Consumer motives, skills, and perceived access for sourcing and consumption of safe vegetables in urban areas in Burkina Faso

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Harriette M. Snoek,[1] Ghalia Nassar,[1] Ireen Raaijmakers,[1] and Apollinaire Nombré[2]

1 Wageningen Economic Research, Wageningen, The Netherlands

2 Université Thomas Sankara, Ouagadougou, Burkina Faso

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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 and a series of reports, aiming to pilot and scale innovative approaches within the food systems of Benin, Mali and Burkina Faso to improve consumption of safe vegetables. The aim of this report is to obtain insights into consumers' perceptions of accessibility, acceptability and safety of vegetables in Burkina Faso. For this purpose a survey was conducted among 1,011 respondents in two urban and peri-urban areas in Burkina Faso. This report describes the results of the consumer survey for Burkina Faso and discusses potential entry points for enhancing the consumption of safe vegetables.

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

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P.O. Box 29703, 2502 LS The Hague, The Netherlands, T +31 (0)70 335 83 30,
E communications.ssg@wur.nl, http://www.wur.eu/economic-research. Wageningen Economic Research is part of Wageningen University & Research.

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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.

Ir. O. (Olaf) Hietbrink
Business Unit Manager Wageningen Economic Research
Wageningen University & Research

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. The first step in achieving this objective was obtaining insights into consumer attitudes, knowledge, demands, and barriers regarding the acceptability, accessibility and food safety of vegetables. These insights can help food system researchers in designing interventions to more effectively increase healthy and safe food consumption. This report describes the results for Burkina Faso.

Consumer surveys were conducted among 1,011 respondents living in two (peri-)urban areas in Burkina Faso (Ouagadougou and Bobo-Dioulasso). Neighbourhoods were selected to represent degrees of urbanisation (urban and peri-urban; rural was excluded) and income levels (slum, low-, and middle-income neighbourhoods; high income was excluded). In these neighbourhoods, convenience sampling was administered through a door-to-door approach and included adult consumers who were responsible for vegetable shopping and/or cooking in their households. The sample included a large share of the respondents with a low educational level (61% had not finished primary school) and most households (76%) reported some degree of food insecurity ranging from mild to severe.

Vegetables seem widely accepted, but the consumption of vitamin A-rich vegetables is low
Almost all respondents reported eating vegetables frequently, at least once a week, but not daily – primarily cooked (97%), but also raw or as a salad (55%). On average, cooked vegetables were eaten five days per week and raw vegetables about one day per week, with just over one-third of the respondents reporting they eat vegetables daily. Results on vegetable purchase were generally in line with results on intake, showing frequent buying of vegetables (on average 3-4 times per week). A majority of the respondents reported eating vegetables in the past 24 hours – vegetables in the 'other' category, including tomato, onion, and okra, were consumed by 77% of the respondents, dark green leafy vegetables by 68%, and vitamin A-rich vegetables were consumed by 9% (e.g. carrots, orange sweet potatoes). This low consumption of vitamin A-rich vegetables is of concern since these are nutrient-dense and have a promising role in overcoming micronutrient deficiencies.

Safety perception of vegetables and chain actors providing them is moderate with most concerns about contamination and residues
Food safety was an important motive perceived by the consumers, comparable in importance to affordability and scoring only slightly lower than healthiness. Vegetables were generally judged as being somewhat 'safe' in the perception of respondents. For specific aspects of safety, the scores for freshness and appearance were highest, while scores relating to contamination with pesticides and fertiliser were lowest. Meaning that consumer perceive the vegetables they eat as fresh and good looking but less safe when it comes to pesticides and fertiliser residues. Around half of the respondents ranked green leafy vegetables (62%) in the top three safest foods, followed by fruits (49%), fish (44%), and other vegetables (40%). In the top three least safe foods, milk (48%), egg (48%), and ground nuts (46%) were most often mentioned. Levels of trust in chain actors for the production, selling, and regulation of safe vegetables was neither positive or negative for all chain actors (authorities, retailers, and farmers). Attitudes towards the safety of vegetables at respondents' first and second most important purchase outlets were positive.

Access to vegetables is generally perceived as neutral to somewhat good; fresh markets are the main outlet for all vegetables followed by street vendors that have less availability but better accessibility and neighbourhood stores

With regards to the sourcing of vegetables, only a minority of consumers (25%) grew their own produce in the past year. As for outlets, fresh markets are by far the most commonly used place of purchase for consumers, followed by street vendors and neighbourhood shops. In particular, green leafy vegetables, vitamin A-rich vegetables, and other vegetables were sourced from fresh markets. The most bought vegetables were onion, tomato, cabbage, green bell pepper, eggplant (gboma), okra, sorrel leaves, boulvaka leaves, African eggplant (koumba), and baobab leaves.

Access to vegetables was scored for respondents' first and second most common outlet of purchase on four elements: availability (selection, quality, and quantity), accessibility (travel time, efforts, and costs), affordability, and accommodation (services provided by the vendor). Access was generally perceived as neutral to somewhat good, with the exception of affordability and outlet services for buying or credits that were perceived somewhat negative. Fresh markets did relatively well on availability but scored lower on accessibility. Street vendors scored especially high on accessibility, but lower on availability. Neighbourhood stores scored lower than the other outlets in almost all aspects, scoring particularly poorly on affordability, and intermediated on accessibility and accessibility.

Consumers were confident about their abilities in purchasing and consuming safe vegetables, such as the capacity to judge the safety of vegetables in stores and their kitchen skills. They did, however, feel less confident about their knowledge of safe vegetables and agreed with the statement that they would like to know more about vegetable safety.

Focus points for interventions are increased frequency, portion sizes and variability of vegetables consumed, providing more information on vegetable production and safety, and access to safer but reasonably priced vegetables at all outlets

Vegetables seemed to be a normal part of the diet since they were consumed frequently, although not daily, by most respondents. However, intake levels should be increased to meet health recommendations and also the diversity of vegetables consumed could be improved with more vitamin A-rich vegetables. The results provide several entry points for interventions. First, vegetable intake could be increased, especially the percentage of people eating vegetables daily. The intake of dark green leafy vegetables, especially vitamin A-rich vegetables, needs urgent attention since the vegetables consumed most commonly are limited in terms of diversity and on vitamin A content. Although different aspects of vegetable safety could be improved, contaminations (including from fertiliser and pesticides) and not being what consumers consider 'naturally grown' seem to cause the greatest concern. Another entry point is the consumer desire for more information on the safety of vegetables. This seems to be related to how food is produced and contaminations (from chemicals, etc.) rather than handling at home. While point of sales is the easiest entry point for information-based interventions, information provided by farmers, retailers, and governments might not always be trusted. Finally, consumers often thought that vegetables were not well priced; particularly those sold as 'safer', such as organic vegetables, which are often high in cost. This suggests there might be a particular requirement for safer but reasonably priced vegetables at all outlets. While improving the selection, quality, and quantities of vegetables at lower prices at neighbourhood stores and street vendors might be a way to achieve higher vegetable purchase, achieving this requires adaptations to the supply chain.

Focus on demographic groups in interventions might be relevant, especially focused on urban neighbourhoods and on slum and low-income ones

Interestingly, demographic analysis indicates that urban neighbourhoods, compared to peri-urban and slum and low-income neighbourhoods and middle-income neighbourhoods, also require attention in possible future interventions. This is because their populations are most at risk for food insecurity, with lower knowledge and awareness on food safety among consumers, and reduced vegetable intake. Despite this, however, respondents from urban neighbourhoods demonstrated higher access to fresh markets.

1 Introduction

1.1 Background

Foodborne diseases have a great impact on the health and well-being of citizens in Africa (Havelaar et al., 2015; WHO, 2015). After animal-based products, fruits and vegetables are an important source of bacterial and chemical contamination (Berger, 2010; Raaijmakers et al., 2023; Rajwar et al., 2016). However, fruits and vegetables are crucial to a healthy diet and their intake is often below recommended levels in many low and middle income countries including Benin, Burkina Faso and Mali (e.g. Delisle et al., 2012; Frank et al., 2019; Traoré et al., 2018). In response to this challenge, 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.

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, since their choices define food system outcomes, through diets, in terms of nutritional status, health and food safety, sustainability, and economic impact (GLOPAN, 2020). In the food environment such as fresh markets, retail, and out of home food outlets, consumers interact with other actors in the food chain such as farmers, vendors, and caterers. Consumers are influenced by policy, market, and environmental drivers of the 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, 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. In turn, we can learn through which mechanisms interventions contribute to consumer behaviour change by measuring the 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 results for the consumer survey conducted in (peri-)urban Burkina Faso, relating to vegetable consumption behaviour, perceptions regarding accessibility (including affordability), acceptability, and safety of vegetables. Differences between consumer groups are also reported, along with the motives and barriers related to the intake of, and access to, desired and safe vegetables and the implications for interventions.

1.4 Outline of the report

This report is structured into three sections. Section 1 explains the study procedure and includes the measures. Section 2 presents the results and starts with a description of the study sample, followed by vegetable consumption and buying behaviour of the Burkinabe, followed by results related to accessibility, acceptability and safety perception of vegetables. Finally, Section 3 provides overall conclusions and recommendations for further research and potential implications for interventions.

2 Methods

2.1 Study area and respondents

Consumer surveys were conducted in two urban and peri-urban areas of Burkina Faso (Ouagadougou and Bobo Dioulasso). The study was achieved in Ouagadougou between 28 July and 10 August and in Bobo-Dioulasso between 2 and 12 August. This period corresponded to the peak of the rainy season when in general there is more availability of vegetables, especially green leafy vegetables. A detailed description of the methodology is published separately (https://doi.org/10.18174/638784). A summary of the methodology used the select the study area and respondents is provided below (see Figure 2.1).

Study area: Urban areas were chosen from the focused cities within the project.

Study sampling: Three steps were used: (1) selection of districts in cities (if applicable); (2) neighbourhoods in districts; and (3) households in neighbourhoods. See also Figure 2.1 for a schematic overview of the sample selection.

1. *District selection:* Criteria for the selection of districts included coverage of main vegetable places (e.g., large markets, production), main facilities (e.g., governmental buildings, business centres, living areas, and universities), and geographical locations (e.g., central, near river). The country coordinator from the SaveVeg consumer research team suggested districts and discussed them with the team, leading to the final selection of 8 districts.
2. *Neighbourhood selection:* Criteria for the selection of neighbourhoods included geographic coverage and income level. The mapping of neighbourhoods was conducted with the aid of local authorities and the country coordinator, and was arranged based on average housing and living environment conditions (e.g., wall/roof material, room number, access to electricity and water, and road conditions) to estimate average income category of the inhabitants. Hence, classification of neighbourhoods was sorted according to the degree of urbanisation (urban and peri-urban; rural was excluded) and income level (slum, low-, and middle-income neighbourhoods; high income was excluded). If fewer neighbourhoods could be selected due to low neighbourhood numbers or unequal distribution of urbanisation/income, then the number of households per neighbourhood type was increased to ensure sufficiency. The final selection included 42 neighbourhoods in total over the 8 districts.
3. *Household selection:* Convenience sampling was administered through a door-to-door approach, and only houses that fit the mapping criteria were visited. The border of the neighbourhoods were first explored and defined so the enumerators stayed within this since generally neighbourhood border are not always to clearly defined. Next, neighbourhoods were divided based on cardinal directions and respondents were recruited in each quadrant. The planned sample size per country (actual number were equal or higher) was 1,011 respondents this way sample sizes per city per category of income and urbanisation combined was at least 168 respondents.
4. *Respondent selection:* To obtain insights into consumer behaviours and potential entry points for intervention, the respondent selection followed criteria including: age (must be an adult); responsibility for buying and/or decision-making of food purchases and preparation; and diverse socioeconomic status and geographic distribution. Within the household the person available and most responsible for food preparation and/or purchase was selected.

Seasonality/timing: Based on previous studies, seasonality of produce was taken into consideration as it influences the diversity and consumption of available foods.

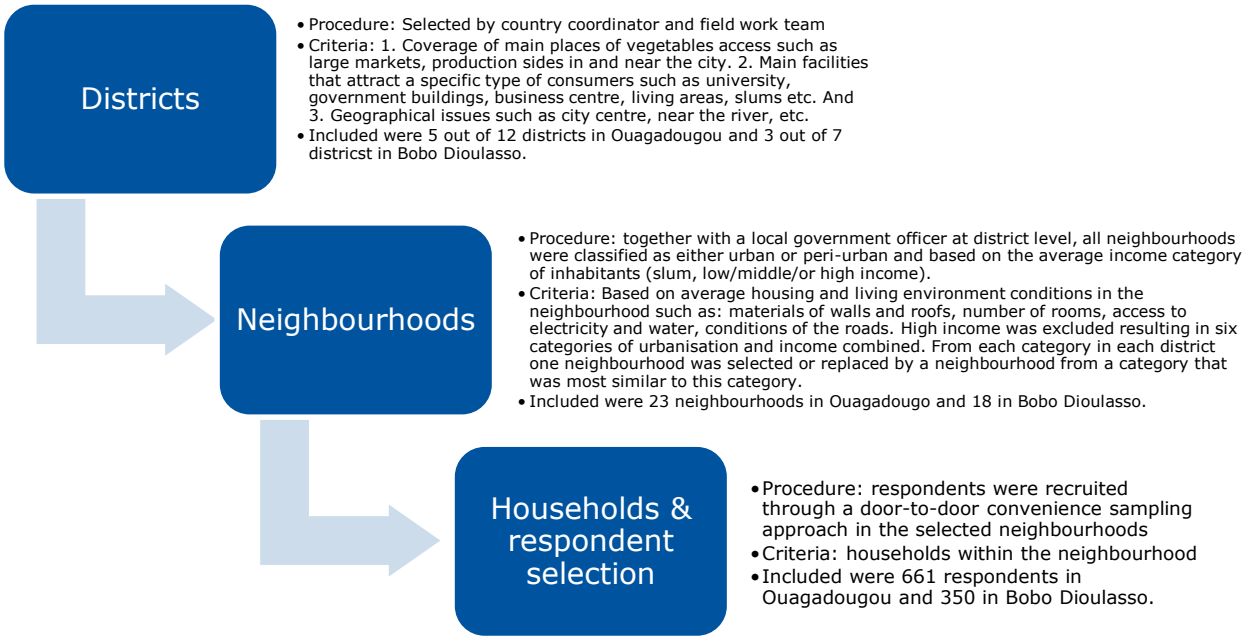

Figure 2.1 *Schematic overview of the sample selection in urban Burkina Faso*

2.2 Study procedure

Data collection: 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. After obtaining informed consent, face-to-face interviews were conducted in French with an eligible respondent at each house. Respondents were given a small gift for their participation, either a vegetables voucher to be used at a local vegetable vendor or soap.

Measures: Table 2.1 summarises the scales used in the consumer survey, including their literature source. Most scales 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, apart from the Food (in)security scale, where items are presented as per the increasing level of food insecurity. Additionally, demographics, family composition, own production, vegetable purchase frequency, safety product attributes of vegetables, safety perception of vegetables, and out-of-home consumption were measured. Cards with photos of vegetables were used to facilitate respondents with their answers.

Table 2.1 *Summary of survey measures*

Scale	Number of items/measures	Literature Source	Answer option/score
Diet Quality Questionnaire (DQQ) a)	28 food groups	Herforth et al. (2019)	Yes/no
Food Choice Motives (FCM)	11 items	Onwezen et al. (2019); Verain et al. (2021); Snoek et al. (2021); Cabral, de Almeida, and Cunha(2017); Dowd and Burke (2013)	7-point Likert scale (1=strongly disagree to 7=strongly agree)
Multi-item Food Safety Motives	7 items	Snoek et al. (2021)	
Food Frequency Questionnaire (FFQ)	Usual consumption frequency and amount of cooked and raw vegetables	Van Assema et al. (2002)	Number of days per week; number of serving spoons
Access to main outlets (availability, accessibility, accommodation, affordability)	11 items	Newly developed based on Freedman et al. (2013); Snoek et al. (2021)	7-point Likert scale (1=strongly disagree to 7=strongly agree)
General attitude to main outlets	5 items	Adapted from Crites et al. (1994); Snoek et al. (2021)	
Safety perception (optimism/pessimism)	7 items	Adapted from De Jonge (2008)	
Trust in actors	3 items	Adapted from Macready et al. (2020); Li et al. (2021)	7-point Likert scale (1=very little trust to 7=very high level of trust).
Subjective knowledge safety	3 items	Adapted from Aertsens et al. (2011)	7-point Likert scale (1=strongly disagree to 7=strongly agree)
Self-efficacy (consuming safe veg)	8 items	Newly developed based on Wilson-Barlow et al. (2014) and WHO (2006)	
Food (in)security	8 items	Nord et al. (2016); Smith et al. (2017)	Yes/no; scale (0=no food insecurity to 7-8=severe food insecurity)

a) Global Dietary Recommendation score (GDR total, healthy and limit; possible range -9 to 9) and adequacy compared to WHO Fruit and Vegetable recommendations (WHO-FV; possible range 0 to 6) were calculated based on the DQQ food groups.

2.3 Analyses

Scale scores were calculated for all multi-item measures with mean and Cronbach's alphas were calculated to check for scale performance. For the food access questions, the factor structure was tested to confirm the four dimension of availability, accessibility, accommodation, and affordability. Analysis confirmed the factor structure for availability, accessibility, affordability, and accommodation. This is with the exception of operation hours, which did not load on the accessibility factor and was therefore deleted from further analysis. The food (in)security scale was the only exception since a sum score rather than an average over the items was calculated in line with literature (Smith et al., 2017). Descriptive statistics were reported. In addition, differences were tested between cities, neighbourhood income groups, male or female gender, and urban versus rural neighbourhoods using either ANOVA (cities, income groups) with post-hoc or t-tests (gender and urban/rural). Finally, perceived access was compared between primary and secondary outlet with paired t-tests.

3 Results

3.1 Demographic characteristics of the sample and selection questions

3.1.1 Highlights and implications

- Consumer surveys were conducted among 1,011 respondents living in Ouagadougou (661) and Bobo Dioulasso (350).
- The sample was diverse in terms of demographic characteristics and included also a high number of vulnerable households with a low-income and education level and some degree of food insecurity.
- A high percentage of the study sample was food insecure (76%). Food security was higher among males compared to females and in slum and low-income neighbourhoods compared to middle-income neighbourhoods. Ouagadougou had a higher food insecurity score compared to Bobo-Dioulasso.

In total, 1,011 respondents were included: 661 in Ouagadougou and 350 in Bobo-Dioulasso. Respondents were selected from a total of 42 neighbourhoods in 8 districts, which provided a good geographical spread over the different cities (Figure 3.1).

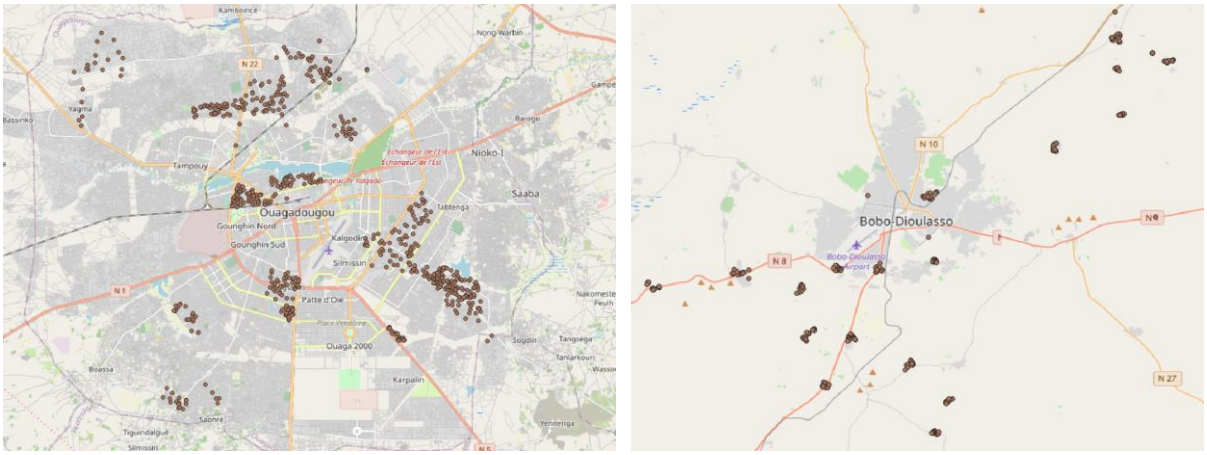

Figure 3.1 *Households in Ouagadougou (left) and Bobo-Dioulasso (right) (n=1,011 in total)*

According to the sampling procedure, approximately one-third of the neighbourhoods were considered slum areas (n=328), one-third low-income settlements (n=337), and one-third middle-income settlements (n=347). The majority of the sample lived in peri-urban neighbourhoods (71.1%). All demographic characteristics of the sample are reported in Table 3.1.

Table 3.1 *Demographic characteristics of the consumer sample in Burkina Faso (n=1,011)*

City	Ouagadougou	661 (65.4%)
	Bobo-Dioulasso	350 (34.6%)
Gender	Male	43 (4.2%)
	Female	969 (95.8%)
Geographic location	Urban neighbourhoods	292 (28.9%)
	Peri-urban neighbourhoods	720 (71.1%)

Neighbourhood by income level	Slum settlement	328 (32.4%)		
	Low-income settlement	337 (33.3%)		
	Middle-income settlement	347 (34.3%)		
Age in years, mean (SD)		35.2 (10.24)		
Educational level	Less than primary	618 (61.1%)		
	Primary school	145 (14.3%)		
	Secondary school first cycle a)	129 (12.8%)		
	Secondary school second cycle b)	89 (8.8%)		
	Higher than secondary school (superieur)	30 (3.0%)		
Ethnicity	Bobo	208 (20.6%)		
	Dioula	31 (3.1%)		
	Fulfulde peulh	19 (1.9%)		
	Gourmantché	19 (1.9%)		
	Gourounsi	34 (3.4%)		
	Lobi	2 (0.2%)		
	Mossi	553 (54.7%)		
	Senoufo	26 (2.6%)		
	Touareg Bella	1 (0.1%)		
	Dagara	20 (2.0%)		
	Bissa	35 (3.5%)		
	Pays Cedeao	1 (0.1%)		
	Other Pays Africains	1 (0.1%)		
	Other ethnicity	61 (6.0%)		
Religion	Islam	592 (58.6%)		
	Catholicism	323 (31.9%)		
	Protestantism	91 (9.0%)		
	Traditional Animism	1 (0.1%)		
	No religion	4 (0.4%)		
Marital status	Married or living together	887 (87.6%)		
	Divorced or separated	14 (1.4%)		
	Widower	54 (5.3%)		
	Never married or cohabitating	56 (5.5%)		
Household size, mean (SD)		6.94 (3.58)		
Number of children aged 1-18 years, mean (SD)		3.78 (2.62)		
		Main	**Second**	**Third**
Income source (number of respondents)	Agriculture	215	43	441
	Trade in agricultural products	27	61	19
	Small trade (informal)	307	326	4
	Wholesale trade (formal)	49	9	43
	Real estate rental company	13	6	2
	Daily worker	45	79	15
	Small craftsmanship	37	61	9
	Transport (including motorbike taxi)	39	17	3
	Permanent civil servant	87	12	3
	Consultant contract employee	65	27	4
	Specialised work (mechanic, mason, tailor, hairdresser)	91	42	15
	Pension (retired)	23	11	3
	No other source of income	4	193	441
	Other	9	33	136

a) Secondary school first cycle is the first 4 years; b) the second cycle is the next 3 years.

According to the selection criteria, the age of the sample was between 18 and 74 years old, with an average age of 35.2 years (SD=10.24). All respondents were either involved in purchase of food (94.3%), responsible for food preparation (94.4%), responsible for purchasing decisions (94.5%), or in charge of purchasing and/or purchasing decisions (94.0%). The sample had a higher distribution of women (95.8%) than men (4.2%). Most women, averaging 98%, were responsible for food-related purchases, such as deciding what to buy and buying food.

The sample was diverse in terms of education, ethnic background, and religion. It had a high percentage of respondents who had not finished primary school (61.1%) and a high percentage of respondents with a Mossi or related ethnic background (54.6%). This is unsurprising, given that the data were largely collected in slums and low-income neighbourhoods who in general were expected to have a lower educational level. Most respondents were married or cohabiting (87.6%), and the average household size was 6.9, with an average of 3.8 children aged between 1 and 18 years old.

Household food insecurity was high, with an average score of 3.0 (SD=2.7) with a score of 0 representing food security, 1-3 mild insecurity, 4-6 moderate insecurity, and 7-8 severe insecurity. Only 23.9% of the sample could be considered food secure based on their scores. Other households reported some degree of food insecurity, ranging from mild (37.0%), to moderate (23.0%), to severe (16.0%). Food insecurity scores differed largely between the cities, with a higher average score in Ouagadougou (mean of 3.3) compared to Bobo-Dioulasso (mean of 2.6) ($t=4.2$, $p<0.001$). As expected, food insecurity scores differed depending on the income level of the neighbourhood ($F=5.7$, $p=0.004$) – with highest insecurity scores in the slum and low-income neighbourhoods (mean of 3.3 and 3.2; not differing from each other) compared to middle-income neighbourhoods (mean of 2.6). In urban neighbourhoods, food insecurity was higher (mean of 3.3) compared to peri-urban neighbourhoods (mean of 2.9) ($t=2.4$, $p=0.008$). Finally, the food insecurity score was higher for male respondents (mean of 4.6) compared to females (mean of 3.0) respondents ($t=3.8$, $p<0.001$) and significantly correlates with respondent age ($r=0.1$) and number of the children in the household ($r=0.1$).

3.2 Food intake and contribution of vegetables to the dietary quality

3.2.1 Highlights and implications

- Vegetables are an important part of the diet and commonly eaten, especially cooked vegetables. Yet, overall consumption does not meet recommended amounts. In particular, the frequency of vitamin A-rich vegetables should be increased.
- Intake was highest in peri-urban compared to urban neighbourhoods, in slum and middle-income compared to low-income neighbourhoods, in Bobo-Dioulasso compared to Ouagadougou, and for men compared to women. Thus, more efforts are needed to increase intake of women and consumers in urban neighbourhoods, especially within Ouagadougou.

3.2.2 Dietary quality

In general, vegetables were among the most frequently consumed food groups, together with staple foods. A high percentage of respondents had a diet that was high in staples and vegetables. Almost all respondents (more than 90%) consumed the common staples (rice, bread, pasta, millet, sorghum, fonio, or maize) and 77.1% consumed the most common vegetables (tomato, eggplant, cabbage, okra, cucumber, green beans, green pepper, and kapok flowers) in the past 24 hours (Figure 3.2). In addition, the consumption of fish and seafood (fresh fish, dried fish, smoked fish, or canned fish) was very common (68.3%). Almost half of the respondents had also eaten dark green leafy vegetables (leaf sauce, boulvaka leaves, baobab leaves, hibiscus leaves, moringa leaves, bean leaves, squash leaves, eggplant leaves, sweet potato leaves, cassava leaves, amaranth leaves, or babenda leaves) in the previous day. Less common were cheese, packaged ultra-processed snacks such as crisps, unprocessed red meats (non-ruminant), fast food, and processed meats such as sausages and canned meat. The percentage of respondents consuming 'healthy' foods was

low, with an average GDR-healthy score of 2.5 (SD=1.2) on a possible scale from 0 to 9; while the percentage of consumption of unhealthy foods was even lower, with an average GDR-limit score of 0.8 (SD=1.0). For 'unhealthy' foods, the whole scale was not used since none of the respondents reported having consumed from all 9 unhealthy food groups in the past day; 4 was the maximum reported. Consequently, the GDR score, which is a combination of healthy and limit scores, ranged between 6 and 16 – rather than between 0 and 18, which is theoretically possible. The overall dietary diversity score was, on average, 10.8 (SD=1.3). For the WHO fruit and vegetable index, 16.3% of the population scored equal to or above the cut-off point of consumption of 3 fruit and vegetables food groups. Vegetables were eaten more frequently than fruit.

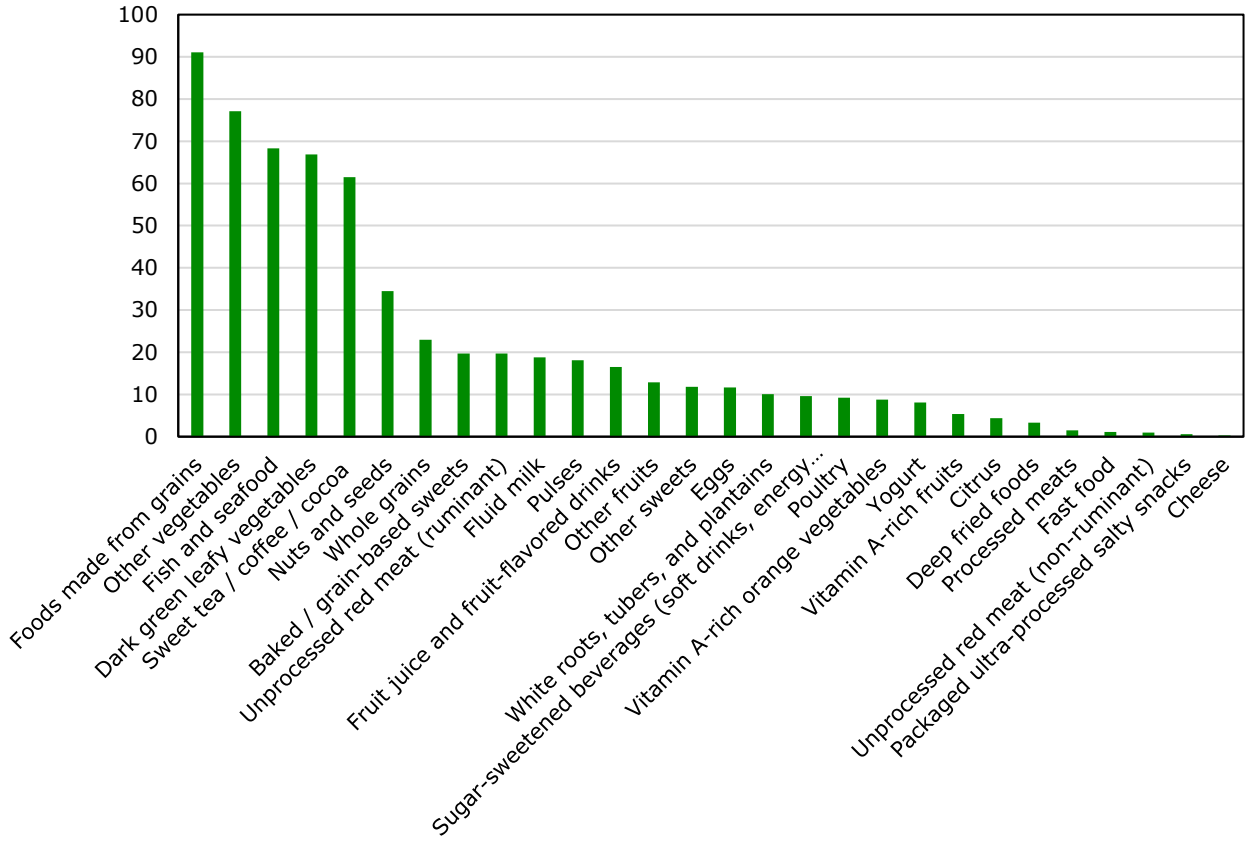

Figure 3.2 *Percentage of respondents in urban Burkina Faso reporting consumption of the food groups (n=1,011)*

3.2.3 Vegetable intake and demographic differences

Almost all respondents typically eat vegetables. When asked about their usual consumption patterns, 96.9% responded that they generally ate cooked vegetables and 55.2% usually ate raw vegetables or salad. On average (mean), respondents ate cooked vegetables 4.9 days per week (SD=2.0) and raw vegetables or salad 1.2 days per week (SD=1.5). Average portions (mean) consumed on such days was 5.1 for cooked (SD=1.6) and 5.0 for raw vegetables (SD=1.8). Portions were defined as a serving spoon (showed with the enumerator) of vegetables. The number of days was multiplied with portions to estimate total vegetable consumption. In turn, total vegetable intake was 31.2 portions per week (SD=12.9): 25.5 portions of cooked vegetables (SD=12.9) and 5.7 portions of raw vegetables (SD=7.4).

Total vegetable intake calculated in portions per week was much higher in Bobo-Dioulasso (mean of 35.8) compared to Ouagadougou (mean of 28.8) (t=7.4, p<0.001). In peri-urban neighbourhoods, vegetable intake in portions per week was higher (mean of 33.4) compared to urban neighbourhoods (mean of 25.8) (t=6.9, p<0.001). Finally, vegetable intake was higher for male compared to female respondents (mean of

41.5 versus 30.8 portions per week; t=4.6, $p<0.001$), and significantly correlates with the number of children in the household; although the correlation was very weak (p=0.1) and did not correlate with age. Finally, mean vegetable intake differed according to neighbourhood income level (F=4.9, $p<0.01$), with the low-income group reporting a lower intake (mean of 29.1 portions per week) compared to slum and middle-income (means of 32.5 and 32.0 respectively and not different from each other).

3.3 Vegetable sourcing

3.3.1 Highlights and implications

- Fresh markets are by far the most important outlet for vegetables. However, since purchasing frequency is 3-4 times a week for most respondents, buying of vegetables from street vendors and neighbourhood shops, the next most important outlets, could also be increased to support more frequent consumption of perishable vegetables, such as green leafy vegetables. Differences in sourcing of vegetables were found between both cities, but it is unclear what underlies these: for instance, differences in food habits, taste preferences, seasonality, or access.
- Onion, tomato, cabbage, green bell pepper, eggplant (gboma), okra, sorrel leaves, boulvaka leaves, African eggplant (koumba), and baobab leaves were the most commonly bought vegetables. In terms of quantity, cabbage was the most purchased raw vegetable and babenda the most purchased green leafy vegetable.

A minority of respondents (24.9%; n=252) grew their own vegetables in the past year. The most-grown crops were: okra (69%); sorrel leaves (68.7%); bean leaves (46.8%); eggplant (35.7%); and tomatoes (31.7%). Respondents also reported growing cabbage, African eggplant, baobab leaves, eggplant leaves, boulvaka leaves (sobon), moringa leaves, cucumber, and lettuce (crops grown by less than 10% of respondents are not reported). Among those growing crops, 99.2% consumed them personally, while 55.6% also sold some vegetables and 23.4% gave crops as gifts to relatives and friends. The reasons for growing vegetables varied. A good majority (64.7%) find it less expensive than purchasing from sellers; more than half find it a good method to earn money through selling (54.4%); and others do so because the produce is better tasting (52.4%) and healthier (48.4%) than bought vegetables. Other reasons include convenience (40.1%), habit/tradition (32.9%), and being free from contamination (e.g., pesticides, fertilisers, and chemicals) (13.1%).

The whole sample sourced their vegetables most often from fresh markets (81%), street vendors (21.5%), farmer's markets (2.2%), neighbourhood store/kiosks (12.1%), supermarkets (0.7%), or other places (0.6%). Most respondents (86.1%; n=870) had bought vegetables in the past week (Table 3.2). Since the supermarket and other places were only reported by 6 and 5 respondents respectively, they are not included in further analysis.

On average, most of the respondents purchased vegetables 3-4 times a week: from fresh markets (n=705, mean=4.39, SD=2.29), street vendors (n=187, mean=3.90, SD=2.31), neighbourhood stores (n=105, mean=4.14, SD=2.03), farmer's markets (n=19, mean=1.90, SD=1.37), supermarkets (n=6, mean=1.67, SD=.82), or other places (n=5, mean=1.60, SD=1.34). The three most purchased vegetables by more than half of the respondents were onion (77.2%), tomato (71.8%), and cabbage (50%). Other popular vegetables were green bell pepper, eggplant (gboma), okra, sorrel leaves, boulvaka leaves (sobon), African eggplant (koumba goyo), and baobab leaves (Table 3.2). In terms of quantity (i.e., portion), cabbage was the most purchased raw vegetable and babenda the most purchased green leafy vegetable. Tomato and green beans were also bought in large quantities.

Table 3.2 *Number of buyers and portions bought per vegetable in the past week a), b), c) by consumers in urban Burkina Faso (n=1,011)*

Vegetable	All outlets N=870 (86.1%)	Fresh market N=705 (69.7%)		Street vendor N=187 (18.5%)		Neighbourhood store N=105 (10.4%)		Farmer's market N=19 (1.9%)	
	Proportion of buyers	***Number of buyers***	***Number of portions***	***Number of buyers***	***Number of portions***	***Number of buyers***	***Number of portions***	***Number of buyers***	***Number of portions***
Onion	77.2%	643	7.86 (9.3)	153	5.67 (7.85)	86	5.71 (4.19)	8	11.86 (11.26)
Tomato	71.8%	596	9.13 (8.37)	131	8.36 (8.43)	80	5.80 (4.91)	9	13.11 (10.81)
Cabbage	50.0%	409	2.24 (1.50)	67	2.66 (3.53)	49	1.82 (1.09)	7	5.71 (2.87)
Green bell pepper	43.4%	359	4.48 (4.30)	82	3.57 (3.76)	35	4.60 (3.81)	5	5.20 (2.95)
Eggplant (gboma)	42.1%	348	4.39 (3.58)	45	4.89 (4.72)	43	4.19 (2.42)	2	6.00 (5.66)
Okra	37.6%	303	14.26 (13.07)	41	17.35 (12.59)	36	15.78 (17.08)	3	54.00 (45.03)
Sorrel leaves	35.7%	282	4.43 (4.33)	43	10.67 (17.84)	35	4.74 (8.00)	6	7.00 (4.56)
Boulvaka leaves (sobon)	34.0%	293	3.72 (4.27)	25	2.40 (1.38)	30	3.90 (2.02)	3	4.67 (2.31)
African eggplant (koumba goyo)	31.5%	253	5.05 (5.76)	36	6.69 (14.99)	31	6.68 (5.02)	5	4.40 (3.36)
Baobab leaves	24.4%	199	3.33 (2.50)	29	2.10 (1.08)	23	2.91 (1.04)	-	-
Spinach	22.8%	183	3.16 (2.89)	21	3.29 (3.16)	26	2.23 (1.21)	3	2.33 (.58)
Cucumber	12.2%	96	5.34 (7.70)	6	3.83 (2.14)	19	7.90 (6.35)	4	4.75 (.50)
Amaranth leaves	10.4%	84	4.35 (6.43)	8	2.25 (.89)	13	3.62 (1.45)	4	13.50 (11.09)
Carrot	9.8%	79	6.89 (6.92)	12	6.5 (4.82)	7	3.71 (1.70)	5	5.20 (3.03)
Lettuce	9.0%	75	6.19 (7.93)	6	2.67 (1.21)	7	7.86 (3.58)	8	7.75 (3.58)
Eggplant leaves	9.4%	68	5.47 (11.14)	23	15.89 (24.09)	2	4.00	2	3.00 (1.41)
Bean leaves	6.7%	55	3.27 (3.27)	6	4.17 (2.64)	6	4.83 (5.31)	1	6.00
Babenda	5.8%	52	9.96 (12.92)	3	9.33 (10.41)	3	6.67 (2.89)	3	8.33 (2.89)
Cleome leaves	5.0%	43	3.84 (3.93)	-	-	8	3.88 (2.53)	2	6.00
Squash	4.8%	36	3.39 (2.53)	5	3.00 (2.12)	9	3.67 (2.24)	-	-
Sweet potato leaves	4.7%	36	3.72 (2.26)	6	4.67 (1.97)	5	3.20 (1.64)	3	9.00 (5.20)
Moringa leaves	3.6%	29	6.28 (10.51)	3	1.50 (.50)	3	14.00 (14.18)	1	4.00
Kapok flowers	3.0%	23	4.17 (3.88)	3	2.00 (1.00)	3	2.67 (.58)	1	5.00
Green beans	2.1%	14	9.32 (10.88)	1	2.00	2	15.50 (.71)	-	-
Pumpkin leaves	1.6%	10	3.70 (2.91)	4	1.00	-	-	2	8.50 (9.19)
Cassava leaves	1.5%	14	3.43 (1.74)	1	1.00	-	-	-	-
Pumpkin	0.9%	8	8.00 (6.02)	1	5.00	-	-	-	-
Sweet potato	0.8%	7	7.14 (3.34)	-	-	1	8.00	-	-
Cowpea leaves	0.8%	6	3.33 (1.75)	1	1.00	-	-	1	2.00
Squash leaves	0.1%	-	-	1	1.00	-	-	-	-

a) The categories 'other outlet' (n=5) and supermarket (n=6) were not included due to the small numbers; b) A cut-off point of 10 buyers was placed for number of portions calculated; c) Proportion of buyers was calculated by adding the number of respondents who had bought at any of the outlets in the past week.

Note: Outlets and vegetables have different sample numbers.

3.3.2 Demographic differences in purchase patterns

Purchases of vegetables from different outlets were compared between demographic groups. Neighbourhood store and farmer's market were the only outlets that showed significant difference in both cities. The purchase of vegetables from neighbourhood stores was lower in Bobo-Dioulasso (mean=.00) compared to Ouagadougou (mean=.18). A t-test for independent samples showed this difference was statistically significant (t=7.65, p<.001). Similarly, the purchase of vegetables from farmer's markets was lower in Bobo-Dioulasso (mean=.01) compared to Ouagadougou (mean=.03) (t=1.99, p=.047).

As for neighbourhood type, the purchase of vegetables from outlets varied between urban and peri-urban neighbourhoods for neighbourhood stores only, while for other outlets no differences according to neighbourhood type were found. Neighbourhood stores were more popular in peri-urban (mean=.15) than urban (mean=.07) neighbourhoods (t=-3.49, p<.001).

The purchase of vegetables varied with neighbourhood income level for three outlets – neighbourhood stores, street vendors, and fresh market. The percentage of respondents that buy vegetables from neighbourhood stores in slum neighbourhoods (mean=.27) was higher than in low-income (mean=.07) and middle-income (mean=.05) neighbourhoods (F=38.14, p<.001). Vegetables purchased from street vendors in low-income (mean=.28) was higher than middle-income (mean=.16) neighbourhoods (F=6.63, p=.001). However, more respondents bought vegetables from fresh markets in middle income (mean=.86) neighbourhoods than low-income (mean=.78) and slum (mean=.79) neighbourhoods (F=4.10, p=.017).

Only street vendors showed significant weak positive correlative with number of children in the household (r=.071, p=.037). The other outlets had no significant correlations with household size or number of children in the household. The purchase of vegetables from different outlets varied between female (n=829) and male respondents (n=41) for three outlets: street vendor, neighbourhood store, and fresh market. The number of female respondents (mean=.23) who buy vegetables from street vendors is higher than male respondents (mean=.00) (t=-3.45, p<.001). More male respondents (mean=.39) frequent neighbourhood stores to buy vegetables than female respondents (mean=.11) (t=5.52, p<.001). Lastly, more female respondents (mean=.82) buy vegetables from fresh markets than male respondents (mean=.68) (t=-2.14, p=.033).

The type of vegetables bought was also compared among demographic groups in which vegetables were purchased by 3% of the sample or more. Purchase of vegetables was higher in Ouagadougou than Bobo-Diolasso (p<.001) for tomato, onion, cabbage, carrot, green bell pepper, cleome leaves, sorrel leaves, bean leaves, amaranth leaves, lettuce, spinach, boulvaka leaves, babenda, and baobab leaves (Table 3.3). Only the purchase of bean leaves was significantly higher in Bobo-Diolasso than Ougadougou (t=-3.57, p<.001). Other vegetables, such as green beans, cassava leaves, squash, pumpkin, and pumpkin leaves showed significance, but were not included due to the low number of respondents who purchased them.

Table 3.3 *Difference in consumer vegetable purchases by city in Burkina Faso (n=1,011)*

Vegetable	Mean		T-value	*P*-value
	Ouagadougou	Bobo-Dioulasso		
Tomato	.78	.60	6.03	<.001
Onion	.83	.67	5.93	
Cabbage	.55	.41	4.26	
Carrot	.15	.00	7.60	
Green bell pepper	.51	.28	7.38	
Cleome leaves	.07	.01	4.47	
Sorrel leaves	.43	.21	7.06	
Bean leaves	.05	.10	-3.57	
Amaranth leaves	.14	.03	5.80	
Lettuce	.12	.02	5.50	
Spinach	.28	.14	4.93	
Boulvaka leaves	.38	.26	4.09	
Babenda	.08	.01	4.67	
Baobab leaves	.27	.19	2.70	.007
Squash	.06	.03	2.15	.032

As for differences in income level of the neighbourhoods, 16 vegetables showed significant differences in purchasing between slum, low-income, and middle-income neighbourhoods (Table 3.4). Other vegetables, such as sweet potato and pumpkin leaves, showed significance, but were not included due to the low number of respondents who purchased them.

Table 3.4 *Difference in consumer vegetable purchases by income level of neighbourhood in urban Burkina Faso (n=1,011)*

Vegetable	Mean			F-value	*P*-value
	Slum	Low-income	Middle-income		
Tomato	.57^{c}	.75^{b}	.82^{a}	28.54	<.001
African eggplant	.24^{b}	.28^{b}	.42^{a}	15.13	
Okra	.30^{b}	.35^{b}	.48^{a}	12.54	
Onion	.68^{c}	.78^{b}	.86^{a}	15.73	
Cabbage	.41^{b}	.47^{b}	.61^{a}	14.73	
Carrot	.18^{a}	.03^{c}	.09^{b}	20.69	
Eggplant leaves	.09^{a}	.04^{b}	.14^{a}	9.07	
Sorrel leaves	.30^{b}	.29^{b}	.46^{a}	13.02	
Spinach	.17^{b}	.18^{b}	.32^{a}	13.03	
Baobab leaves	.20^{b}	.19^{b}	.32^{a}	9.15	
Squash	.09^{a}	.02^{b}	.03^{b}	10.26	
Green bell pepper	.39^{b}	.39^{b}	.51^{a}	6.97	
Boulvaka leaves	.27^{b}	.34^{a}	.40^{a}	6.46	.002
Cleome leaves	.08^{a}	.02^{b}	.05^{a}	5.49	.004
Lettuce	.09^{ab}	.05^{b}	.12^{a}	4.91	.008
Cucumber	.16^{a}	.09^{b}	.12^{ab}	3.45	.032

^{abc} Within a row, means without a common superscript differ significantly from each other in host-hoc analysis (p<.05).

The kind of vegetables purchased also differed according to neighbourhoods. The purchase of 13 vegetables differed between urban and peri-urban neighbourhoods (Table 3.5). All vegetables mentioned in Table 3.6 had higher consumption in urban neighbourhoods compared to peri-urban neighbourhoods, apart from carrot and cleome leaves. Other vegetables, such as sweet potato, pumpkin leaves, and green beans, showed significance, but were not included due to the low number of respondents who purchased them.

Table 3.5 *Difference in consumer vegetable purchases by neighbourhood type in Burkina Faso (n=1,011)*

Vegetable	Mean		T-value	*P*-value
	Urban	Peri-urban		
Tomato	.87	.66	6.83	<.001
African Eggplant	.39	.28	3.33	
Okra	46	.34	3.35	
Onion	.88	.73	5.31	
Cabbage	.62	.45	4.79	
Carrot	.04	.12	-3.90	
Green bell pepper	.57	.38	5.66	
Sorrel leaves	.46	.32	4.34	
Amaranth leaves	.16	.08	4.05	
Spinach	.34	.18	5.41	
Baobab leaves	.31	.22	3.19	.001
Cleome leaves	.02	.06	-3.09	.002
Boulvaka leaves	.39	.32	2.29	.022

Purchases of some vegetables correlated with household size and/or number of children in the household. Purchase of cleome leaves (r=.065, p=.040) and sorrel leaves (r=.072, p=.022) showed weak positive correlation with household size. Meanwhile, purchase of carrots (r=-.066, p=.036) showed a weak negative correlation with number of children in the household.

With regards to differences between genders, male respondents bought more of these 10 vegetables than female respondents: African eggplant, okra, sweet potato, cleome leaves, sorrel leaves, moringa leaves, amaranth leaves, cucumbers, spinach, baobab leaves, and boulvaka leaves (Table 3.6). Other vegetables, such as green beans, sweet potato, and sweet potato leaves, showed significance, but were not included due to the low number of respondents who purchased them.

Table 3.6 *Difference in consumer vegetable purchases by gender in urban Burkina Faso (n=1,011)*

Vegetable	Means		T-value	*P*-value
	Male	Female		
African Eggplant	.67	.29	5.09	<.001
Okra	.63	.36	3.46	
Cucumber	.35	.11	4.70	
Moringa leaves	.16	.03	4.64	
Sorrel leaves	.72	.34	5.15	
Amaranth leaves	.35	.09	5.46	
Spinach	.46	.21	3.80	
Baobab leaves	.60	.23	5.70	
Boulvaka leaves	.77	.32	6.67	
Cleome leaves	.30	.04	7.94	

3.3.3 Out-of-home consumption

Out-of-home meals were bought by 34.8% of the sample in the past week. The most often used outlets were street food vendor (fixed place) (26%), mobile street food vendor (7%), and small informal restaurant (6%). Less than 5% of the sample bought food at a restaurant (plate) (2%), canteen at work or school (1.2%), and fast food (boxes/paper) (2.8%) (Table 3.7). Purchase frequency was, on average, 2.33 (SD=1.47) days per week (range 1-7 days). In terms of frequency, street vendors (fixed/mobile) were the most often used outlets, at an average of 2.45 (SD=1.54) days per week.

Table 3.7 *Consumption of out-of-home meals by outlet by consumers in in Burkina Faso, where and frequency*

Outlet	Proportion of respondents that bought here in past week (% of buyers) a)	Frequency bought in past week (includes only the buyers)
Street food vendor (fixed place)	26.3%	2.56 (1.62) times
Mobile street food vendor	7.3%	1.96 (1.03) times
Small informal restaurant	5.5%	1.73 (1.12) times
Restaurant (plate)	2.2%	1.32 (0.56) times
Canteen at work or school	1.2%	3.25 (2.05) times
Fast food (boxes/paper)	2.8%	1.54 (0.69) times

a) Only respondents that bought out-of-home meals in the past week were included (34.8% of the total sample of 1,011).

3.4 Food safety perception and motives

3.4.1 Highlights and implications

- Food safety was an important motive for respondents – equal to affordability and scoring only slightly lower than healthiness. This suggests that general awareness creation around food safety is not crucial, since consumers are already considering this in their food purchasing. However, specific perceptions might differ between products and consumers and relate to different sources (e.g. chemical or micro-biotical) and different handling practices that those that cause the greatest health hazards.
- Vegetables are judged as 'somewhat' safe, which suggests that food safety should be improved to meet consumers' standards.
- Governments, farmers, and retailers were neither trusted nor mistrusted for keeping food safe.
- Safety concerns of consumers were particularly regarding contamination (including from fertilisers and pesticides). From consumers' perspectives, this should be the focus for improved food safety. They also thought vegetables were often not well priced.

3.4.2 Food choice motives

Health, safety, and affordability were considered very important by respondents, with an average score between 6.0 and 5.8 on a scale from 1 (not important at all) to 7 (very important). Other motives considered important were gives energy, tasty, natural, convenient, environmentally friendly, and mood. On the other hand, familiarity, weight control, and local/seasonal were considered moderately important (Figure 3.3).

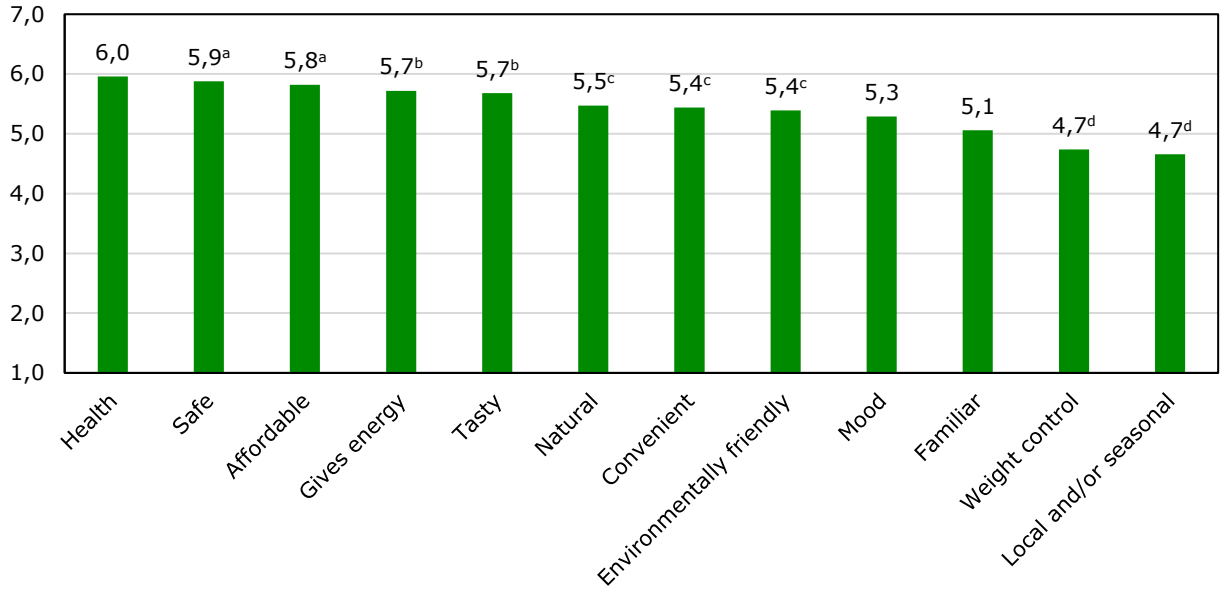

Figure 3.3 *General food choices motives (average score on a scale from 1 (not important at all to 7 very important) – based on single item (n=1,011). All differences significant with the exception of similar letters which indicate not significantly different*

The importance of food safety in food choice was measured with an additional (multi-item) method. This multi-items measure of the food safety motive results in a similar score as the single item with an average score of 5.8 (SD=0.7) – suggesting that safety aspects were important for respondents.

The importance of food safety differed largely between the two cities (t=-2.7, p<0.004), with a slightly higher average score in Bobo-Dioulasso (mean of 5.9) compared to Ouagadougou (mean of 5.8). Food safety motive scores also differed with neighbourhood income level (F=8.3, p<0.001), with the lowest scores in the slum and low-income neighbourhoods (mean of 5.8 both) compared to middle-income neighbourhoods (mean of 6.0). Food safety was more important in peri-urban neighbourhoods (mean 5.9) than urban neighbourhoods (mean 5.7) (t=-3.9, p<0.001). Finally, the importance of food safety did not differ between male and female respondents, and did not significantly correlate with age, household size, and number of children in the household.

3.4.3 General food safety perceptions

Overall perception of the safety vegetables was neutral to slightly positive, with an average vegetable safety optimism score of 4.6 (SD=1.1). At the same time, respondents slightly agreed with pessimistic statements on vegetable safety, with an average score of 4.5 (SD=1.2) – indicating some concerns regarding the safety of vegetables provided to them. Trust was neither positive or negative for all chain actors, with average scores of around 4 on a scale from 1 (negative) to 7 (positive) for authorities (mean of 4.0, SD=1.8), farmers (mean of 3.9, SD=1.7), and retailers (mean of 3.9, SD=1.6).

Respondents were asked to rank foods based on their safety. Green leafy vegetables were ranked most often as the first choice, so the safest relative to other foods by 29.9% of respondents and were also most often ranked in the top 3 – so either as the first, second, or third most safe foods (by 61.7%). Fruits came a close second, ranked first by 20.8% and in the top three safest by 48.8%. Also, fish and other vegetables were often ranked in the top 3 (by 43.6 and 40.1% respectively). There was, however, great variation between respondents, with 64.3% ranking green leafy vegetables as the most safe (top 3 highest rankings) and 10.4% ranking them as least safe (top 3 lowest rankings). Milk (48.4%), egg (47.7), and groundnuts (46.2) were ranked most often in the lowest three positions, so the least safe relative to the other foods. Chicken was also often ranked low.

3.4.4 Safety attributes of vegetables

Respondents rated their perception of safety attributes of vegetables sold at places where they (or their household members) usually buy (see Figure 3.4).

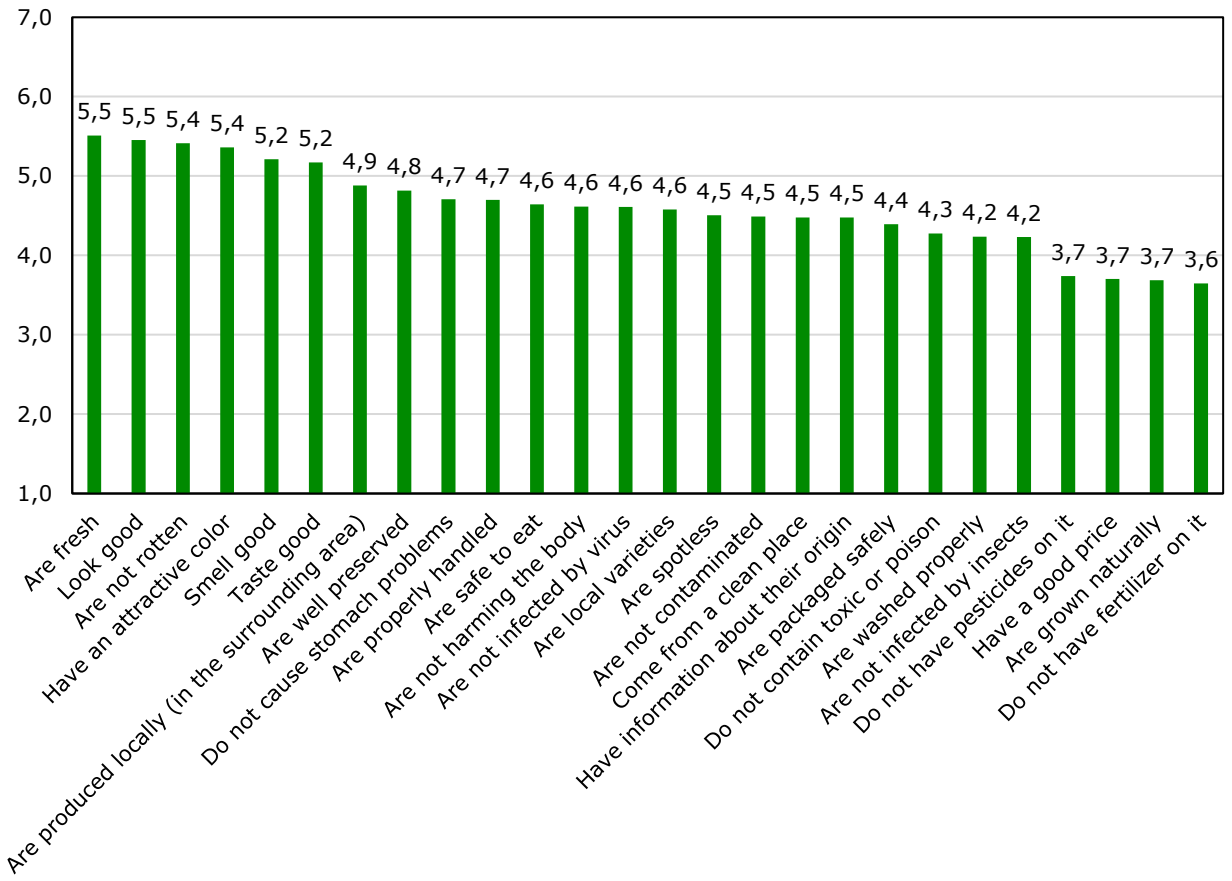

Figure 3.4 *Perception of product attributes by consumers in urban Burkina Faso of the vegetables sold at places where they usually buy (n=1,011)*

Vegetables were judged most positively on freshness (are fresh, not rotten, well preserved), appearance (look good, attractive colour), and good taste and smell. Respondents provided an average score between 5 and 6 for these aspects, indicating that they (somewhat) agreed with the statement. On average, respondents also somewhat agreed that the vegetables were produced locally, were safe (safe to eat, not harming or causing problems), and were handled hygienically (including use of clean water, in a clean place, packaged, not contaminated) – represented by a slightly positive score. With regards to beliefs that the vegetables do not contain pesticides and fertiliser, had a good price, and are grown naturally, average scores were slightly negative.

3.4.5 General attitude safety of vegetables at outlets

Respondent attitudes towards vegetable outlets were measured in terms of cognitive attitude (safe, fresh, neat) and affective attitude (good, of high quality) for the primary and secondary most important outlets for buying vegetables. In general, attitudes towards the safety of vegetables at respondents' primary and secondary outlets for purchasing were positive. Vegetables were considered safe ($M_{Primary}$=5.1, SD=1.11; $M_{Secondary}$=4.9, SD=0.96), fresh ($M_{Primary}$=5.5, SD=0.86; $M_{Secondary}$=5.2, SD=0.78), neat ($M_{Primary}$=5.0, SD=.99; $M_{Secondary}$=4.9, SD=.90), good ($M_{Primary}$=5.3, SD=.91; $M_{Secondary}$=5.1, SD=.79), and of high quality ($M_{Primary}$=4.7, SD=1.23; $M_{Secondary}$=4.5, SD=1.16). Attitude scores did not differ between outlets (Figure 3.5).

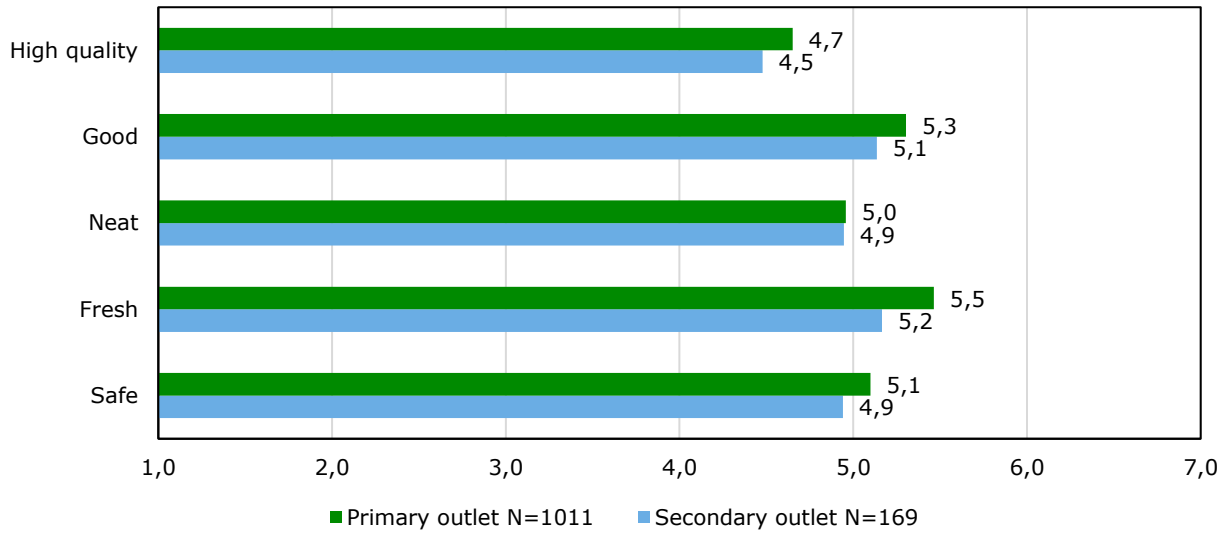

Figure 3.5 *General attitude of vegetables by consumers in urban Burkina Faso per outlet where they usually buy. Note: sample size differed significantly with all respondents (n=1,011) reporting about their primary outlet and a subsample also reporting about their second outlet (n=169)*

3.5 Accessibility, safety knowledge, and skills

3.5.1 Highlights and implications

- Respondents were confident about their skills to purchase and consume safe vegetables, including regarding their kitchen skills. This suggests they would not perceive to benefit from a general information campaign on food safety skills.
- They did, however, feel less confident about their knowledge of safe vegetables, so information campaigns targeting this area might be valuable.
- In general, perceived access to vegetables was somewhat good – but the price and affordability of vegetables was an issue for respondents.
- Street vendors scored especially highly on accessibility compared to, for example, fresh markets. This suggests that these locations could be an entry point to increase vegetable purchase. However, the availability of vegetables from street vendors scored lower and should be improved to attract and retain consumers.

3.5.2 Abilities related to safe vegetable consumption

Respondents felt neutral about their knowledge on the safety of vegetables (mean=4.0, SD=1.0). When asked: 'Would you like to know more about the safety of vegetables?', 98.5% replied in the affirmative. On average, respondents felt somewhat confident they were able to purchase and consume safe vegetables (mean=5.0, SD=0.8) and were also confident in their safe kitchen skills (mean=5.7, SD=0.6).

Subjective knowledge about food safety differed largely between the cities, with the highest average score in Bobo-Dioulasso (mean=4.7) compared to Ouagadougou (mean=3.6) (t=-17.5, p<0.001). Subjective knowledge was also higher in peri-urban (mean=4.1) than urban (mean of 3.8) neighbourhoods (t=-5.0, p<0.001) and was significantly correlated with number of children in the household, although the correlation was low in strength (r=0.1). Subjective knowledge did not differ with neighbourhood income or between genders, and was uncorrelated to age.

3.5.3 Perceived access to safe vegetables

Respondents were asked about different aspects of access regarding their primary outlet and (if applicable) secondary outlet for vegetable purchasing (Figure 3.6). Most respondents (80.3%) stated fresh markets are their primary outlet, and an additional 4.4% said it was their secondary outlet. However, the majority of the respondents (83.3%) stated they did not have a secondary outlet for buying vegetables. Combined data for primary and secondary outlets resulted in 858 cases for fresh markets, 179 for street vendors, and 113 for neighbourhood stores. Other outlets (n=3), farmer's markets (n=16), and supermarkets (n=11) were not included due to their small numbers.

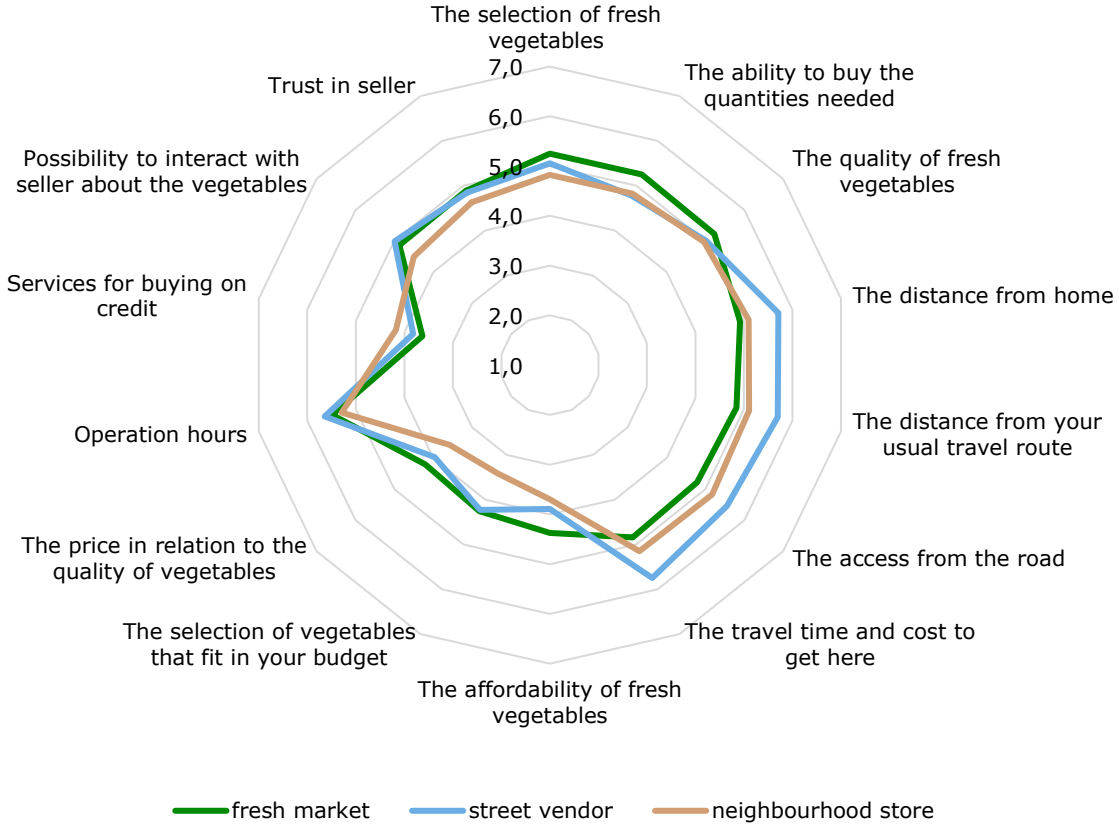

Figure 3.6 *Aspects of accessibility per outlet perceived by consumers in urban Burkina Faso (n=858 for fresh market; 179 for street vendor; 113 for neighbourhood store (score from 1, extremely bad, to 7, extremely good)*
Note: Differences could not be tested since respondents had different combinations of outlets (primary and secondary outlet) and numbers became too small.

With the exception of services for buying on credit, access was, on average, considered neutral to somewhat good (average scores between 4 and 5.4 on a scale for 1 (bad) to 7 (good)). At fresh markets – the most commonly used outlet – availability (selection, qualities, and quality) and accessibility (access from the road) were rated somewhat good, with scores around 5. Additionally, most aspects of accommodation (operation hours, possibility to interact with vendor, trust in vendor) were all rated around 5, while affordability and services for buying or credits were rated lower. Street vendors scored slightly lower compared to fresh markets with regards to selection of vegetables and quality (availability), but better on all aspects of accessibility. Neighbourhood stores scored lower than the other outlets in almost all aspects, scoring particularly low on affordability, and also lower on availability than fresh market, and intermediated on accessibility and accessibility – although this outlet scored highest on services for buying on credit.

Scores on availability, accessibility, affordability, and accommodation compared between outlets (fresh market compared to others only, due to sample sizes). The patterns for the accessibility factor scores were similar to that of the separate aspects of accessibility, but were now also tested for significance. Fresh markets did relatively well on availability (only farmers markets did better) but scored lowest on accessibility and accommodation (Figure 3.7). Street vendors and neighbourhood stores scored especially high on accessibility. Farmer's markets particularly stood out for a high availability and affordability, but achieved lower on accessibility.

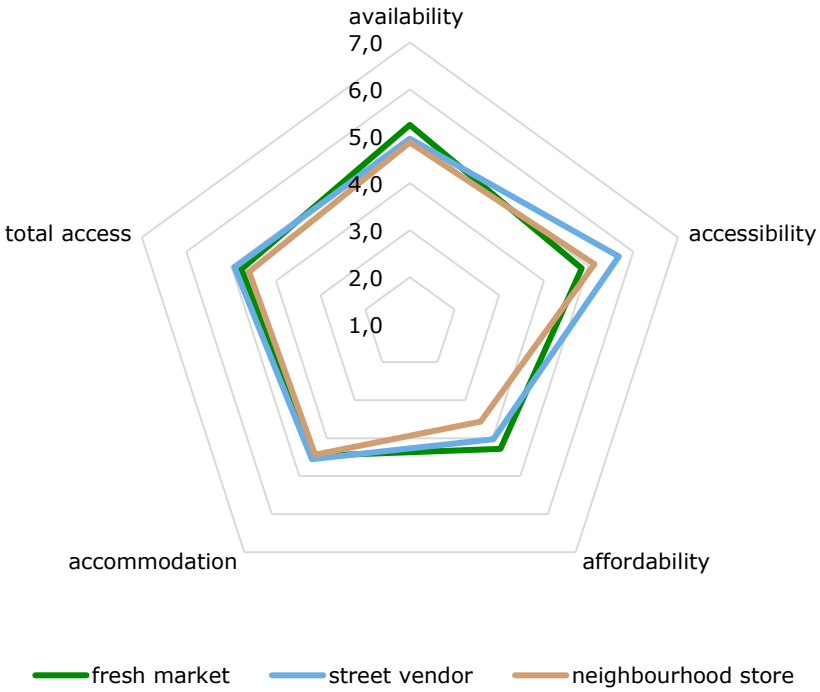

Figure 3.7 *Accessibility per outlet perceived by consumers in urban Burkina Faso (n=858 for fresh market; 179 for street vendor; 113 for neighbourhood store) (score from 1, extremely bad, to 7, extremely good)*
Note: All differences between market and other outlets were tested and significant, except fresh market versus street vendor on access; test on paired data including only cases that reported both outlets while bars include all data.

3.5.4 Demographic differences in access to markets

Access to fresh markets was compared between demographic groups. Total access to fresh markets was higher in Ouagadougou (mean of 4.8) than Bobo-Dioulasso (mean of 4.6) (t=6.8, p<0.001). In urban neighbourhoods, perceived access was higher (mean of 4.8) compared to peri-urban neighbourhoods (mean of 4.7) (t=3.6, p<0.001), although the difference was again small. The access score did not differ by neighbourhood income level. Female respondents (mean of 4.8) perceived better access compared to males (mean of 4.5) (t=3.1, p<0.01). Finally, perceived access correlated significantly but weakly with the age of respondents or number of children in the household (rs of .1) – with higher perceived access among younger respondents and for those with smaller families.

For other outlets, the sample sizes and thus statistical power was lower, but one significant difference in access between demographic groups was found. Access to street vendors was higher in Ouagadougou (mean of 5.0) compared to Bobo-Dioulasso (mean of 4.7) (t=4.0, p<0.001).

4 Conclusion and discussion

Through the SAFEVEG project, we aim to improve vegetable consumption by increasing the accessibility, affordability, and acceptability of safe vegetables. This study provided insights regarding the acceptability of vegetables and perceptions of vegetable safety, and highlighted possibilities for consumers to purchase, prepare, and consume safe vegetables. In addition, it showed how these factors differ between the demographic characteristics and geographic locations (cities, urban, and peri-urban) of consumers. A strength of the study was its large sample, diverse in terms of education, ethnic background, and religion. The sample included a high percentage of vulnerable households, since a large share of the data was collected in the slums and low-income neighbourhoods. A large proportion of those questioned had not finished primary school (61%) and household food insecurity was high: most households reported some degree of food insecurity, ranging from mild (37%), to moderate (23%), to severe (16%).

Below, we summarise the main outcomes of the study, discuss their limitations and implications, and suggest directions for interventions.

4.1 Acceptability

To acquire insights into what is common and 'fits' in the culture (acceptability), vegetable consumption and purchase behaviour were measured. The results showed that vegetables are an important part of the diet and almost all of the sample reported usually eating vegetables, especially cooked (97%) but also raw vegetables or salad (55%). Frequency was also high, with just over one-third of the sample reporting eating vegetables daily. On average, cooked vegetables were reported being eaten as frequently as 5 days per week and raw vegetables 1 day per week. Vegetables from the 'other' category, including tomato, onion, and okra, were consumed by a large share of the respondents (77%), and dark green leafy vegetables were also consumed by a majority of the sample (67%) in the past 24 hours. However, the intake of vitamin A-rich vegetables (9%) was low. This latter is of concern since these are nutrient-dense and have a promising role in overcoming micronutrient deficiencies (Beal and Ortenzi, 2022). Results on vegetable purchase were generally in-line with those on intake, showing the frequent buying of vegetables at an average of 3-4 times per week. The top three vegetables most often bought by respondents were onion (77.2%), tomato (71.8%), and cabbage (50%). In terms of quantity, most respondents bought the vegetables in relatively average numbers.

Our study was not designed to quantify the portions eaten or bought by consumers. We can only conclude that on the days respondents ate vegetables, most respondents reported eating 1 to 6 portions. The average number of portions (31.2 per week, 4.5 per day) was in line with WHO recommendations, but we do not have insights into the portion sizes and therefore total intake of vegetables.

4.2 Safety perception

Perception of safety was measured in relation to other food choice motives, for specific vegetable product attributes, for different chain actors, and related to outlets. The results showed the importance of food safety to consumers overall, although specifically for vegetables. Its significance is comparable to affordability and only healthiness was considered more important. Many studies have shown that taste, health, and affordability are important motives driving consumer choice (e.g., Adegbola et al., 2019; Pacho, 2020; Raaijmakers et al., 2018, 2023), and this study highlights that, in Burkina Faso, safety and energy provision should be added to this list.

Vegetables specifically are generally judged as being somewhat safe. Scores for vegetable safety were positive, but not very high – demonstrating that consumers have concerns, but overall are not overly worried about safety. This is further supported by the scores obtained on food safety pessimism statements, such as 'You worry about the safety of vegetables', as respondents also slightly agreed with this. Vegetables were generally ranked as safe compared to other food. Interestingly, green leafy vegetables were considered safer than other vegetables. In terms of interventions, the product attribute scores provide more specific entry points on what consumers believe is required to increase the safety of vegetables. The figures show that, on average, most attributes scored somewhat positively: scores on freshness and appearance were most positive, while those for contamination and chemicals (including pesticides, fertiliser, toxic or poison, insects) and 'grown naturally' were lowest. So, although vegetable safety in all aspects could be improved in the perception of the consumer, contamination and not being naturally grown seems to cause the greatest concern. It should be noted that this is the consumer perception of safety and does not necessarily correspond with actual safety of products. Furthermore, consumers often thought that vegetables were not well priced, which could be especially true for vegetables that are sold as 'safer' (e.g., organic vegetables which are often highly priced). This suggests there might be a greater need for safer but reasonably priced vegetables. Trust in governments, farmers, and retailers for keeping food safe was neither positive nor negative. This should be kept in mind since retailers and governments are common agencies for information campaigns, but their information might be mistrusted. Fresh markets could be useful in implementing trust-related interventions, e.g. labelling interventions, since they are the primary outlet used for purchasing vegetables. Safety and high-quality attitudes were rated highly, but not as high as fresh, good, and neat.

4.3 Accessibility, knowledge, and skills

Results on vegetable sourcing showed that, in this sample, only a minority of the respondents (25%) had produced their own vegetables for personal consumption in the past year. Several interventions have been developed to support homegrown vegetables (e.g. Merrey and Langan, 2014), although it is unclear from our data if these have the potential to reach a larger proportion of consumers. Most respondents (86%) had bought vegetables from outlets in the past week. Fresh markets are by far the most relied on, followed by street vendors and neighbourhood stores. Supermarkets were not seen as suitable outlets for buying fresh produce. Vegetables gathered from the wild or given as gifts/in kind were not included in this study, since this approach was not considered an important entry point for intervention.

To obtain more insights into access levels, we measured respondents' knowledge and skills (self-efficacy) around eating healthy and safe vegetables. We also assessed their perceived access to vegetables at different outlets.

Respondents were confident about their skills in terms of purchasing and consuming safe vegetables, such as their ability to judge the safety of vegetables in the store and feeling confident about their kitchen skills. However, they felt less confident about their knowledge of safe vegetables and said they would like to know more about this topic. These results suggest a perceived gap in knowledge contrasting with a high sense of confidence in their own skills. A possible explanation for this discrepancy is an overestimation of their own skills. Earlier research showed that consumers have an optimism bias about their own safety-related behaviour and think food contamination mostly occurs outside their homes rather than through their own handling (Wilcock et al., 2004). The results show the consumers themselves feel a need for information on vegetable safety, but perhaps more in relation to how food is produced than storage or cooking at home. In light of the earlier results, information shared by governments, farmers, and retailers might not be highly trusted. This poses challenges for interventions, since the point of sale is the easiest way to provide information. Qualitative consumer research (such as interviews) is needed to obtain more insights into specific information needs. The current question 'Would you like to know more about the safety of vegetables?' was a single-item question and requires further exploration. Results on product attributes suggest consumers would like to know more about contaminations, since this was a product attribute they were less positive about.

Access was scored on four dimensions: availability (selection, quality, and quantity), accessibility (travel time, efforts, and costs), affordability, and accommodation (services provided by the vendor). Access of

vegetables was generally perceived as being somewhat good, with aspects of availability and operation hours scoring highest (just above 5). Meanwhile, services to buy on credit and affordability aspects were scored lower (around 4). Fresh markets did relatively well on availability but scored lower on accessibility. Street vendors scored especially high on accessibility but lower on availability.

Neighbourhood stores scored particularly low on affordability and did not really stand out on any aspect – although this outlet did score highest on services for buying on credit. Improving the selection, quality, and quantities of vegetables for lower prices at neighbourhood stores and street vendors might be a way to achieve higher vegetable purchase, although this requires adaptations to the supply chain. Another opportunity may be with outlets that are currently not commonly used: supermarkets and farmers markets. Finally, in line with earlier results on perceptions of safe vegetables, the price and affordability of the vegetables is an issue for consumers.

4.4 Demographic differences in linkage to accessibility

Clear differences were found between cities. Ouagadougou is seemingly most at risk for low consumption of safe vegetables, with highest levels of food insecurity, low vegetable consumption, and lower subjective knowledge on and perceived importance of food safety, compared to Bobo-Dioulasso. However, in Ouagadougou, higher access to fresh markets and street vendors was reported – a contradiction since these outlets are usually the main source of fresh vegetables. A possible explanation for lower intake in Ouagadougou might be related to other factors, such as habits and culture, while the better access might be explained by the higher level of urbanisation in Ouagadougou compared to Bobo-Dioulasso.

Analysis on demographic differences showed that attention is particularly required for consumers living in urban neighbourhoods, since they consume the least amounts of vegetables and reported higher food insecurity compared to peri-urban areas. Food safety was also considered less important in urban neighbourhoods, and perceived knowledge on food safety was lower – while access to fresh markets was higher. Consumers from slum and low-income neighbourhoods can also be deemed an at-risk group when it comes to food security and vegetable intake (only for low-income). Respondents from these neighbourhoods consider food safety less when making choices compared to those in middle-income neighbourhoods – suggesting they should be targeted with safety awareness interventions. Yet, when using food safety as a selling point, those in slum and low-income neighbourhoods might be less receptive than those in middle-income areas. The differences seen between income areas might indicate that safety is considered an expensive luxury, and therefore not for the poor. Lower educational levels may also be a factor, since this has been related to lower knowledge of food-related topics. The other characteristics considered in this study – age and household size – seem less relevant for demographic profiling in relation to selling, since only a few differences were found and associations were weak. Some differences between male and female respondents were found with mixed results on vulnerability of men and women: men had higher intake of vegetables but also higher food insecurity and lower access to fresh markets compared to women. It should be kept in mind that the results are based on a small sample of men.

Some differences in purchase patterns were found. Purchases of vegetables from neighbourhood stores was higher in Ougadougou and peri-urban neighbourhoods than Bobo-Dioulasso and urban neighbourhoods. Purchases of almost half of the vegetables were higher in Ougadougou compared to Bobo-Dioulasso; vegetables such as spinach, okra, and green bell peppers were purchased more by those in urban neighbourhoods; more men purchased leafy greens than women; and higher purchases of carrot were reported in slum neighbourhoods. It is not clear what underlies these variations – whether it's differences in food patterns, taste preferences, seasonality, or access. Another point for discussion is that few differences in eating and buying patterns were found between the men and women included in this sample. In general, cultural differences regarding men and women's responsibilities for food purchases and cooking are common in Burkina Faso. In our sample, all respondents – male or female – had to be responsible for cooking and/or purchase of foods to be included, suggesting that this is a specific group of men. Men reported higher vegetable intake, higher value of food safety in the choice of food, and more subjective knowledge – which might be related to differences in income and/or educational level, with men, on average, more highly educated. Women, on the other hand, reported higher access to neighbourhood stores, which might reflect

the fact their activities are closer to their homes. Interventions targeting neighbourhood stores should keep in mind that women are an important clientele. Interestingly, no differences were found between men and women in access to fresh markets, the main outlet for vegetables.

4.5 Entry points for interventions

The results provide several entry points for interventions. Intake of vegetables could be increased, especially the percentage of people eating them on a daily basis. The intake of vitamin A-rich vegetables also needs particular attention. Moreover, purchase variety could be increased among most consumers to include more diverse and nutrient-rich vegetables, such as sweet potato and cowpea leaves. Although the safety of vegetables could be improved in all aspects, the greatest concerns seem to be around contamination (including from fertiliser and pesticides) and produce not being 'naturally grown'. Another entry point is the consumer's need for information on the safety of vegetables. This seems more related to how food is produced than handling at home, particularly in terms of contamination. While point of sales are the easiest route for information-based interventions, trust in farmers and retailers might inhibit their efficacy.

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Wageningen Economic Research
P.O. Box 29703
2502 LS The Hague
The Netherlands
T +31 (0)70 335 83 30
E communications.ssg@wur.nl
wur.eu/economic-research

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Wageningen Economic Research
P.O. Box 29703
2502 LS Den Haag
The Netherlands
T +31 (0) 70 335 83 30
E communications.ssg@wur.nl
wur.eu/economic-research

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The mission of Wageningen University & Research is "To explore the potential of nature to improve the quality of life". Under the banner Wageningen University & Research, Wageningen University and the specialised research institutes of the Wageningen Research Foundation have joined forces in contributing to finding solutions to important questions in the domain of healthy food and living environment. With its roughly 30 branches, 7,600 employees (6,700 fte) and 13,100 students and over 150,000 participants to WUR's Life Long Learning, Wageningen University & Research is one of the leading organisations in its domain. The unique Wageningen approach lies in its integrated approach to issues and the collaboration between different disciplines.