovations.

7.2 Conclusions on policy recommendations

The first results achieved from the activities carried out with consumers show not only the great diversity that characterizes the contextual and individual conditions across areas and groups of consumers but also reveal the variety of factors affecting the nutrition-relevant decision making. This evidence urges to adopt public policy strategies ensuring – as far as possible – that the deriving interventions (i) are tailored to meet the observed situational specificities and the personal preferences and needs, and (ii) are integrated to enhance their mutual effectiveness, thus avoiding possible conflicting effects. With the aim to improve the consumers' food security and their diet quality, appropriate policy measures should first of all target the operators of the local food supply chains (e.g., providing individual, time-limited and small monetary incentives; supporting the accessibility to land and capital; ensuring knowledge transfer and technological services), thus boosting their nutrition-sensitiveness and the availability and affordability of healthy foods. Moreover, creating infrastructures and logistic facilities that allow farmers to access the market directly and stably could further leverage the consumers' trust towards producers, thus increasing their propensity to include new nutrient-dense foods in their diet.

With regard to policies focused on the consumers' food behaviours and aimed to contrast the different forms of malnutrition, tailored nutritional recommendations and awareness-raising campaigns should promote the diversification of food items (e.g., whole grains, legumes rich in minerals, animal sourced proteins and, more in general, novel local foods) and the reduction of unhealthy products (e.g., salty snacks and sweet beverages) entering in the household diets. These communication initiatives should give priority to the groups less sensible towards (e.g., the long-term benefits generated by) healthy consumptions and to the ones more reluctant to change their food habits since they are the individuals that generally register poor quality diets. Not least, the adopted interventions should be integrated by public and private initiatives aimed at fighting the food insecurity and unbalanced diets – especially for the group of consumers identified by the project – for instance by organizing / reinforcing knowledge transfer programs and events in schools and food groceries and by implementing direct payment schemes. Monitoring price increases in rural areas in period of crisis can also support policymakers in detecting exacerbation of food security.

Finally, policies targeting women empowerment and literacy in rural areas should be promoted, as eenhancing education and literacy for rural women can support their empowerment in local and rural communities, which can have at last a positive effect on their diet diversity and these of their children and household (when women are responsible for household food production and purchase).

7.3 Conclusions on implications for the project FoodLAND

This deliverable describes first models and results that will serve as guidance to produce more detailed analyses for each target city and rural Food Hub and then to obtain a segmentation of the local consumers to be associated with their specific preferences, behaviours, needs and conditions. This comprehensive knowledge will generate information to support two main project domains: first, by further refining the research and innovation activities involving the local researchers, food operators and Food Hubs and enhancing their capacity to meet the consumers' characteristics; second, by tailoring the nutritional recommendations and orienting the envisaged consumer awareness-raising campaigns to be implemented.

A synopsis of the main indications for the project R&I activities (not exhaustive and not excluding possible interactions) emerged at country or cross-country level includes:

- consumers either trusting food operators, or being patient, or risk takers show higher propensity to include nutrient-dense products in their diets (pioneers) -> R&I developing brand new products (e.g., new varieties and species; new mineral-rich legumes; quinoa-enriched novel foods);
- consumers either trusting peers / community, or being impatient, or risk averse tend to be status quo-oriented (laggards) -> R&I developing new local foods to be integrated with traditional diet / receipt (e.g., new blended flours; dried local fruits and vegetables);
- consumers purchasing eco-friendly food products -> R&I developing eco-friendly technologies and systems (e.g., precision irrigation and protection; smart storage; integrated aquaculture; gardening and bio-degradable mulching; bio-based packaging);
- consumers purchasing foods to be regarded as "good providers" (status concern) register lower diet quality indicators (GDR) -> R&I developing new local foods to be integrated with traditional diet / receipt (e.g., new blended flours; dried local fruits and vegetables);
- consumers with either low level of dietary diversity or unbalanced diet (lack of food items and their micro-nutrients) -> R&I developing new food items (e.g., mineral-rich legumes; fish; grains)
- consumers such as rural women and vulnerable groups with specific needs (lack of food groups or items and their micro-nutrients) -> R&I developing nutrient-dense products (e.g., baby foods; mineral-rich legumes; therapeutic foods; fish products; quinoa-enriched novel foods);
- consumers aware of their household diet healthiness -> R&I developing brand new products (e.g., new varieties and species);
- consumers with older age or no education show lack of access to basic food groups -> R&I developing new local foods to be integrated with traditional diet / receipt (e.g., new blended flours; dried local fruits and vegetables);
- consumers with low level of income and especially rural consumers are more exposed to food insecurity -> R&I privileging yield-enhancing innovations and delivering affordable food products (e.g., precision agriculture; smart storage; integrated aquaculture; drought tolerant crop such as quinoa);
- consumers with middle or high level of income show propensity to adopt new local products -> R&I developing local novel / orphan food products (e.g., local varieties and species);
- consumers living in rural areas highly dependent on the market for the purchase of food -> R&I developing local novel / orphan food products (e.g., local varieties and species);
- consumers willing to pay for good quality products -> R&I developing value added products and services (e.g., precision protection and harvesting; primary and secondary food processing; bio-based packaging).

With regard to the identification of the nutritional recommendations and the deriving implementation of population awareness-raising campaigns, this report and its first results suggest the opportunity to shape these outputs to fit the high level of heterogeneity observed across groups of consumers and in the different cities and rural areas. On the one hand, the recommendations should be customized according to the specific consumers' needs and diet quality indicators and paying special attention to women of reproductive age and children's requirements. On the other, the envisaged campaigns aimed at nudging consumers towards

healthier food behaviours and balanced diets should be tailored to meet the characteristics of the main consumer categories (e.g., rural and urban consumers) and of the identified groups (e.g., by differentiating the initiatives between consumers facing food security issues and unbalanced diet profiles and consumers privileging unhealthy foods and beverages but showing higher propensity to renew their unhealthy diet). With the aim to take into due account the diversity of the consumers' conditions and nutritional status and preferences, the campaigns will be conducted along three main waves (also by triggering repeated concise messages). Firstly, a widespread dissemination of nutritional recommendations will be implemented in collaboration with the local consumers' organizations and authorities to reach out to the urban and rural populations (here including health warnings about the excessive consumption of unhealthy foods and beverages). The second wave will raise awareness among vulnerable groups on the benefits of healthy and sustainable food consumption patterns specifically addressing the relevant forms of malnutrition affecting women of reproductive age and children within 1,000 days of life. Thirdly, the last wave of the local campaigns will embody in the recommendations the nutrition-responsive and novel food products developed by the project. On the one hand, this last phase will be carried out through the organization of local Conferences and with the collaboration of the local food groceries (project stakeholder advisors). On the other, the three waves will be implemented through the development of new tools with inclusive use of language and visuals (e.g., images or videos on the consumption of healthy, balanced diets and attractive; support to mainstream media – local dialect radio and television – transmission; clear, easy to understand and meaningful information and emotional messages) and the use of social media.