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Insights into consumer attitudes, knowledge, demands, and barriers can help food system researchers in designing interventions to more effectively increase healthy and safe food consumption. This report is part of a larger project, aiming to pilot and scale innovative approaches within the food systems of Benin, Mali and Burkina Faso to improve consumption of safe vegetables. A consumer survey was done to obtain insights into consumers' perceptions of accessibility, acceptability and safety of vegetables in Benin, Mali, and Burkina Faso. This report describes the methodologies of these consumers surveys.

Key words: fruits and vegetables, consumption, Mali, Burkina Faso, Benin, consumer behaviour, food system

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Royaume des Pays-Bas



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SafeVeg

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Preface

Safe Locally-Produced Vegetables for West Africa's Consumers (SafeVeg) is an action-research programme - launched in November 2020 and running until 2025 - and covers three West African countries - Benin, Burkina Faso and Mali. It was developed within the context of the EU initiative on Climate-relevant Development Smart Innovation through Research in Agriculture in developing countries (DeSIRA).

The SafeVeg initiative aims to reduce undernourishment, improve the income and productivity of small-scale food producers - particularly for women and youth, and expand sustainable land use. The programme is implemented by the World Vegetable Center in collaboration with Wageningen University & Research (WUR) and CIRAD (French Agricultural Research Centre for International Development), and a multitude of national partners in the three focus countries.

The first year of the programme was dedicated to diagnostic research that explored barriers and opportunities for innovations across the vegetable value chain, including in production, marketing and consumption. Regarding vegetable intake, the research focused on why people do not eat enough of this nutritious food, which was overseen by the World Vegetable Center, University of Abomey-Calavi and WUR. The team carried out extensive literature reviews, consulted many different stakeholders in the three countries and implemented surveys among thousands of consumers.

The findings indicate that people in Benin, Burkina Faso and Mali eat below the recommended daily amounts, which results in micro-nutrient deficiencies, including anaemia, and has negative impacts for child development. The research also concluded that safe vegetable consumption can be enhanced by reducing costs and increasing availability and acceptability among consumers.

Households cannot always afford vegetables although they are perceived as reasonably priced. Also, people have limited trust in the safety of vegetables due to a growing awareness that they can be produced with high dosages of agro-chemicals or undergo unhygienic handling, including washing with water infested with microbes. Finally, access to safe vegetables is perceived as a main limitation for consumers.

In this publication series, we will share the results of the multiple studies and experimental interventions that have been undertaken to promote consumption of safe vegetables in the three focus countries. We hope these results will be of value to others also aiming to increase the accessibility, availability and affordability of healthy diets in West Africa and beyond.



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Summary

The overall aim of the SafeVeg project is to pilot and scale innovative approaches within local vegetable food systems – to reduce malnutrition and improve income and productivity of small-scale food producers in (peri-)urban Benin, Burkina Faso, and Mali. SafeVeg’s Work Package 2 contributes to this by assessing current vegetable consumption levels and concerns among consumers regarding vegetables in the food environment: the acceptability and accessibility of vegetables and vegetable food safety perception. This report describes the methodologies of these surveys.

Study respondents were adult consumers responsible for buying food and living in low- and middle-income urban and peri-urban neighbourhoods in 9 cities in Benin, Mali, and Burkina Faso

The survey was conducted in urban and peri-urban neighbourhoods in Benin, Mali, and Burkina Faso. More specifically in the cities of Parakou, Porto Novo, Cotonou, and Abomey-Calavi for Benin, Bamako, Kati, and Sikasso for Mali, and Ouagadougou and Bobo-Dioulasso for Burkina Faso. Study respondents were adults and responsible for buying food and/or being responsible for making the decision about what food to buy. Only respondents from low and middle-income neighbourhoods were included.

Study sampling included selection of districts, neighbourhoods, and households to cover different geographical areas and neighbourhoods housing and living conditions reflecting low and middle-income

In each city, the sampling will be done in several steps: First selection of districts, then selection of neighbourhoods in districts and finally selection of households in neighbourhoods. The selection of the districts in each city was done based on: 1. Coverage of main places of vegetables access 2. Main facilities that attract a specific type of consumers. And 3. Geographical issues such as city centre, near the river, etc. Neighbourhoods were identified and selected according to geographic coverage (urban and peri-urban) and income level (slum, low income, middle income, and high income) based on average housing and living environment conditions in the neighbourhood. In the third and final step, a convenience sample of consumers were recruited through a door-to-door approach in the selected neighbourhoods.

The study procedure was structure face-to-face interviews in respondents’ homes

Structured face-to-face interviews were administered in respondents’ home and data was entered in the mobile phones of the trained interviewers. KoBo toolbox software was used to programme the survey in French and then translated to local language. Informed consent was obtained and respondents were given a small gift for their participation, either a vegetables voucher to be used at a local vegetable vendor or soap.

Measures included were related acceptability of vegetables, perceptions of safety, and perceived access and derived from literature or developed for the purpose of the study

Measures included were related to vegetable *acceptability* (consumption and sourcing of vegetables), *perception of safety* (motivations, safety product attributes of vegetables, safety perception of vegetables, trust in actors) and *perceived access* (access to vegetable outlets, knowledge and ability). Additionally, demographics, family composition, and food security was measured. Most scales used for this survey have been used in previous studies and validated elsewhere. However, two scales were developed for the purpose of this study: access to outlets and self-efficacy for consuming safe vegetables. The order of items within scales was randomised. Cards with photos of vegetables were used to facilitate respondents with their answers.

1 Introduction

1.1 Background

The SafeVeg project aims to reduce undernutrition and micronutrient deficiencies improve income and productivity of small-scale food producers, particularly for women and youth, and expand sustainable land use in Benin, Burkina Faso, and Mali. For this purpose, SafeVeg aims to increase the intake of vegetables among urban and peri-urban consumers in Benin, Burkina Faso and Mali, by designing interventions to make locally produced vegetables more accessible, acceptable, affordable, and safe.

SafeVeg's Work Package 2 is contributing to this aim by looking at concerns from the consumer's perspective. Consumers play a central role in the food system and insights into their attitudes, knowledge, demands, and barriers can help researchers and policy makers design effective interventions which help increase healthy and safe consumption. From these, In turn, we can learn through which mechanisms interventions contribute to consumer behaviour change by measuring the determinants of behaviour. A consumer survey was designed and implemented to measure consumer behaviour and determinants of behaviour.

1.2 Research aim

The overall aims of the consumer survey were:

- To get insights into the vegetable consumption behaviour (peri-)urban consumers in Benin, Burkina Faso and Mali, and their interface in the food environment;
- To identify entry points for potential interventions.

1.3 Approach

During the course of 2022, consumer surveys were conducted in (peri-)urban Benin, Mali, and Burkina Faso to investigate vegetable consumption behaviours and identify possible entry points for interventions. This report provides the methodologies of these surveys while the outcomes of the surveys are described in a separate publications (Snoek et al., 2023a, Snoek et al., 2023b, Snoek et al. 2023c).

1.4 Outline of the report

This report is structured into four sections. Chapter 2 describes the study area and subjects. Chapter 3 provides details on the study sampling and Chapter 4 on the study procedure. Finally, Chapter 5 describes are measures used with their sources, information on validity of the measures and factor structure when applicable.

2 Study area and subjects

2.1 Subject selection

In the overall project, there is an emphasis on women and youngsters, but men are also included since in more than half of the households the husband makes the most decisions about purchases. Mothers of young children are also less mobile and rely on their family. There are several advantages to focus on youth also, in the consumer interventions. For the survey however, since the aim is to get insights into consumer behaviours and potential entry points for intervention, we will select participations as much as possible to reflect a representation of the diversity of consumers in the study area. Study participants were selected according to the following criteria:

- Being an adult, aged 18 years or over;
- Being responsible for buying food and/or being responsible for making the decision about what food to buy;
- Willing to comply with all study procedures;
- Confirmed informed consent;
- A diverse sample in term of socio-economic status (including slum, low income, and middle income but excluding high income (as the key groups in the project plan are youth and women));
- A good geographic spread

2.2 Study area

In SafeVeg WP6 a food environment scan has been implemented. In this scan the specific study areas were selected in three steps:

1. Census data for dense population (proxy for poor);
2. Talking to local administrators about poor or marginalised areas to get to;
3. Select the main/central secondary school as a starting point and sample every outlet within 1 km in all directions

In **Benin**, this approach resulted in the selection neighbourhoods in the following cities: Parakou, Porto Novo, Cotonou, and Abomey-Calavi. All four cities were also included in this consumer survey. For practical reasons, the study started in Parakou and one week later in Cotonou, Abomey-Calavi and Porto Novo combined.

In **Mali**, not all area identified in WP6 could be included due to budget and time constraints. We selected: Bamako, Kati, and Sikasso. Kati was selected since it is an urban area but provides and produces a lot of vegetables therefore we expected differences in availability of vegetables. The Kati region also provides vegetables to Bamako and the bulk of the potatoes and all sweet potatoes of Mali are coming from Sikasso. Bougouni and Koutiala are also urban areas but were not selected since religion and cultural area were considered comparable with Sikasso, therefore vegetable consumption was considered comparable with Sikasso. Baguineda and Farabana were not be selected as they are rural areas.

For **Burkina Faso** we included Ouagadougou and Bobo Dioulasso since these cities are by far the most important in terms of population size.

3 Study sampling

In Benin, Mali, and Burkina Faso there are three levels of geographical location for most cities: 1. The city level or municipality (commune in French), 2. The districts (arrondissements in French), and 3. The neighbourhoods (quartiers in French). In each city, the sampling will be done in several steps: First selection of districts, then selection of neighbourhoods in districts and finally selection of households in neighbourhoods.

3.1 Selection of districts

The selection of the districts in each city was done based on knowledge of the cities and based on the following criteria: 1. Coverage of main places of vegetables access such as large markets, production sides in and near the city. 2. Main facilities that attract a specific type of consumers such as university, government buildings, business centre, living areas, slums etc. And 3. Geographical issues such as city centre, near the river, etc. The choice of districts was suggested by the country coordinator and discussed in the team.

In **Benin**: we included all 3 districts in Parakou. In Porto Novo and Abomey-Calavi we selected 3, and in Cotonou we selected 5 districts. In Appendix 1 an overview of all districts is presented.

Table 3.1 Selected districts per city in Benin

City	Neighbourhoods	Districts (total)	Districts selected
Parakou	4-13 per district (42)	3	3
Porto Novo	9-29 per district (86)	5	3
Cotonou	8-22 per district (143)	13	5
Abomey-Calavi		9	3

In **Mali**: we selected 3 districts in Bamako, in Kati and Sikasso there is only one district, so we included that one.

Table 3.2 Selected districts per city in Mali

City	Neighbourhoods	Districts (total)	Districts selected
Bamako	52	6	3
Kati	11	1	1
Sikasso	15	1	1

In **Burkina Faso**: we selected 5 districts in Ouagadougou and 3 in Bobo Dioulasso.

Table 3.3 Selected districts per city in Burkina Faso

City	Neighbourhoods	Districts (total)	Districts selected
Ouagadougou	55	12	5
Bobo Dioulasso	72	7	3

3.2 Selection of neighbourhoods

Then, within the selected districts all neighbourhoods were identified according to geographic coverage and income level. First, to have a good coverage of the city on neighbourhoods were described as city centre and more towards the outside of the city to ensure a good geographical spread. In addition, we contacted the local authorities of the selected districts and ask them about the neighbourhoods in the districts, which one could be considered slum, low-income, middle-income, and high-income areas. This was be done based on average housing and living environment conditions in the neighbourhood. Such as: materials of walls and roofs, number of rooms, access to electricity and water, conditions of the roads. The country coordinator made a description of these conditions and present this to the local government to ensure that all have similar definitions. All neighbourhoods were mapped on Conditions of the roads (good, medium and bad); Access to electricity and water (totally, partly, no access); Number of rooms; and Income level (Slum, low, medium, high) which resulted from all criteria combined. And finally, districts that have neighbourhoods with the different income groups (e.g. slum) were chosen over those that did not. Based on this and the geographical area neighbourhoods of the selected districts were sorted in a table according to degree of urbanisation and income level.

For each cell one or two neighbourhoods were selected; one if there were 3 districts or more and 2 if there was only one district. Neighbourhoods were selected according to the following strategy:

1. If there is only one or two in a cell that one or two were chosen
2. If there is a WP6 neighbourhood in a cell that one is chosen, unless it is a high income neighbourhood since those are excluded; if there is more than one two WP6 neighbourhood in one cell one is two are randomly chosen
3. If there are more than 1 (or 2) neighbourhoods per cell one is chosen randomly

This resulted theoretically in 6-12 neighbourhoods per district. However, in some districts one or more cells were empty since for example all slum areas were in the outskirts of the city rather than the city centre. If there is an empty cell one will be chosen that is most comparably; first choice: similar cell in another district, second choice similar income level but urban/peri-urban, third choice similar peri-urban/urban but other income level (if more than one option: random). In almost all cities, the neighbourhoods were not equally distributed over the districts. For example, in Porto-Novo most middle-income neighbourhoods (5 out of 7) were in one district since other districts had few middle-income neighbourhoods and most low-income neighbourhoods were in another district (see Appendix 2 for more details). Also, the number of neighbourhoods differed per country and per city. In some cities there were several neighbourhoods per district and two were selected for each category, whereas in other cities, districts had only few neighbourhoods and one was selected. If fewer neighbourhoods could be included due to either fewer number of neighbourhoods in general or since the distribution of neighbourhood types was not equally spread (e.g., few urban middle income), the number of households per neighbourhood was increased to ensure sufficient respondents per neighbourhood type.

For **Benin**: In Cotonou, none of the neighbourhoods could be considered peri-urban due to the geographic position of the city, the urbanisation degree is high. In Abomey-Calavi there are only 3 slum neighbourhoods in the selected districts, all peri-urban.

Table 3.4 Number of neighbourhoods selected per city in Benin

City	Districts selected	Slum urban	Slum peri-urban	Low-income urban	Low-income peri-urban	Middle-income urban	Middle-income peri-urban	Total
Parakou	3	0	6	3	3	6	0	18
Porto Novo	3	3	3	4	2	3	3	18
Cotonou	5	5	0	10	0	10	0	25
Abomey-Calavi	3	0	3	3	3	3	3	15
Total	14	8	12	20	8	22	6	76

For **Mali**: In Bamako, all slum areas in the selected districts were included, that were only 4. For Kati, one slum area was included since there was only one. None of the low and middle-income areas could be classified as 'peri-urban'.

Table 3.5 Number of neighbourhoods selected per city in Mali

City	Districts selected	Slum urban	Slum peri-urban	Low-income urban	Low-income peri-urban	Middle-income urban	Middle-income peri-urban	Total
Bamako	3	2	2	3	2	3	3	15
Kati	1	0	1	2	0	1	0	4
Sikasso	1	2	0	1	1	1	1	6
Total		4	3	6	3	5	4	25

For **Burkina Faso**: In Ouagadougou all four slum income neighbourhoods were included, and all were peri-urban. Also, all four peri-urban middle-income neighbourhoods are included. In Bobo-Dioulasso, all seven slum income neighbourhoods were included, as all were peri-urban. Similarly, all middle-income areas were also peri-urban. One area that had been defined as low income and peri-urban turned out to be more middle-income on the ground and was excluded (Secteur 28 in district 6). Since there were no other low-income urban neighbourhoods, sample sizes in low-income peri-urban neighbourhoods were increased.

Table 3.6 Number of neighbourhoods selected per city in Burkina Faso

City	Districts selected	Slum urban	Slum peri-urban	Low-income urban	Low-income peri-urban	Middle-income urban	Middle-income peri-urban	Total
Ouagadougou	5	0	4	5	5	5	4	23
Bobo Dioulasso	3	0	7	0	5	3	3	18
Total		0	11	5	10	8	7	42

3.3 Selection of households

In the third and final step, a convenience sample of consumers were recruited through a door-to-door approach in the selected neighbourhoods. Since neighbourhoods will have some diversity in housing, interviewers selected only houses that fitted the criteria for either slum area, low income, or middle income. Also, the border between neighbourhoods is not always clear, especially in urban areas, one neighbourhood goes into another without a clear border. To ensure that data was collected in the intended neighbourhood, in Benin and Mali a circle was drawn from the neighbourhood centre and enumerators stayed within this 1 kilometre radius. This method was the same used by SafeVeg WP6 team in Benin. In Burkina Faso, the neighbourhoods were divided in North, South, East, and West and from each section households were selected. The total number of households in an area is therefore divided into 4. The interviewer's starting point was the main market, from there interviewers randomly chooses the first household, then counts 5 households afterwards to investigate the next household and so on until the limit of the first quarter was reached. This was repeated until all four quarters were covered. If the household encountered seems to be an atypical household, i.e. a household that seems to belong to the high-income class, then the following household was considered. From the beginning, the interviewer walks and estimates the limits of the neighbourhood, so that the household jumps are made in such a way that the whole neighbourhood is covered.

In **Benin**, a minimum of 17 respondents were selected per neighbourhood with the actual number based on the reality of each city: that is the number of available households. For each category of consumers (slum urban, middle income peri-urban, etc.) for each city, 51-85 respondents were included (51 for cities with 3 districts and 85 for cities with 5 districts. This resulted in a sample of 306 in Parakou, 306 in Porto Novo,

306 in Abomey-Calavi and 510 in Cotonou, 1,428 in total (102 respondents in each district). See also Appendix 2 for a more detailed description per district and neighbourhood.

Table 3.7 *Planned sample size per city per neighbourhood type in Benin a)*

City	Slum urban	Slum peri-urban	Low-income urban	Low-income peri-urban	Middle-income urban	Middle-income peri-urban	Total
Parakou	0	102	51	51	102	0	306
Porto Novo	51	51	68	34	51	51	306
Cotonou	170	0	170	0	170	0	510
Abomey-Calavi	0	102	51	51	51	51	306

a) Actual numbers were equal or higher.

In **Mali**, a minimum of 51 respondents were selected per neighbourhood in Kati and Sikasso. In Bamako, a minimum of 35 respondents were selected, resulting in 1,242 respondents in total: 306 in Sikasso, 306 in Kati and 630 in Bamako (210 respondents in each district).

Table 3.8 *Planned sample size per city per neighbourhood type in Mali a)*

City	Slum urban	Slum peri-urban	Low-income urban	Low-income peri-urban	Middle-income urban	Middle-income peri-urban	Total
Bamako	106	106	105	106	105	105	633
Kati	0	102	102	0	102	0	306
Sikasso	102	0	51	51	51	51	306

a) Actual numbers were equal or higher.

In **Burkina Faso**, a minimum of 20 respondents will be selected per neighbourhood in Ouagadougou and 17 respondents will be selected per neighbourhood in Bobo Dialasso. For each category of consumers (slum urban, middle income peri-urban, etc.) in each city at least 51-100 respondents were included. This results in a sample size of 661 in Ouagadougou and 350 in Bobo Dialasso, 1,012 in total, which was above planned sample sizes.

Table 3.9 *Planned sample size per city per neighbourhood type in Burkina Faso a)*

City	Slum urban	Slum peri-urban	Low-income urban	Low-income peri-urban	Middle-income urban	Middle-income peri-urban	Total
Ouagadougou	0	200	100	100	100	100	600
Bobo Dioulasso	0	106	0	110	51	51	318

a) Actual numbers were equal or higher

In the final data collection, slightly more consumers were recruited than was planned. In some neighbourhoods more respondents than the minimal amount required were recruited but never less than the planned sample sizes. This deviation from the original plan was not considered an issue since the aim was to have a diverse rather than a representative sample.

3.4 Seasonality and timing

In Burkina, the dry season lasts about 8 months, between October and the end of April, or even May in the almost desert North. The rainy or wintering season lasts from May-June to the end of September or the beginning of October, and reaches its peak in August. A previous study in rural west-Burkina Faso showed that three groups of products were more seasonal than others (Lourme-Ruiz 2021): vitamin A-rich fruits (mainly mango) peaked in April compared with February or August. More leafy vegetables were consumed in August and 'other vegetables' more in February compared with other seasons (especially low in April). Seasonality also influences the diversity of available foods, however with regional differences (Achigan-Dako et al., 2010).

4 Study procedure

Data was collected through structured telephone interviews administered by tablets. All instructions, questions and answer categories were programmed in the KoBo toolbox software in French and then translated to local language. Interviewers followed a two-day training prior to the start of the survey and as part of the training, a pilot survey was conducted by each enumerator and discussed in the group. Some questions were found incorrect and were directly adjusted in the toolbox.

Interviews will be done with consumers at their home. Face-to-face with an enumerator reading out the questions and inputting the answers in a smartphone or tablet. To ensure a good data collection process, the research team contacted local authorities prior to the recruitment of respondents.

Consumer consent was done in two steps. First, the enumerator shortly introduced themselves (name, institute, and purpose of the study) to the first adult person willing to speak to them and asked if they could answer a few questions to assess the person's willingness and qualification for participation. After questions on age, responsibility for cooking, and responsibility for grocery shopping, the most suitable adult person (between 18 and 70) responsible for cooking (preference) or decision making about the food, or both, present in the household at that time and willing to respond was identified. From this person an informed consent was obtained. In the affirmative, informed consent was read and oral recorded consent was collected. Research participation was voluntary, and participants had the right to withdraw at any moment without given any reason. The research was conducted in accordance with the principles of the Declaration of Helsinki (World medical association, 2013) prior to the consent, respondents were provided with information about the funders, the access to data (restricted to researchers involved), project partners, and possibility to gain for information about the project (card with website). Also, they were given to opportunity to ask questions.

No personal data was recorded such as names, address, or phone numbers. Names were used only during the interview for reasons of politeness and to identify the person to be interviewed but only initials were recorded. We did however collect GPS coordinates. Data was stored in a safe place on a shared drive of Wageningen University and handled confidentially.

Participants received a small incentive for their participation, in Benin and Mali this was a vegetable voucher and in Burkina Faso two pieces of soap. The value of the incentive was CFA 1,000 which equals approximately 1.5 euro.

5 Measures

Below, the measures used in the questionnaire are described in detail. Some general issues: Items from scales were presented in a randomised order to the respondents. Apart from the Food insecurity scale where the items represent an increasing level of food insecurity. Also, show cards were used to facilitated respondents with answers on the 7-point scales, these were the answer categories printed in a large font size that the respondents could use by pointing his or her finger to the right category. Also, show cards were used for all questions in specific vegetable type showing pictures of all vegetables with their names in French and in local language.

5.1 Identification

City, district, and neighbourhood were recorded as well as date of interview and interviewer. Finally, GPS coordinates were estimated by the KOBO software on the interviewers' mobile phone.

5.2 Introduction, selection questions, and informed consent

5.2.1 Selection criteria: age and position in household

Questions one age, gender, responsibility of preparing food, deciding about what food to buy, responsibility for buying food, and whether the person was the household head were recorded for each adult in order to identify the best person to interview.

5.3 Overall diet including vegetable consumption

Diet quality was measured with the Diet Quality Questionnaire (DQQ): a 24 h recall questionnaire consisting of dichotomous Yes/No questions. The methodology and food groups asked for were based on Herforth et al. (2019) and adapted for specific countries.¹ It consisted of 28 food groups and participants were asked about their consumption of specific food items, most commonly eaten in their country, as a proxy for the food group. Since amaranth was not included in the original questionnaires for Benin and Burkina Faso but considered an important vegetable by stakeholders it was included as a separate question but not included in dietary quality calculations. Due to a mistake, the questionnaire was not adapted well for Mali in the KOBO toolbox and therefore accidentally the Benin version of the DQQ was administered. In all food groups most foods are similar but there are also differences in foods and therefore this outcomes should be considered with great caution. The differences were sometimes formulations (e.g. canned meat versus corned beef) but in other cases foods were different (e.g. tamarind drink in the Mali questionnaire and not in the Benin version). See Appendix 3 for a detailed comparison of the foods. Based on the dichotomous answers with yes being 1 and no being 0 dietary diversity scores were calculated.

5.3.1 Global Dietary Recommendation (GDR) score: GDR healthy, GDR limit, and GDR

The Global Dietary Recommendation score is a method to measure the adherence of a population to 11 global dietary recommendations, its methodology was also developed by Herforth et al. (2020). It captures risk factors positively and negatively associated with the risk of NCDs (Global Diet Quality Project, n.d.). To calculate the GDR score, the score of food groups that should have a limited intake (GDR Limit) was subtracted from food groups that should be consumed to follow a diverse and healthy diet (GDR Healthy).

¹ <https://www.globaldietquality.org/dqq>

Both scores can take a range from 0 to 9. The GDR score is the combination of GDR healthy minus GDR limit and can range from -9 to 9. The cut-off value of ≥ 1 indicates that at least 6 out of 11 global dietary recommendations are met.

5.3.2 HO Fruit and Vegetable indicator (WHO-FV)

To analyse the status of fruit and vegetable consumption within the population, the WHO-FV indicator, created by Herforth et al. (2020), was used. It is a population indicator for the consumption of ≥ 400 g of vegetables per day, as recommended by the WHO. The score is computed by summing the consumption of the food groups provided in Appendix 3. Each group contributed one to the score, giving a possible range of 0-6. The cut-off of ≥ 3 indicated adhering to the WHO recommendation. Note that this score and cut-off values have not yet been validated in all populations.

5.4 Motives

5.4.1 General food motives and safety motives

Finally, to assess the general food choice motives we used an 11-item scale based on the single-item FCQ (Onwezen et al., 2019) with several adaptations for the reason that after developing this questionnaire new findings revealed better insight into the underlying dimensions of sustainability. Firstly, the original three items in this questionnaire 'is environmentally friendly,' 'is animal friendly,' and 'is fairly traded' have been omitted. Secondly, two items from the Sustainable Food Choice Questionnaire (SUS-FCQ) have been added: 'is local and/or seasonal' and 'is produced in a way that is not harming the environment' (Verain et al., 2021). Thirdly, the item 'is safe' was self-developed by Snoek et al. (2021) and used for the first time in a survey. It was added to include food safety as motive as this item was not yet included in the original FCQ and the single-item FCQ. The single-item FCQ and the SUS-FCQ are validated questionnaires. All items were scored on a 7-point Likert scale ranging from 1 = not important at all to 7 = extremely important. The FCQ was originally measured on a 4-point Likert scale, but has been adapted to a 7-point scale, which also features in more recent studies (Cabral et al., 2017; Dowd et al., 2013) to ensure consistency with the single-items FCQ.

5.4.2 Multi item version safety motives

Food safety motives was measured with 7 newly developed items based on earlier qualitative studies on food safety perceptions of consumers in low and middle-income countries. The food safety motives were measured on a 7-point scale. The questions were phrased in a similar way as the FCQ starting with the statement 'It is important to you that the food you eat on a typical day...' and included items related to hygiene (Comes from a clean place; Is handled in a hygienic way), freshness (Is fresh; Does not have an unpleasant smell), chemical contamination (Is free from contaminations and adulterations (e.g. pesticides, fertilisers or chemicals); Is grown naturally without use of medicine or chemicals) and one item on viruses (Is free from viruses) that was added in light of the COVID crisis. The factor structure was checked with EFA in the three countries and in each country 2 factors were found with eigenvalues above 1 but the pattern matrixes did not show a consistent pattern. In Benin, there seemed to be a second factor that included the two hygiene-related items and one item on freshness but both hygiene related items also loaded on the first factor and the question on unpleasant smell loaded on both factors. In Mali a clear structure was found with both hygiene related and both freshness-related items loading on a second factor. In Burkina Faso on the other hand, the two hygiene related items and the smell item loaded on the same factor. But unexpectedly, the item on virus also loaded on this factor while the freshness item loaded on the other factor. Overall, either a single factor structure or a two factor structure with 3 items on contamination and 4 items on freshness and hygiene seemed to best fit with data over the three countries and with interpretations. Alphas were calculated and especially the fresh and hygiene factor showed a somewhat lower alpha. Therefore, the one-factor structure was chosen which had a sufficient reliability in all three countries with Cronbach's alphas between .75 and .80.

Table 5.1 *Cronbach's alphas of safety motive constructs*

		Cronbach's alpha
Safety motive (multi-item)	Benin	.796 a)
	Mali	.749
	Burkina Faso	.804
Safety motive (fresh and hygiene)	Benin	.643 b)
	Mali	.677
	Burkina Faso	.663 c)
Safety motive (not contamination)	Benin	.824
	Mali	.753
	Burkina Faso	.675 d)

a) improves to .826 if item on freshness is deleted; b) improves to .718 if item on freshness is deleted; c) improves to .835 if item on freshness is deleted; d) improves to .711 if item on virus is deleted.

5.5 Intake of vegetables

To estimate the respondents' usual vegetable intake, the standardised Food Frequency Questionnaire (FFQ), developed and validated by Van Assema et al. (2002) was applied. This FFQ measures usual fruit and vegetable intake. FFQs are considered a suitable tool to rank individuals according to their usual consumption of foods or food categories (Thompson et al., 2013). As we aimed to identify and rank the SEC on their usual vegetable consumption behaviour, the FFQ fitted the best whereas it is less suitable for establishing the level of intake of a population. Respondents indicated their usual consumption frequency (number of days per week) and usual consumption amount of both cooked and raw vegetables (number of servings in spoons). These data were converted in three steps to determine total vegetable intake: Converting intake levels into meaningful data (into portion sizes), multiplying the intake frequency by portion sizes, and adding together the subgroups raw and heated vegetables (van Assema et al., 2002). A serving spoon is needed for each enumerator to show to the respondents when discussing the portion sizes that they consume. For number of days, the scale ranged from 0 to 7 with the possibility to also use for example 0.5 (twice a month) or 0.25 (one per month). For portions the scale ranged from 0 to 7 (7 or more) but in practice also 8 and 9 portions were used since not all enumerators restricted to the options provided.

The choice of vegetables presented on the show cards was based on: 1. All vegetables included in the DQQ, 2. vegetables that were mentioned as important in stakeholder workshops (Raaijmakers et al., 2023abc), and 3. lettuce, onion, cucumber, tomato, cabbage, and carrots were added if not yet in the list since we asked also explicitly about raw vegetable use. Pictures were presented for vegetables that can be eaten raw and cooked separately.

Table 5.2 Final list of vegetables used in the questionnaire and on show cards in local language or French

	Benin	Mali	Burkina Faso
DQQ	1. Carottes, 2. patate douce à chair orange, 3. feuilles de mauve de jute (crin crin), 4. feuilles d'aubergines (gboman), 5. feuilles d'amanvivè /vernonia, 6. feuilles de manioc, 7. Feuilles d'oseille, 8. feuilles de moringa, 9. feuilles de haricot, 10. feuilles de gombo, 11. Tomates, 12. aubergine, 13. gombo, 14. chou, 15. betterave, 16. Concombre, 17. poivron vert, 18. haricots verts, 19. champignons	1. Carottes, 2. courge, 3. patate douce à chair orange, 4. feuilles d'aubergine, 5. feuilles de manioc, 6. epinards, 7. fakoye, 8. feuilles de patate douce, 9. feuilles de moringa, 10. feuilles de baobab, 11. feuilles de niébe, 12. Tomate, 13. aubergine, 14. n'goyo, 15. gombo, 16. concombre, 17. choux, 18. poivron vert, 19. haricots verts, 20. salade / laitue	1. Carottes, 2. courge, 3. citrouille, 4. patate douce à chair orange, 5. feuilles de boulvaka, 6. feuilles de baobab, 7. feuilles d'oseille, 8. feuilles de moringa, 9. feuilles de haricots, 10. Feuilles de courge, 11. feuilles d'aubergine, 12. feuilles de patates douces, 13. feuilles de manioc, 14. feuilles d'amaranthe, 15. babenda, 16. Tomates, 17. Aubergine (gboma), 18. chou, 19. gombo, 20. concombre, 21. haricots verts, 22. poivron vert, 23. fleurs de kapok
Added from stakeholder workshop	20. Feuilles d'amarante (fotêtê), 21. feuilles d'hibiscus, 22. feuilles de niébé	21. Betterave, 22. feuille arachide, 23. feuilles d'amaranthe	24. feuilles de niébé, 25. oignon, 26. cleome, 27. feuilles de citrouille 28. epinards
Added from Van Assema (raw vegetables)	23. laitue, 24. oignon	24. oignon	29. laitue

5.6 Vegetables sourcing

5.6.1 Own production

This section included questions on growing of vegetables by the household, types of vegetables grown, purpose (own consumption, selling, or gifts for friends and relatives), and motives for growing vegetables. Questions were based on earlier research experiences by the team.

5.6.2 Purchase frequency of specific vegetables

Purchase of vegetables was asked for the past week. To assist the respondent in memorising purchases of last week, first they were asked about different outlets (open market, street vendor, neighbourhood store, farmers' market, supermarket, and other places) as well as the number of days they went to this place. Next, going down into their memories for each occasion (day and point of purchase) the interviewer stated: 'Think about the time you went to ...' followed by the name of the outlet. Then asked 'Which vegetables did you buy?' and 'How much did you buy on this occasion?'. To assist the choice of vegetables, the show card with the picture of the vegetables was presented. The same selection of vegetables was used as for the intake of vegetables question but all vegetables were put together instead of raw and cooked separately.

5.7 Access and general attitude main outlets

5.7.1 Dimension of access for primary and secondary outlets

Access was defined by availability, accessibility, accommodations, affordability, and acceptability similar to the model developed by Penchansky and Thomas (1981). The model was developed for healthcare services but translated to food outlets. In the model, **availability**, is the relationship of the volume and type of existing resources) to the client's volume and types of needs. In other words, the adequacy of the products offered. **Accessibility**, the relationship between the location of supply and the location, taking account of persons' transportation resources and travel time, distance, and cost. **Accommodation** is the manner in which the supply resources are organised to accept clients (including hours of operation and services) and the clients' ability to accommodate to these factors and their perception of the appropriateness.

Affordability, the relationship of price and people's income, ability to pay, possible credit arrangements, etc. **Acceptability**, the relationship of clients' attitudes about personal and practice characteristics of providers to the actual characteristics of existing providers. Acceptability was considered to be covered by other parts on the questionnaire on motives for vegetable choice. For the other 4 concepts, specific items were constructed based on the definitions and literature. Freedman et al. (2013) used a similar model to define nutritious food access including economic, spatial, and service delivery aspects contributing to the concepts of affordability, accessibility, and accommodation, and availability. Also, items were based on earlier qualitative and quantitative studies in Bangladesh on motives for buying from specific outlets, such as ability to get products on loan (Snoek et al., 2021). Finally, to the accommodation concept, we added also a question on trust given the importance of trust in consumer vendor relationships.

The scale consistent of 14 items on availability (3), accessibility (4), affordability (3), and accommodation (4) as was asked for the primary outlets for buying vegetables as well as the second most important outlet, defined by the respondents themselves. Factor structure was calculated for the first outlet and supported the intended four factor structure, with the exception that 'operation hours' showed mixed results. In Benin and Mali, the item loaded on the dimension 'availability' rather than on 'accommodation'. The factor of accommodation included three items that were perhaps more related to the relationship between consumer and vendor rather than general service provided by the shop. In Burkina Faso, the item operation hours had loadings on several of the dimensions. Apart from that item, the intended factors were confirmed with EFA in Burkina Faso. In Mali, in addition to the operation hours items, also the item 'trust in vendor' did load on the intended factor but had loadings above .3 on two other factors. For reasons of consistency we used the same structures as in the other countries including the 'trust in vendor' item. Since Cronbach's alpha for the factor accommodation were low, in future studies this needs more exploration.

Cronbach's alphas in Benin were .72 for availability, .89 for accessibility, .75 for affordability, and .64 for accommodation. Cronbach's alphas in Mali were .80 for availability, .92 for accessibility, .67 for affordability, and .55 for accommodation. Cronbach's alphas in Burkina Faso were .86 for availability, .96 for accessibility, .84 for affordability, and .56 for accommodation. Alphas were also calculated for a total access score that included all the items: .80 in Benin, .70 in Mali, and .84 in Burkina Faso.

Scores on each item were combined for first and second outlet per outlet. So for each outlet either the first or the second score was used or none depending on the outlets that were reported.

5.7.2 General attitude

The attitude towards the primary and secondary outlet for buying vegetables was measured using a five-item questionnaire—three items for cognitive attitude (safe, fresh, neat) and two items for affective attitude (good, of high quality) (Crites et al., 1994). The use of bipolar items (e.g., good/bad) such as used in the original scale was not well-understood in earlier studies with respondents of lower literacy and the questionnaire being read aloud by and interviewer (Snoek et al., 2021). Therefore, we used a seven-point answering scale ranging from strongly disagree to strongly agree.

Benin: Primary outlet's factor structure showed one factor with an eigen value above one that explains 56.6% of the variance. It also showed a good Cronbach's alpha of .782. Secondary outlet's factor structure

showed two factors with an eigen value above 1. Factor 1 was comprised of 3 items (fresh, nice, and good) that explained 53.8% of the variance with factor loadings from .579 to .839. The other 2 items (safe, of high quality) loaded on factor 2 that explained 23.9% of the variance with factor loadings from -.294 to .679. However, Cronbach's alpha was .746 which is considered good.

Mali: Both primary and secondary outlet's factor structure showed one factor with an eigen value above one that respectively 59.3% and 60.5% of the variance. It also showed a good Cronbach's alpha of .827 for primary and .836 for secondary outlet.

Burkina Faso: Both primary and secondary outlet's factor structure showed one factor with an eigen value above one that respectively 67.3% and 64.8% of the variance. It also showed a good Cronbach's alpha of .877 for primary and .863 for secondary outlet.

We decided it is best to still report the secondary outlet of Benin as it is the only secondary outlet that had two factor loadings across the datasets. This allows us to have uniformed reporting for all three countries.

5.8 Safety perceptions and trust in food chain, access, and attitudes

5.8.1 Optimism and pessimism

Furthermore, participants' confidence in the safety of food was measured by a validated 7-item scale by De Jonge (2008). This scale comprised of two dimensions of confidence: optimism and pessimism. Contrary to the 5-point Likert scale that has been used in this study we applied a 7-point scale ranging from 1 = 'strongly disagree' to 7 = 'strongly agree'. We adapted the questions to focus them on vegetables rather than food in general.

Factor analysis showed two factors with an eigen value above 1. Optimism and pessimism were calculated and showed good Cronbach's alphas: .939 for optimism and .761 for pessimism in Benin. In Burkina Faso, Cronbach's alphas were .906 for optimism and .802 for pessimism. Alphas would have increased if the item 'As a result of the occurrence of food safety incidents you are suspicious about certain vegetables' was deleted but for reasons of consistency the same calculations were done in all three countries.

5.8.2 Product attributes vegetables focused on safety

Since no scale on product safety attributes was found in literature we developed a list of attributes to be tested. In total 26 attributes were presented to consumers. Consumers were asked for each attribute to tell how much they agree or disagree to some statements for the vegetables that are sold in places where they or members from their household usually buy. Agreement was given on a 7-point scale ranging from 1 = 'strongly disagree' to 7 = 'strongly agree'. Attributes were selected on 7 domains: general safety/ not harming (3 items), contamination (8 items), appearance (3 items), freshness (4 items), origin (3 items), cleanness (3 items), and other motives (2 items). The domains and the specific attributes were based on an earlier qualitative study that explored perceptions of safety in urban Bangladesh (Snoek et al., 2021) and on the food choice motive questionnaire (Steptoe et al., 1995).

5.8.3 Trust in actors

Similar to Macready et al. (2020) in Europe and Li et al. (2021) in China, consumers' overall trust in actors was measured by asking respondents, 'how much trust you have in the following groups regarding the production, selling and regulation of safe vegetables,' and scored for each actors on a 7-point scale (1 = very little trust to 7 = very high level of trust). The following actors were included with the definition that was copied from Macready and adapted a bit to the context of Africa: farmers (producing plants and animals for human consumption), retailers (supermarkets, markets, food stores) and authorities (government agencies).

In the original scale food manufacturers are also included but we excluded them since we had a focus on fresh vegetables.

5.8.4 Safety perception vegetables

Consumers were asked to rank eight foods from most safe to least safe. The food groups included fruits and vegetables, more specifically: Fruits, Green leafy vegetables, Other Vegetables. And in addition food groups that, according to literature have a high risk for microbiotic and/or chemical contamination: Fresh fish, Egg, Chicken, Milk, Casava and yam, Groundnuts. Fresh animal based products are known for their risk of microbiotic contamination while the main food contributors to residues and chemicals in the West-African diet were staples (maize, sorghum, rice, millet, cassava), peanuts, oils, and smoked fish (Ingenbleek et al., 2020). A selection of those foods was made based on what is most commonly consumed in the countries.

5.9 Abilities

5.9.1 Subjective knowledge questionnaire safe vegetables

The respondents' own perception of their knowledge about vegetables was measured with the three item-scale subjective knowledge scale developed by Aertsens and colleagues (2011).

Two items was framed positively meaning that higher scored represented a higher knowledge (You know a lot about the safety of vegetables; Among your circle of friends, You are one of the 'experts' on safety of vegetables) and three items were phrased negatively (You do not feel very knowledgeable about the safety of vegetables; Compared to most other people, You know less about the safety of vegetables; When it comes to vegetables safety, You really don't know a lot). Additionally, one question was added related to the study purpose 'You would like to know more about the safety of vegetables'. Answers were given on a 7-point Likert scale ranging from 1 = strongly disagree to 7 = strongly agree. First, negatively framed items where recoded to have a positive scale. Next, exploratory factor analysis was conducted.

A final note, on this measure consumers scored relatively low indicating that they perceived themselves as having not so much knowledge on the safety of vegetables. We have to keep in mind that quite some items in the scale were negatively framed, if respondents simply agree with most

Table 5.3 Cronbach's alphas of the subjective knowledge safety scale per country

		Cronbach's alpha
Subjective knowledge safety	Benin	.77
	Mali	.76
	Burkina Faso	.79

5.9.2 Self-efficacy questionnaire consuming safe vegetables

The respondents' beliefs in their own ability to prepare and increase their vegetable consumption (self-efficacy) was measured with items on abilities to eat and consume safe vegetables (2 items), to determine how to choose safe vegetables when buying (2 items), kitchen skills related to safe preparing, use of safe water, hygiene, and heating and storing temperature (4 items). Answers were given on a 7-point Likert scale ranging from 1 = strongly disagree to 7 = strongly agree.

The factor structure was checked with EFA in the three countries and in each country a 2-factor structure was found with eigenvalues above 1 for each factor and a total explained variance between 59.5 and 79.3. The pattern matrix showed that consumption-related and kitchen skills-related items loaded on different factors. Cronbach's alphas were calculated and showed good values for both health and safety (see Table 5.4. In Benin, the item 'Vous savez comment garder une bonne hygiène dans la cuisine' did not contribute well to the alpha and in Mali the item 'Sur la base de vos connaissances, vous savez comment

chauffer et conserver les légumes à la bonne température.' Performed less. But for reasons of consistency all items were used in all countries.

Table 5.4 Cronbach's alphas of the safety self-efficacy scales per country

		Cronbach's alpha
Self-efficacy consumption safety	Benin	.85
	Mali	.76
	Burkina Faso	.78
Self-efficacy safe kitchen skills	Benin	.86 a)
	Mali	.70 b)
	Burkina Faso	.75

a) improved to .88 if items on keeping a good hygiene in the kitchen is deleted; b) improved to .79 if item on knowledge how to heat and store vegetables at good temperatures is deleted.

5.10 Out-of-home consumption

Respondents were asked how many days in the past week they had bought a meal (not a snack) from the following places:

- Mobile street food vendor (vendor going from home to home)
- Small informal restaurant (informal restaurant with a sitting area)
- Restaurant (formal big restaurant with a sitting area)
- Canteen (restaurant at a work location or school)
- Fast food (informal and formal restaurant where you can sit. It is with fast served small dishes, egg, spaghetti. This is often a small restaurant and serves in boxes/paper)

If needed, the interviewer used the definition to explain what was meant with the different outlet.

5.11 Demographics and Segmentation variables

Family composition was measured by question on marital status of the respondents, number of children between 1-17 years and total number of persons in the household. Children under 1 were not included in the calculation of household size. Demographic questions further included religion, ethnicity, migration (duration of living in the city and in the neighbourhood), education, and primary means of income for the household. The questions and answer categories were copied from those of the Demographic and Health Surveys (DHS) programme.²

5.11.1 Food (in)security scale

Food insecurity was measured by an 8-item scale based on the dichotomous (yes/no) Food Insecurity Experience Scale Survey Module of the FAO (1996) (Nord et al., 2016). The scale starts with the question 'Since March 2020, was there a time when because of lack of money or other resources you or your household members...' Which is followed by the eight statements that reflect food insecurity from milder (example: 'Were worried you would not have enough food to eat?') to severe levels (example: 'Went without eating for a whole day?') Scores are calculated by adding up the values '1' for each statement answered with yes. Cut-off points were defined as 0 = no food insecurity, 1-3 = mild food insecurity, 4 to 6 = moderate food insecurity, and 7 to 8 = severe food insecurity (Smith et al., 2017).

² <https://dhsprogram.com/>

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Appendix 1 District and neighbourhood description

Benin district description

City	Districts	Number of neighbourhoods	Population
Cotonou	1st district	10	57,962
	2nd district	12	61,668
	3rd district	13	69,991
	4th district	11	36,357
	5th district	15	20,039
	6th district	18	75,336
	7th district	12	27,535
	8th district	08	32,420
	9th district	04	57,691
	10th district	07	38,728
	11th district	13	34,879
	12th district	14	97,920
	13th district	06	68,486
Parakou	1st district	23	114,558
	2nd district	10	71,121
	3rd district	09	69,799
Porto- Novo	1st district	29	33,161
	2nd district	13	52,571
	3rd district	22	33,535
	4th district	14	63,306
	5th district	08	81,747
Abomey-Calavi	Akassato	10	61,262
	Godomey	09	253,262
	Glo-Djigbé	09	28,103
	Hèvié	05	67,218
	Kpanroun	08	9,679
	Ouèdo	06	27,522
	Togba	07	73,331
	Zinvié	11	18,157
	Abomey-Calavi	06	117,824

Mali description of districts

City	Districts	Number of neighbourhoods	Population
Bamako	1st district	Between 7-12	Unknown
	2nd district	Between 7-12	Unknown
	3rd district	Between 7-12	Unknown
	4th district	Between 7-12	Unknown
	5th district	Between 7-12	Unknown
	6th district	Between 7-12	Unknown
Kati	1st district	11	Unknown
Sikasso	1st district	15	Unknown

Burkina Faso description of districts

City	Districts	Number of neighbourhoods	Population
Ouagadougou	1st district	6	102,528
	2nd district	5	83,436
	3rd district	5	311,406
	4th district	4	207,647
	5th district	4	129,984
	6th district	5	222,854
	7th district	4	282,837
	8th district	3	152,880
	9th district	4	336,483
	10th district	5	263,969
	11th district	6	254,928
	12th district	4	66,314
Porto- Novo	1st district	5	70,165
	2nd district	10	191,254
	3rd district	9	122,536
	4th district	12	177,049
	5th district	12	152,296
	6th district	13	89,836
	7th district	8	181,467

Appendix 2 Neighbourhood selection

Benin

Cotonou

In Cotonou, none of the neighbourhoods could be considered peri-urban, this has to do with the position of the city since its growth is geographically restricted. Since no peri-urban neighbourhoods could be selected, two neighbourhoods per category (district and income level) were selected. In the final selection in Cotonou, 25 neighbourhoods were included. A total of 5 slum neighbourhoods were included (all urban), these were all slum neighbourhoods in the selected districts. Since we could not include 10 the number of respondents per neighbourhood was increased to 34 for the slum neighbourhoods only. For the low-income neighbourhoods, 10 were included, all urban, two per district. For the middle-income neighbourhoods, 10 were included, again all urban. In one district (no. 13) there were no middle-income neighbourhoods therefore those were replaced by one for the 4th and one from the 6th district.

Table *Final selection of neighbourhoods description by district of Cotonou (clean version)*

Districts	Slum	Low income	Middle income
4^{ème} District			
Urban	ABOKICODJI LAGUNE	MISSESSIN OHE	SODJATINME EST SODJATINME OUEST ^a ABOKICODJI CENTRE
6^{ème} District			
Urban	LADJI VOSSA	AHOANSORI TOWETA I HINDE II	AIDJEDO III GBEDJROMEDE JERICHO ^b
9^{ème} District			
Urban	VOSSA KPODJI -	ZOGBU ZOGBOHOU	KINDONOU FIFADJI
12^{ème} District			
Urban	- -	CADJEHOUN AZALOKOGON CADJEHOUN DETINSA	CADJEHOUN AGONGA FIDJROSSE KPOTA
13^{ème} District			
Urban	AHOGBOHOU -	AGLA MISSITE	^a ^b
Sample	34 per neighbourhood	17 per neighbourhood	17 per neighbourhood

^{a,b}This neighbourhood was included to substitute a neighbourhood in another district or from another neighbourhood type since in that district there was no other neighbourhood that matched the criteria for neighbourhood type.

Abomey Calavi

The final selection in Abomey Calavi included 15 neighbourhoods. All three slum neighbourhoods were included, and all three were peri-urban. Since not sufficient neighbourhoods could be included the number of respondents per neighbourhoods was increased to 34 for the slum neighbourhoods only. For the low-income neighbourhoods 6 were included; 3 urban and 3 peri-urban. Similarly, for the middle-income neighbourhoods also 6 were included; 3 urban and 3 peri-urban. In these neighbourhoods the sample remained 17 per neighbourhood.

Table *Final selection of neighbourhoods of Abomey-Calavi districts*

Districts	Slum	Low Income	Middle Income
AKASSATO			
Urban	-	MISSESSINTO	ADJAGBO
Peri Urban	ZOPAH PALMERAIS ^a KOLLECTIN	HOUEKEHONOU	^b
GODOMEY			
Urban	-	ASSROSSA	NONHOUENOU
Peri Urban	TOGBIN KPEVI	N'GBEHO	ALLEGLETA GBODJE-WOMEY ^b
ABOMEY CALAVI			
Urban	-	ZOGBADJE	AIFA
Peri Urban	^a	KANSOUNKPA	SEME
Sample	34 per neighbourhood	17 per neighbourhood	17 per neighbourhood

^{a,b}This neighbourhood was included to substitute a neighbourhood in another district or from another neighbourhood type since in that district there was no other neighbourhood that matched the criteria for neighbourhood type.

Porto Novo

In the final selection in Porto Novo, 18 neighbourhoods were selected. All 6 slum neighbourhoods (3 urban; 3 peri-urban) in the included districts were selected. For low income, 6 neighbourhoods were selected (4 urban; 2 peri-urban. Since there were not more than 2 peri-urban low-income neighbourhoods in the selected districts, we selected an additional urban neighbourhood. In addition, all urban neighbourhoods were in the same (the 2nd) district since other districts had no other low-income neighbourhoods. Finally, 6 middle-income neighbourhoods were selected (3 urban, 3 peri-urban).

Table *Final selection of neighbourhoods of districts of Porto- Novo city*

Districts	Slum	Low income	Middle income
2ème District			
Urban	^a	^b	TCHINVIE
Peri urban	GUEVIE-DJEGANTO ^e ZOUNKPA	AGBOKOU ODO	^g
3ème District			
Urban	OUENLINDA AHOLOUCOMEY FOUN-FOUN TOKPA ^d	ADJINA NORD ^b FOUN-FOUN SODJI OGANLA--ATAKPAME ^c OGANLA SOKE ^f	ADJINA SUD
Peri urban	AVAKPA TOKPA	ZEBOU-ITATIGRI	^h
5ème District			
Urban	^d	^c	DOWA CENTRE
Peri urban	^e	^f	TOKPOTA ZINLIVALI TOKPOTA DAVO ^g TOKPOTA DADJROUGBE ^h
Sample	17 per neighbourhood	17 per neighbourhood	17 per neighbourhood

^{a-f}This neighbourhood was included to substitute a neighbourhood in another district or from another neighbourhood type since in that district there was no other neighbourhood that matched the criteria for neighbourhood type.

Parakou

In the final selection in Parakou, 18 neighbourhoods were included. 9 urban and 9 peri-urban; 6 slum, 6 low income, and 6 middle income. No urban slum neighbourhoods were not found so those were replaced by peri-urban neighbourhoods from the same district. Also, no peri-urban middle-income neighbourhoods were found so those were replaced by urban middle-income neighbourhoods from the same district. In the 3rd district, no neighbourhood was found in the low-income peri-urban category, therefore it was replaced by a neighbourhood in that category from the first district.

Tableau 1 Final selection of neighbourhoods description by district of Parakou

Geographical	Slum area	Low income	Middle income
1st District			
City centre (urban)	^a	BAKINKOURA	TITIROU CAMP ADAGBE ^b
city outskirts (peri -urban)	BEROUYAROU TOUROU peulh ^a	TOUROU III (Tourou rivière) ^c TOUROU I (Tourou Palais royal)	^b
2nd District			
urban	^d	ZONGO-ZENON	BANIKANI ^e BAPARAPE
peri-urban	ASSAGBINE-BAKA ^d KOROBOROROU-PEULH	GOROMOSSO	^e
3rd District 3			
urban	^f	GANOU	ZONGO I ^g AMAOUIGNON DEKPAROU
peri-urban	WANSSIROU GAH WORE ^f	^c	^g
Sample	17 per neighbourhood	17 per neighbourhood	17 per neighbourhood

^{a-f} This neighbourhood was included to substitute a neighbourhood in another district or from another neighbourhood type since in that district there was no other neighbourhood that matched the criteria for neighbourhood type.

Summarising table sample size Benin

City	Slum urban	Slum peri-urban	Low-income urban	Low-income peri-urban	Middle-income urban	Middle-income peri-urban	Total
Parakou	0	6 x 17	3 x 17	3 x 17	6 x 17	0	
Total	0	102	51	51	102	0	306
Porto Novo	3 x 34	3 x 34	4 x 17	2 x 17	3 x 17	3 x 17	
Total	102	102	68	34	51	51	306
Cotonou	5 x 34	0	10 x 17	0	10 x 17	0	
Total	170	0	170	0	170	0	510
Abomey-Calavi	0	3 x 34	3 x 17	3 x 17	3 x 17	3 x 17	
Total	0	102	51	51	51	51	306

Mali

Bamako

The final selection in Bamako included 15 neighbourhoods. All slum areas were included. Since there were not enough neighbourhoods that fits within the criteria 'slum' + 'urban / peri-urban' the number of respondents in the included neighbourhoods increased from 35 to 53 respondents. The same applied for the respondents living in a 'low income' + 'per-urban' area.

Districts	Slum	Low income	Middle income
Comune I			
Urban	KOROFINA SUD (N=53)	BANCONI (N=35)	DJELIBOUGOU (N=35)
Peri-urban	KALÂBAMBOUGOU ^e (N=53)	LASSA ^c (N=53)	BOULKASSOUMBOUGOU ^d (N=35)
Urban		FADJIGUILA ^b (N=35)	LAFIABOUGOU (N=35)
Peri-urban	DOGODOUMA (N=53)	TALICO (N=53)	DJIKORONI (N=35)
Urban	NIAMAKORO N=53	SABALIBOUGOU (N=35)	DA0UDAB0UG0U (N=35)
Peri-urban			TOROCOROBOUGOU ^f (N=35)

^{a-f} This neighbourhood was included to substitute a neighbourhood in another district or from another neighbourhood type since in that district there was no other neighbourhood that matched the criteria for neighbourhood type.

Sikasso

The final selection in Sikasso included 6 neighbourhoods. The selected slum areas in WP6 were included, despite that they are both categorised as urban, no peri-urban area was included in the slum area. For the low-income and middle-income areas 2 neighbourhoods, for each one in the urban and peri-urban were selected.

Districts	Slum	Low income	Middle income
Urban	Sanoubougou I (N=51) Sanoubougou II (N=51)	Mamassoni (N=51)	Medine (N=51)
Peri-urban		Natien (N=51)	Bougoula hameau (N=51)

Kati

The final selection in Kati included 4 neighbourhoods. Regarding the slum area, there was no neighbourhood that was classified at 'urban' therefore the only slum area in Kati is included. to have enough power the number of respondents need to be increased from N=51 to N=102.

Regarding the low and middle-income area, none of the neighbourhoods are classified as 'peri-urban', therefore two neighbourhoods in the 'urban' area were selected in the low-income group. For the middle-income group the number of respondents will be increased from N=51 to N=201, as the second neighbourhood isn't safe due to security reasons (military barack).

Districts	Slum	Low income	Middle income
Urban		Kati Coura (N=51) Samakebougou (N=51)	Kati Koko (N=102)
Peri-urban	Farada (N=102)		

Summarising table sample size Mali

City	Slum urban	Slum peri-urban	Low-income urban	Low-income peri-urban	Middle-income urban	Middle-income peri-urban	Total
Bamako	2 x 53	2 x 53	3 x 35	2 x 53	3 x 35	3 x 35	
Total	106	106	105	106	105	105	633
Kati	0	1 x 102	2 x 51	0	1 x 102	0	
Total	0	102	102	0	102	0	306
Sikasso	2 x 51	0	1 x 51	1 x 51	1 x 51	1 x 51	
Total	102	0	51	51	51	51	306

Burkina Faso

Ouagadougou

The final selection in Ouagadougou included 23 neighbourhoods. All four slum income neighbourhoods were included, and all were peri-urban. Since not sufficient neighbourhoods could be included, the number of respondents per neighbourhood in these neighbourhoods were raised to N=50. All four peri-urban middle-income neighbourhoods are included, to include the sufficient number of respondents. the number of respondents living in these specific neighbourhoods will be increased to N=25.

Districts	Slum	Low Income	Middle Income
Arrondissement 2			
Urban		Secteur8 Hamdalaye ^c Secteur8 Larlé Secteur8 Marché du 10 Secteur11 Nimnin (N=20 each)	Secteur11 Dapoya (N=20)
Peri Urban			
Arrondissement 4			
Urban			Secteur18 Somgandé (N=20)
Peri Urban		Secteur19 Toudoubwéogo (N=20)	
Arrondissement 6			
Urban			Secteur25 Pagalayiri ^e Secteur27 Bongnaam (N=20 each)
Peri Urban		Secteur28 Sonré (N=20)	Secteur29 Songnaaba (N=25)
Arrondissement 9			
Urban			
Peri Urban	Secteur39 Toudweogo (N=50)	Secteur37 Yagma Secteur38 Silmiyiri ^d (N=20)	Secteur38 Kossoghin Secteur40 Dapaweoghin (N=25 each)
Arrondissement 11			
Urban		Secteur46 Kaatr jaar (N=20)	Secteur46 Zone 1 (N=20)
Peri Urban	Secteur47 Rayongo Secteur47 Yamtenga Secteur48 Karpala non loti (N=50 each)	Secteur50 Lanoyiri (N=20)	Secteur51 Sanyiri (N=25)
Total	N=200	N=200	N=200

Bobo-Dioulasso

The final selection in Bobo-Dioulasso included 18 neighbourhoods. All seven slum income neighbourhoods were included, as all were peri-urban (there are no urban neighbourhoods), this to assure that we've enough respondents living in a slum area. The same decision has been made to the respondents living in the neighbourhoods living in the low-income areas.

Districts	Slum	Low Income	Middle Income
Arrondissement 3			
Urban			Secteur 13 (N=17)
Peri Urban	Kékéléso (N=16) Léguéma (N=16) Moussobadougou (16) Noumousso (N=16)	Kouentou (N=22)	
Arrondissement 5			
Urban			Secteur 26 (N=17)
Peri Urban	Dingasso (N=16)	Dodougou (N=22)	Dogotélama (N=17)
Arrondissement 6			
Urban			Secteur 19 Kodenie (N=17)
Peri Urban	Logofourouso (N=16) Samaragan (N=16)	Farakoba (N=22) Darsalamy (N=22) Matourkou (N=22)	Moamy (N=17) Koumi (N=17)
Total	N=106	N=110	N=106

Summarising table sample size Burkina Faso

City	Slum urban	Slum peri-urban	Low-income urban	Low-income peri-urban	Middle-income urban	Middle-income peri-urban	Total
Ouagadougou	0	4 x 50	5 x 20	5 x 20	5 x 20	4 x 25	
Total	0	200	100	100	100	100	600
Bobo Dioulasso	0	7 x 16	0	5 x 22	3 x 17	3 x 17	
Total	0	106	0	110	51	51	318

Appendix 3 Comparison of DQQ in Benin and Mali in French

	Benin version	Mali version
	Hier, avez-vous mangé l'un des aliments suivants	
C1	Riz, pain, macaroni, spaghetti, akassa, pâte/wô, <u>aklui de maïs</u> ou de riz ?	Riz, pain, macaroni, spaghetti, kaba tô, <u>cous cous de maïs</u> , <u>moni</u> ou <u>seri</u> / bouillie de maïs ou de riz?
C2	Maïs grillé ou bouilli, mil, sorgho, ou fonio ?	Maïs grillé ou bouilli, sorgho, mil, fonio, ou popcorn?
C3	Manioc, gari, igname, pâte à base d'igname, wassa wassa, patate douce à chair blanche, banane plantain, ou taro ?	Manioc en tubercule, tô de manioc, attieke, igname, patate douce à chair blanche, pomme de terre, taro, ou plantain?
C4	Haricots, niébé, voandzou, pois, bouillie de soja, ou fromage de soja ?	Haricots, sô haricots ou niébé, petits pois, voandzou, ou soja?
	Hier, avez-vous mangé l'un des légumes suivants:	
C5	Carottes ou patate douce à chair orange ?	Carottes, <u>courge</u> , ou patate douce à chair orange?
C6.1	Sauce feuille, <u>feuilles crin</u> , <u>feuilles de gboman</u> , <u>vernonia</u> , ou <u>feuilles de manioc</u> ?	Sauce feuille, <u>feuilles de patate douce</u> , <u>feuilles de moringa</u> , <u>feuilles de baobab</u> , ou <u>feuilles de niébé</u> ?
C6.2	Feuilles d'oseille, <u>feuilles de moringa</u> , <u>feuilles de haricot</u> , <u>feuilles de gombo</u> ?	Feuilles d'aubergine, <u>feuilles de manioc</u> , <u>epinards</u> , <u>fakoye</u> , ou <u>feuilles d'amaranthe</u> ?
C7.1	Tomates, aubergine, gombo, <u>chou</u> , ou <u>betterave</u> ?	Tomate, aubergine, <u>n'goyo</u> , gombo, ou <u>concombre</u> ?
C7.2	Concombre, poivron vert, haricots verts, ou <u>champignons</u> ?	Choux, poivron vert, haricots verts, ou <u>salade</u> ?
	Hier, avez-vous mangé l'un des fruits suivants:	
C8	Mangue ou papaye ?	Mangue <u>mûre</u> ou papaye?
C9	Orange, mandarine, ou pamplemousse?	Orange, mandarine, ou pamplemousse?
C10.1	Banane <u>douce</u> , ananas, pastèque, ou avocat ?	Banane, avocat, pastèque, <u>melon</u> , ananas, <u>goyave</u> , ou <u>jujubier</u> ?
C10.2	Fruit de baobab, <u>coco</u> , <u>chap chap</u> , <u>azongwégwé</u> , ou fruits issus de la cueillette ?	<u>Pomme</u> , <u>poire</u> , <u>raisins</u> , baobab, <u>zegene</u> , ou d'autres fruits issus de la cueillette?
	Hier, avez-vous mangé l'une des sucreries suivantes:	
C11	Gateaux, <u>atchonmon</u> , biscuits, galettes sucrées, <u>beignet de blé / doko</u> , ou <u>beignets de banane</u> / talé-talé ?	Gateaux, <u>gâteau ni</u> , ou biscuits <u>sucrés</u> ?
C12	Bonbons, chocolats, <u>nougats</u> , caramels, cacahuètes sucrées, ou crème glacée ?	Bonbons, chocolats, caramels / <u>aloua</u> , cacahuètes sucrées, <u>sesame sucré</u> , crème glacée, <u>glace</u> , ou <u>riz au lait</u> ?
	Hier, avez-vous consommé l'un des aliments d'origine animale suivants:	
C13	Oeufs ?	Oeufs?
C14	<u>Wagashi</u> , ou d'autres fromages à base du lait ?	Fromage, <u>naré</u> , ou La Vache Qui Rit?
C15	Yaourt, lait caillé, dèguè ou <u>fourra</u> ?	Yaourt, lait caillé / <u>nônô koumou</u> , dèguè ou <u>lafiri</u> ?
C16	Saucisses, jambon, ou <u>viande en conserve</u> ?	<u>Viande séché</u> , saucisson, jambon, <u>corne boeuf</u> , ou <u>pâté</u> ?
C17	Boeuf, mouton, <u>cabri</u> , chevre, ou des abats de ces animaux ?	Boeuf, mouton, chevre, ou des abats de ces animaux?
C18	Porc, <u>lapin</u> , <u>agouti</u> , ou viande de brousse ?	Porc ou viande de brousse?
C19	Poulet, canard, pintade, <u>dinde</u> , pigeon, ou <u>caille</u> ?	Poulet, pintade, canard, pigeon, ou d'autres oiseaux?
C20	Poisson frais, poisson fumé, fretins, sardines en boîte, crevettes, crabe, ou huîtres ?	Poisson frais, poisson fumé, poisson séché, sardines en boîte, crabes, ou crevettes?
	Hier, avez-vous consommé l'un des autres aliments suivants:	
C21	Arachides, <u>pâte d'arachide</u> , sauce d'arachide, <u>klui klui</u> , cajou, <u>goussi</u> , ou <u>graines de baobab</u> ?	Arachide, <u>cacahuètes</u> , sauce d'arachide, ou <u>noix de cajou</u> ?
C22	Chips comme <u>Yoyo</u> ?	Chips comme <u>Pringles</u> , <u>Lays</u> , <u>Doritos</u> , ou <u>Slice</u> ?
C23	Nouilles instantanées comme Indomie ?	Nouilles instantanées comme <u>Kellogg's</u> ou Indomie?
C24	Frites de pomme de terre, <u>igname frite</u> , <u>patate douce frite</u> , <u>banane frite</u> / aloko, <u>beignet d'haricot</u> / <u>ata</u> , <u>klui klui</u> ?	Frites de pomme de terre, <u>patates frites</u> , aloko <u>frit</u> , <u>beignets</u> , ou <u>poulet frit</u> ?
	Hier, avez-vous pris l'une des boissons suivantes:	
C25	Lait liquide ou lait en poudre ?	Lait liquide ou lait en poudre?
C26	Thé sucré, café sucré, ou chocolat chaud comme Milo ?	Café sucré, thé sucré, <u>kinkéliba</u> avec du <u>sucré</u> , ou chocolat chaud comme <u>Nesquick</u> ou Milo?

	Benin version	Mali version
C27	Jus de fruit, jus en sachet, <u>l'eau citronnée</u> , jus de gingembre, ou bissap ?	Jus de fruit, jus en sachet, bissap, jus de gingembre, ou <u>jus de tamarind</u> ?
C28	Sucrierie comme Coca Cola, Sprite, ou <u>Youki</u> , Malta, ou des boissons énergisantes ?	Jus comme Coca Cola, <u>Fanta</u> , Sprite, Malta, ou boissons énergisantes <u>comme XXL</u> ?
	Hier, avez-vous eu de la nourriture dans un endroit comme...	
C29	Des endroits qui servent des hamburgers, du shawarma ou des pizzas ?	Des endroits qui servent des hamburgers, du shawarma ou des pizzas?

Note: foods that are underlined differ between the countries

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