

EatSafe: Evidence and Action Towards Safe, Nutritious Food

Food Safety Attitudes and Practices in Traditional Markets in Nigeria: A Quantitative Formative Assessment

May 2022

This EatSafe report presents evidence that will help engage and empower consumers and market actors to better obtain safe nutritious food. It will be used to design and test consumer-centered food safety interventions in traditional markets through the EatSafe program.

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ACRONYMS AND ABBREVIATIONS

Below is a list of all acronyms and abbreviations used in the report.

ANOVA	Analysis of Variance
DALY	Disability-Adjusted Life Years
FBD	Foodborne Disease
FES	Focused Ethnographic Study
FTF	Feed the Future
GAIN	Global Alliance for Improved Nutrition
ILRI	International Livestock Research Institute
IQR	Inter-quartile range
LMIC	Low- and middle-income country
PPI	Poverty Probability Index
PY	Project Year
QC	Quality control
RTE	Ready-To-Eat
SD	Standard deviation
SES	Socioeconomic status
USAID	United States Agency for International Development
USD	U.S. Dollars

EXECUTIVE SUMMARY

Food safety is critical to public health and safety. Feed the Future's Evidence and Action Towards Safe, Nutritious Food (EatSafe) seeks to improve food safety in traditional food markets, a key source of nutritious foods for millions of people in low- and middle-income countries, by leveraging consumer demand as a driving force to shape food systems. Improving food safety in traditional markets requires understanding the motivations, knowledge, perceptions, and behavior that shape the decisions of both consumers and food vendors, to enable consumers to demand safer food and vendors to deliver it.

In Nigeria, EatSafe operates in Kebbi and Sokoto States, and its Key Commodities are grains (rice, maize, cowpea, soybean), fresh fish, fresh vegetables, and fresh beef. Along with other Phase I (formative research) activities, this assessment provides the local context in Kebbi State, Nigeria necessary to design effective food safety interventions in Phase II (intervention implementation). To understand the knowledge, attitudes, and practices (KAP) relevant to food safety among both food consumers and vendors, EatSafe conducted three studies under the umbrella of this quantitative formative assessment:

1. Structured Consumer Survey (n=470);
2. Structured Vendor Survey (n=478); and
3. Direct Observations of Vendor Behaviors (n=50, *subset of survey respondents*).

Key findings are summarized below. A detailed summary of findings, including implications for EatSafe's intervention design, can be found on page 62 of this assessment.

Consumer Survey. Traditional markets in Kebbi State are lively and complex venues. Consumers are predominantly Hausa and Muslim. Because both females and males are primary shoppers for their household, and spouses share food purchasing decisions, EatSafe interviewed an equal number of men and women. The group is well educated, and well above the extreme poverty line. All of EatSafe's Key Commodities in Nigeria are commonly purchased in the markets. Consumers shopped at the same traditional market for several years and were generally satisfied with their experience.

Key factors in consumers' market and vendor selection decisions included proximity of market to home, food prices, food quality, and food variety. Within the market, shop appearance and cleanliness were not as salient, mentioned only by a quarter of consumers. Consumers are loyal to specific vendors, but also compare shops before buying. EatSafe interventions should account for existing consumer standards for price and quality.

Consumers are aware of several foodborne hazards and their consequences; however, this knowledge does not seem to translate into high levels of concern of any specific commodity. Because consumers use visual and olfactory cues to decide if food is safe before buying it, food safety messages should leverage these signals.

Consumers have access to a range of media, with television, social media, and radio the most frequently cited. Most people own a mobile phone and use it to access the internet. Fictional TV is popular for entertainment, as well as social media, and to a lesser extent radio serials. Consumers consider medical professionals (e.g., doctors, nurses, health workers) as trusted sources for health or food safety information. A clear gap was that only few consumers could name any organization working locally on food safety.

Vendor Survey. Compared to surveyed consumers, vendors were more commonly Hausa and male. While vendors' overall socioeconomic status was relatively high, female vendors faced a significantly higher probability of poverty. While overall education levels are relatively high, 30% of vendors had no formal education. Shop structures vary from masonry to wooden tables and containers on the ground, and none have refrigeration.

Vendors are satisfied with selling at the market, and like consumers, vendors perceive the market as clean. Market management is regarded positively, seen as a service provider and regulation enforcer. Female vendors communicated less frequently with the management and had a more neutral view of their role, compared to male vendors. Vendors believe prices are the top factor that influence whether customers return, while cleanliness was cited infrequently.

Vendors and consumers have infrequent conversation on topics relevant to food quality and safety, initiated by both parties. Consumers also bring complaints, primarily about price, and less frequently, on shelf life or taste of the food they bought. Female consumers are perceived as making more requests than males; gender seems to mediate social interactions in the market. Vendors are generally open to customers' feedback, which they see as important to improve their business and retaining customers.

Consumers' willingness to verbally express demand to vendors is a positive finding that confirms EatSafe's theory of change. At the same time, attention to vendors' emotional wellbeing and leveraging positive feedback in balance with criticism is warranted. For instance, vendors have a strong sense of pride in their business, and value seeing themselves as role models and leaders. Such values should be considered and leveraged in intervention activities.

While vendors did not see any of EatSafe's Key Commodities in Nigeria as high risk, 25% associated fresh vegetables, beef, and fish with foodborne illness. Most vendors report taking several actions to keep the food they sell clean, a finding partially confirmed by direct observations of vendors (see below). Vendors are highly confident that they can identify safe food provided by suppliers. On average, vendors rely on four suppliers with whom they have trusting relationships. However, they do not frequently talk to them about food quality or safety.

In terms of information access, vendors commonly use radio, more so than consumers, while TV and Internet are also used – confirming the suitability of radio as a messaging channel for both consumers and vendors. Medical professional and "friends and family" are the most trusted sources of information about food safety, consistent with consumers' responses.

Direct Observation of Vendor Behaviors. Direct observations of vendor behaviors occurred in only Market #1, the largest market of the three, and found vendor practices could contribute to food contamination. For instance, food is usually not covered, is handled with bare hands that also touch money, and perishable foods are kept at ambient temperature. Handwashing or sanitizing was observed but was limited. However, few animals were seen near shops, efforts to wipe surfaces were observed, and tools to handle food were available, although not frequently used by vendors. Both the survey and the observations highlight those verbal communications between consumers and vendors on topics related to food safety occur regularly, initiated by both parties.

I. INTRODUCTION

For food to be safe, it must be free of disease-causing pathogens, parasites, chemical contaminants, or adulterants. These foodborne hazards can both cause acute illness and raise the risk of chronic disease. The majority of foodborne disease (FBD) burden falls on those living in low- and middle-income countries (LMICs) (1,2), who comprise 75% of deaths from FBD despite comprising only 41% of the global population. The WHO sub-region containing Nigeria has the highest per capita FBD burden, primarily attributed to diarrheal disease agents and helminths (i.e., intestinal worms) (3).

Traditional or informal markets, where millions of consumers in LMICs purchase their foods (4), can be especially risky for foodborne hazards. Traditional markets often have inadequate poor market infrastructure, including limited access to potable water (5), poor hygienic conditions (6,7), and limited food storage facilities (8). Research suggests samples of food sold in traditional Nigerian markets have high contamination levels (9). Nigeria, as a transitioning lower-middle-income country with considerable urbanization, falls into the category of country for which food safety concerns are generally at their most critical due to rapid economic, demographic, and dietary change but limited food safety management capacities (10).

Feed the Future's Evidence and Action Towards Safe, Nutritious Food (EatSafe) seeks to improve food safety in traditional markets in LMICs by empowering consumers to demand safer food practices. In Nigeria, EatSafe operates in Kebbi and Sokoto States, and its Key Commodities include grains (rice, maize, cowpea, soybean), fresh fish, fresh vegetables, and fresh beef. Increasing consumer demand requires a deep understanding of the motivations, attitudes, beliefs, and practices that shape the decisions of both consumers and food vendors, in order to enable consumers to demand safer food and vendors to deliver it (11,12).

This EatSafe in Nigeria cross-sectional survey assessment was designed to yield large-sample data on consumers' and vendors' knowledge, attitudes, and practices (KAP) relevant to food safety, as well as demographics and contextual information on food purchasing and vending behaviors, in three traditional markets in Kebbi State, Nigeria. The assessment tools were designed to complement other formative research activities in Nigeria (e.g., qualitative research, policy analysis, and a Focused Ethnographic Study (FES) (13,14)). The findings will inform the detailed design of a food safety intervention, to be implemented and tested in Phase II (Intervention Implementation).

This report presents the findings from three studies, carried out under the umbrella of the EatSafe in Nigeria quantitative formative research assessment, including:

1. Structured Consumer Survey (n=470);
2. Structured Vendor Survey (n=478); and
3. Direct Observations of Vendor Behaviors (n=50, *subset of survey respondents*).

I.1. BACKGROUND AND RATIONALE

Several studies specific to Nigeria have concluded that vendors have poor food hygiene knowledge and/or practices (15–17). For example, a 2010 study found that 24% of street food vendors in Owerri prepared food in unhygienic conditions, 43% did not use aprons, 48% handled food with bare hands, and 62% handled money while serving food (18). Others, however, have found that vendors have moderate to good knowledge and/or practices (19–21), or high levels of knowledge but poor practices (22,23). Studies of Nigerian consumers have

generally found poor knowledge regarding food safety practices, and awareness of foodborne illnesses (24,25).

While there have been several prior studies of consumer and especially vendors' knowledge and practice related to food safety in Nigeria (26), a recent review (27) noted that these tended to focus on only consumers *or* vendors (not both) and on street-vended or ready-to-eat foods. They also did not assess the salience of food safety as a concern, relative to other concerns, or the sociocultural issues that might influence food safety-related behaviors. Further, despite the fact that consumer demand has been a major driver of safer food in middle- and high-income countries (28–30), there have been few or no studies that leverage the power of consumer demand to improve food safety in Nigeria – EatSafe's objective.

2. METHODOLOGY

Under the umbrella of the EatSafe in Nigeria quantitative formative research assessment, this report provides findings from three studies: consumer survey, vendor survey, and observations of a subset of vendors. Detailed methods for the consumer and vendor survey, as well as the vendor observations are available in [Appendix 1](#) and [Appendix 2](#), respectively. Ethical approval for the study was received from the local Institutional Review Board, the National Health Research Ethics Committee of Nigeria.

EatSafe recruited participants from three traditional markets in Kebbi State, Nigeria.

Participants included two groups:

- **Consumers:** Those who have primary or shared responsibility for purchasing food for their household, and shop in the target markets at least once a month on average.¹
- **Vendors:** Those who sell at least one of the EatSafe in Nigeria Key Commodities at the target market at least one day per week for the past three months.

Both groups were stratified by gender. Target gender quotas for consumers were 50/50%, and quotas by market were approximated based on relative market size, in terms of number of vendors of the considered commodities. Given that that female vendors constitute a substantial minority in the population, EatSafe intentionally oversampled females were to ensure sufficient representation of their perspectives.²

Data collection occurred in 2021. Both consumer and vendor surveys contained the following modules: demographics; market behaviors; perception and attitudes about food safety and gender; and sources of information. The consumer survey contained an additional module on food consumption and purchasing. Surveys were developed in English and translated into Hausa, allowing participants to select their language of preference.

¹ Within each household, one respondent (the “primary shopper”) was interviewed.

² A commodity-wise stratification scheme was used in vendor recruitment to ensure representation of all Key Commodity groups. Quotas of 50%, 20%, 15%, and 15% were imposed for grains/legumes, fresh vegetables, fish, and beef vendors, respectively. These commodity quotas were intended to be reflective of the total vendor population in the target markets.

3. CONSUMER SURVEY FINDINGS

3.1. OVERVIEW OF CONSUMER DEMOGRAPHICS

A total of 470 consumers were surveyed, among whom 400 (85%), 46 (10%), and 24 (5%) were shoppers at the three target markets, proportional to the market's relative size (**Table 1**). Gender parity was achieved across the markets, as per target quotas, except for Market #3, which had slightly more female participants (57%) than the others. The target gender quota of 50/50% may have slightly oversampled females, based on visual observation that the approximate proportion of females in the selected markets was 40-45% of the total consumer population, during preliminary market visits.

Table 1. Consumer Demographics

	FEMALE (N=238)	MALE (N=232)	TOTAL (N=470)
MARKET			
Market #1 (Largest)	200 (84%)	200 (86%)	400 (85%)
Market #2	26 (11%)	20 (9%)	46 (10%)
Market #3	12 (5%)	12 (5%)	24 (5%)
AGE (p = 0.447)			
Mean (SD)	30.1 (8.4)	29.1 (7.2)	29.6 (7.8)
Median (Q1 Q3)	28 (25, 35)	28.0 (25, 32)	28 (25, 34)
Min - Max	18- 67	18 - 60	18 - 67
MARITAL STATUS (p = 0.655)			
Married	146 (61%)	131 (57%)	277 (59%)
Unmarried	86 (36%)	96 (41%)	182 (39%)
Divorced	4 (2%)	4 (2%)	8 (2%)
Widowed	2 (0.8%)	1 (0.4%)	3 (0.6%)
EDUCATION (p = 0.513)			
Higher	122 (51%)	117 (50%)	239 (51%)
Secondary	100 (42%)	91 (39%)	191 (41%)
Primary	10 (4%)	11 (5%)	21 (5%)
Pre-primary	2 (0.8%)	3 (1%)	5 (1%)
None	4 (1.7%)	10 (4%)	14 (3%)
# OF HOUSEHOLD RESIDENTS (p = 0.936)			
Mean (SD)	6.1 (4.0)	6.3 (4.5)	6.2 (4.3)
Median (Q1 Q3)	5 (3, 8)	5 (3, 8)	5.0 (3, 8)
Min - Max	1 - 28	1 - 37	1 - 37
ETHNICITY * (p = 0.942)			
Hausa	195 (82%)	183 (79%)	378 (80%)
Fulani	5 (2%)	6 (3%)	11 (2%)
Igbo	10 (4%)	13 (6%)	23 (5%)
Yoruba	10 (4%)	11 (5%)	21 (5%)
Others	15 (6%)	16 (7%)	31 (7%)
RELIGION (p = 0.243)			
Christian	44 (19%)	53 (23%)	97 (21%)
Muslim	194 (81%)	179 (77%)	373 (79%)

* One respondent each belonged to the Ibibio and Kanuri ethnic groups, while two respondents each belonged to the Ijaw and Tiv ethnic groups.

On average consumers were 30 (± 8) years old, with 23% under the age of 25, 45% between 25 and 30, 27% between 31 and 45, and 4% older than 45 years. Over half (59%) of respondents were married. Over 90% of consumers reported having secondary school education. About half pursued post-secondary education (i.e., university-level education and specialized vocational schools). Educational attainment was comparable between genders.

Over 80% were employed or engaged in unpaid work, with 22% of respondents working in salaried positions, 18% students, and 19% and 16% self-employed out of and in the food sector, respectively. Relative gender parity was achieved in occupational categories with the exception of those unemployed, which was more prevalent among female consumers than among males (**Figure 1**). Among the respondents who worked in food sector-related work (N=73; 16% of the total), 70% worked in food production (e.g., crop or animal farming). Fewer of those employed in the food sector worked in food processing (8%), vending (6%), or small-scale reselling (4%).³

The average household size (defined as the number of residents who share meals in the home at the time of interview) was 6 (± 4) residents, varying from 1 (N=29) to 37 (N=1). Households consisted of 10 or fewer members, with 18% of residents under five years old on average. Two-thirds of households had children under five years old, with an average of one child per household, while only 1% of households had more than five children. Adolescents between five and 18 years old were present in 64% of households, constituting 22% ($\pm 20\%$) of all residents.

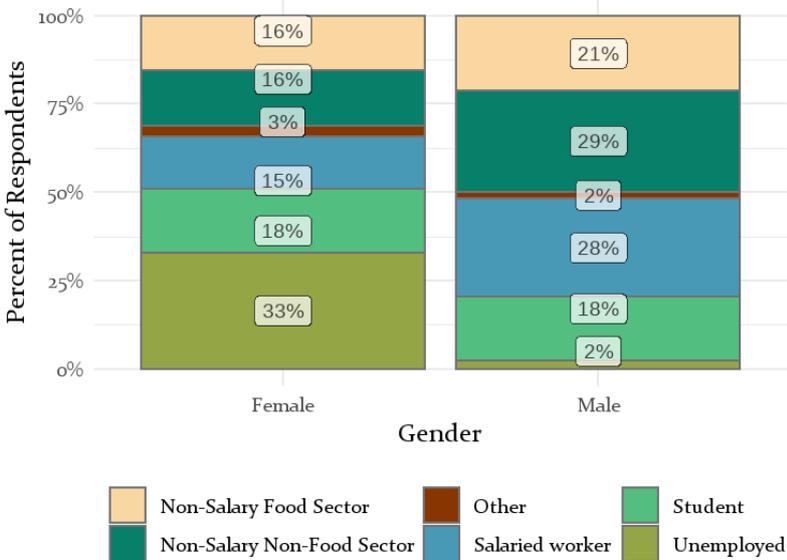


Figure 1. Consumer Occupations, by Gender

Mirroring the sociodemographic composition of the region, Hausa was the dominant ethnic group (80%), which was consistent between gender. The religious makeup was 79% Muslim and 21% Christian. On average, consumers had lived in Kebbi State 23 (± 11) years at the time of the interview.

³ Re-selling food was an exclusion criterion for consumer enrollment, so this is not representative of the wider population of market consumers. The three respondents that selected “small-scale reselling” as their occupation answered no to the question “Do you ever resell the food you buy?”

3.1. HOUSEHOLD CHARACTERISTICS AND ASSETS

Nearly all (93%) consumers had access to electricity in their households. Household drinking water sources included tube wells/boreholes (36%) and directly piped water (26%). Most households (83%) were roofed with metal materials (e.g., zinc, aluminum), with fewer roofed with non-metal materials (e.g., concrete, coated tiles, wood). Households averaged 3 rooms and mattresses. Half of household does not own any motorized vehicle. Of those who did own a vehicle, motorbikes were the most common (33%). One-fifth of households owned cars.

All households contained at least one type of cooking stove, with most reporting firewood-based (59%), electric (44%), charcoal (27%), and natural gas (21%) stoves. Most households (65%) had refrigerators. Nearly all (99%) consumers had toilet or latrine access at or near their household, with only one respondent reporting that no facilities were available. A majority (77%) of households had flush toilets; among these households (N=363), 45% reported that their toilet flushed to a pit latrine. A majority (87%) of households reported owning a television, and radio ownership was also common (49%). Slightly more males owned radios compared to females.

Mobile phones of any type were personally owned by 70% of consumers, as opposed to having access to a phone but not owning it. Though smartphone access was widespread (70%), significantly fewer females than males had access to smartphones (66% vs. 75% respectively). Among those who did not personally own a mobile phone, 70% had access to a mobile phone if they needed it. A majority (80%) reported that their household does not own a computer. Access and use of media are covered in [Sources of Information](#). Data on mobile phone ownership is reported here as it is one component of the Probability of Poverty Index (PPI).

Half of households (N=227) engaged in crop production. Among EatSafe’s Key Commodities, households cultivated rice (21%), maize (14%), cowpea (14%), and vegetables (13%) (**Figure 2**). Among these households, 56% owned agricultural implements (e.g., sprayers, sickles, or wheelbarrows). About 40% of households reported owning any land (agricultural or otherwise). Trends in livestock ownership corresponded to the prevalence of crop production and land ownership, as 43% of respondents owned livestock.

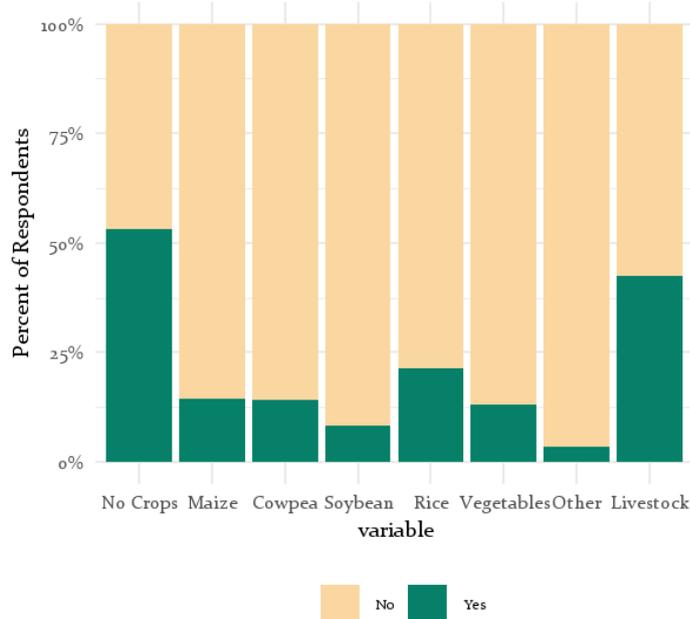


Figure 2. Crops Cultivated by Consumers’ Households

Variables related to household assets were used to compute a PPI (see [Appendix 1](#) for PPI methodology). At the \$3.10/day international poverty line, the [mean probability of poverty across the consumer population was 16% \(median: 8%; IQR: 16%\)](#). This low probability signifies that, overall, the group consists of individuals with relatively high socioeconomic status. Differences in probabilities of poverty across gender were not significant, indicating that participants represent similar ranges of SES. For reference, a PPI score of 60-64 in Nigeria corresponds to a 15% probability of being below the \$3.10/day poverty line (43,46). In terms of Nigeria national poverty lines, a PPI score of 60-65 carries a very low probability of being below both the food and the 100% national poverty lines (0.2% and 3.8% respectively), and a 49% probability of being below the 200% national line (43).

PPI scores were relatively high for most of the individual components from which the PPI was derived, generally exceeding 50% of the total maximum value of the score. The variables that contributed to lower PPI values were vehicle ownership, toilet access, and the number of household residents, highlighting barriers to overcoming poverty. Overall, scores for housing quality (i.e., number of rooms and mattresses, roofing material, etc.) were relatively high, indicating that most have sufficient and stable housing.

3.2. HOUSEHOLD SHOPPING BEHAVIORS

[A high proportion of both male and female consumers have primary responsibility for buying food for their household \(60% vs. 58%, respectively\)](#). A quarter of respondents (both males and females) reported that their spouse was the primary food shopper for the household, though a few reported that someone else was responsible. Regardless of whether they were the primary shopper for the household, over half of consumers reported that they play a role in *deciding* which foods to purchase for the household, a role also held by one-third of respondents' spouses. Respondents' parents were other important contributors to food purchasing decision-making in the household, cited by 23% vs. 19% of males and females, respectively.

Half of consumers surveyed self-identified as a primary food preparer in the household, including 47% and 58% of males and females, respectively. This suggests that while females are more likely to prepare foods, a substantial proportion of males in the assessment population reportedly also share this responsibility. Among the respondents who did not identify themselves as a primary food preparer in their households (N=219, including 120males and 99 females), 53% reported that food preparation was the primary responsibility of a first or second wife, followed by parents (16%), siblings (14%), or children (7%).

Over half (63%) of households reported that over half of their household foods come from purchases. A sizeable fraction (18%) reported that their households were highly self-reliant, purchasing less than 25% of the total foods consumed by their household. This was surprising in an urban setting, but understandable given the high prevalence of crop cultivation among consumers. Overall, these findings indicate that the market environment is critical to ensure access to safe, nutritious foods.

Respondents purchased food from a variety of sources (**Figure 3**). [Half of consumers surveyed reported that they typically purchase foods from local traditional markets](#). Wholesale markets were also a common source of purchased foods, being cited by 26% of respondents overall, and 24% of males vs. 29% of females. This relatively high proportion of consumers who buy from wholesale markets was surprising; since food re-sellers were explicitly excluded from this

assessment, we consider these as purchases for household consumption. Other sources constituted smaller fractions of overall food purchases among those surveyed.

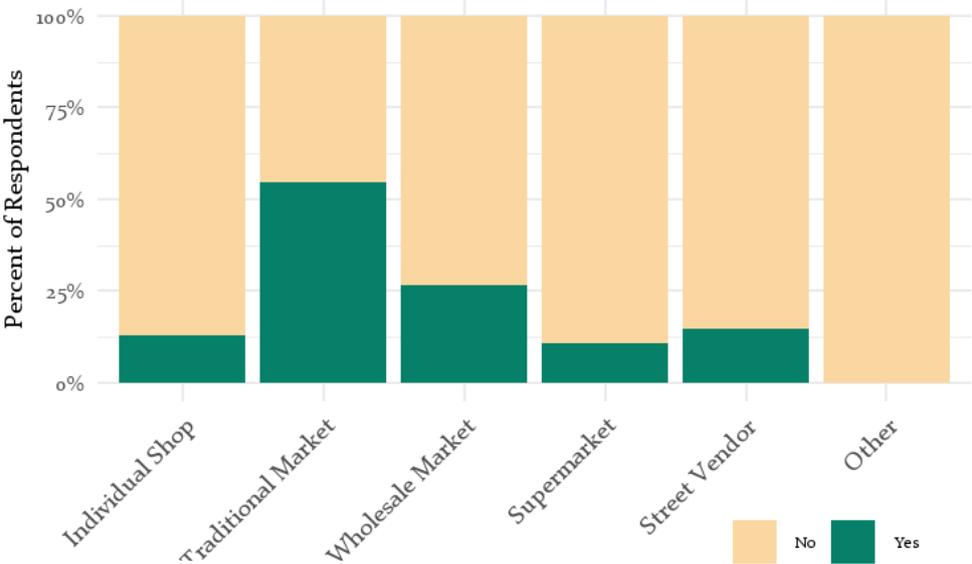


Figure 3. Consumers' Regular Five Sources of Purchased Foods

Consumers visited larger marketplaces (e.g., traditional markets and wholesale markets), where multiple food vendors are densely consolidated weekly (i.e., at least once per week). Among those who utilize traditional markets and wholesale markets, 50% and 64% of consumers visit these markets on a weekly basis, respectively. Fewer consumers frequently purchase food at supermarkets, with half of respondents reporting they shop at supermarkets less than once per month. Unlike the other sources, of the 32% of consumers who utilize this source, supermarkets were visited only occasionally (e.g., special occasions; **Figure 4**).

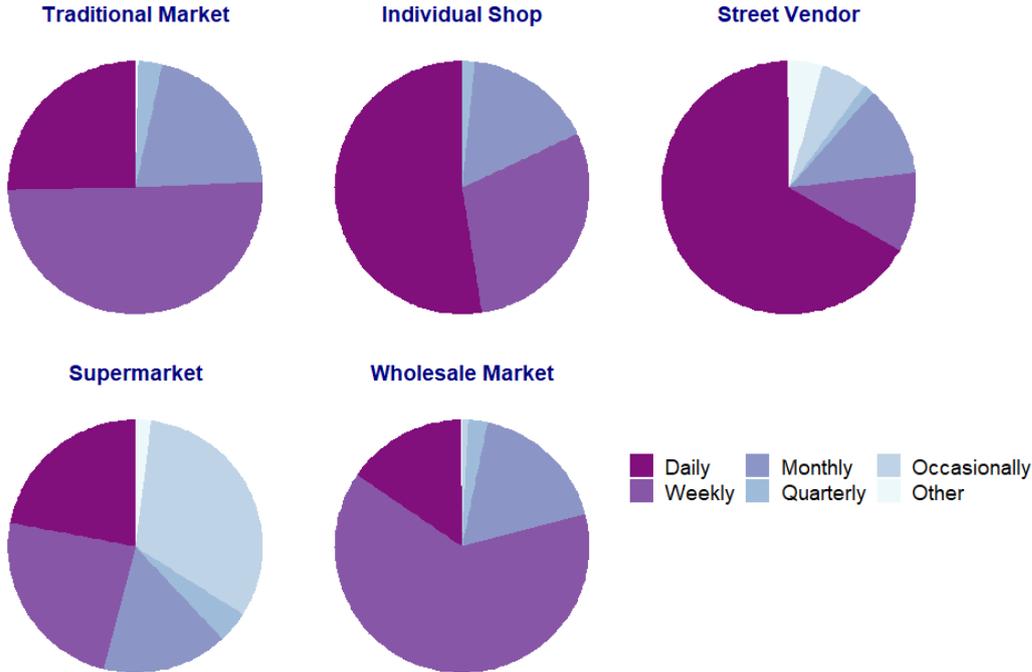


Figure 4. Frequency of Consumers' Food Purchases from Five Sources

Customers seem loyal to their markets. Consumers reported utilizing 1.3 (± 1.1 , maximum of six) traditional marketplaces total, with similar usage across genders. The specific selected markets were visited by participants frequently, as 64% and 88% reported visiting at least once per week and month, respectively. Most of the surveyed consumers are longstanding customers of the selected market, with 69% and 83% reporting that they have been shopping at the market for at least three years and one year, respectively.

Consumers choose a market based on many factors, but price, proximity, and food quality were the top drivers. Myriad motives were reported by consumers when asked about the top three reasons why they choose to shop for food at the specific selected market, rather than other markets (Figure 5). The most commonly cited factor motivating the choice of markets was price, which was cited by 56% of surveyed consumers. Other important factors included proximity of the market to home (42%), the quality of food (37%), and food variety (21%).

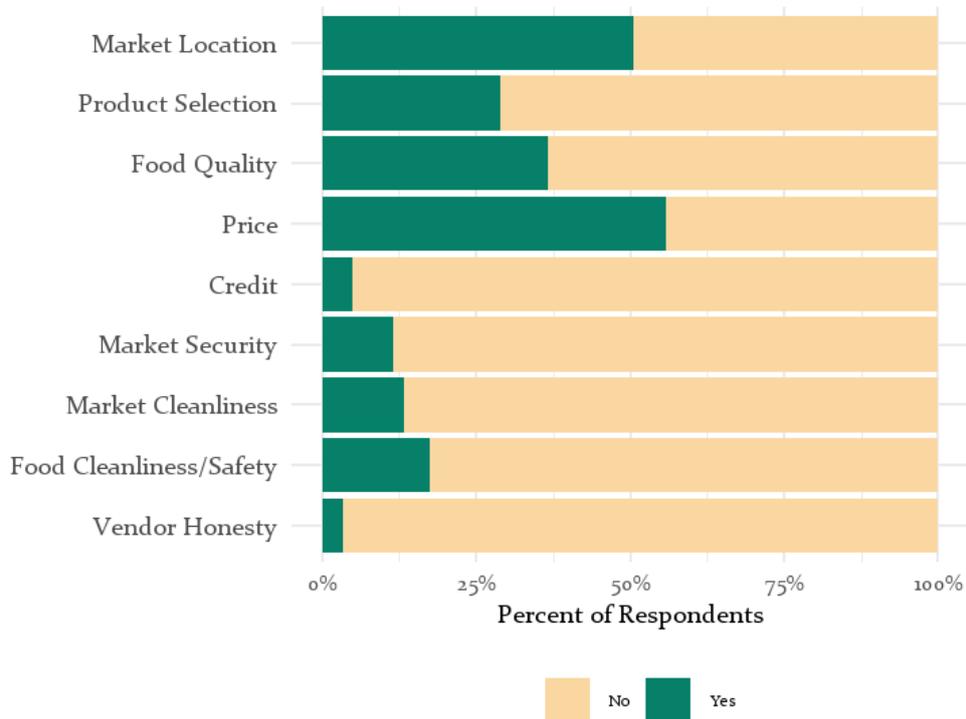


Figure 5. Market Attributes Consumers Consider When Selecting a Market

The order of mention (“rank”) was also tracked and used as a proxy for salience, i.e., the item mentioned first was considered most salient, for the people that mention it. For this question, i.e., reasons to choose a market, the rank was highest for “proximity to home” “proximity to work” and “food quality” (mean ranks of 1.24, 1.55, and 1.70 respectively, out of a range from 1=highest rank to 3=lowest rank). While the price of food was the most frequently cited attribute, it was not usually mentioned first. The mean rank of food price, when mentioned, was relatively moderate at 1.85 out of 3. While the cleanliness and safety of food was also a commonly mentioned attribute, it was ranked second to last in the list of attributes (“available credit” ranked last) with a mean rank of 2.41 out of 3.

Market cleanliness was mentioned by only 13% (N=62) of consumers. Among the remaining consumers who did not list this attribute as a motivating factor in selecting a market (N=408), half reported that cleanliness is never a reason why they would select a market, with relative

consistency across genders. On a scale from “very dirty” to “very clean,” around [half of consumers \(54%\) perceived the market to be either “clean” or “very clean.”](#) One-third of consumers considered market cleanliness of the to be “average,” while 11% rated it as below average. There was little discrepancy (<5%) in this figure across gender groups. Dust/filth (42% of consumers) and improper disposal of garbage (37%), plant waste (34%), and animal waste (25%), along with standing water (30%) were the aspects that consumers most often cited as contributors to the market’s “dirtiness.”

Over 60% of consumers were “often” or “always” able to find everything they need at the market. Few consumers (5%) reported that they “never” find everything they need; those consumers were more often male. Consumers generally reported that if they cannot find something they need at the selected market, they will go somewhere else to purchase the necessary item(s). The most frequent places consumers visit to find items that could not be purchased at the selected market were neighborhood shops or kiosks (32% of consumers) and supermarkets (28%), with a range of other food sources cited by <20% of consumers. About one-fifth of consumers reported that if they cannot find something at the selected market, they would not look for it elsewhere and would make do without.

3.3. BEHAVIORS IN THE MARKETPLACE ENVIRONMENT

Most consumers (81%) prefer a specific time of day to shop for food at the selected markets, with relative consistency across genders. [Hours between 12-5 PM were the most common shopping times](#) reported, with 61% of consumers reporting that they regularly shop during these hours. Only 4% of consumers reported shopping at the market in the evening after 5:00 PM, with male consumers significantly more likely to do so than female consumers ($p = 0.01$).

[Consumers regularly purchase a range of food products from the selected markets](#), including EatSafe in Nigeria’s Key Commodities and their derived products (**Figure 6**), including fresh vegetables (42% of consumers), rice and (39%), beef (35%), wild or aquaculture fish (33%), maize (28%), soybean (12%). These purchasing trends across commodities are consistent with consumption trends, from any food source (see [Food Consumption Behaviors](#)).

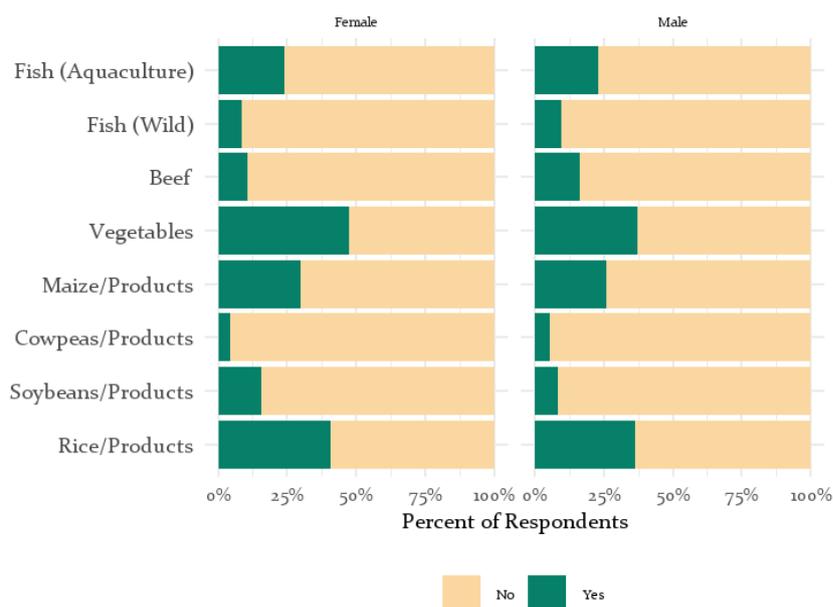


Figure 6. Foods Bought by Consumers, by Gender

The average consumer visits 4 (SD: ±3) shops during a typical shopping trip, with a maximum of 32 shops visited during a trip. “Regular customer” relationships with vendors in the market were reported by a quarter of members. Many consumers appear to have firm ideas about the vendors that they wish to purchase from before they arrive at the market. A minority (27%) of consumers reported that they “often” or “always” compare among shops before deciding which vendor(s) to purchase from. There were negligible differences in this behavior between males and females. Consumers reported using several criteria to compare among shops in the marketplace and decide where to buy food. The most prevalent criteria used were the quality and price of food, reported by 62% and 59% of consumers, respectively. The variety of available food products was another commonly cited criterion (45% of consumers), and both appearance and cleanliness of vendors’ stalls were cited by a quarter of respondents. The location of the shop within the market and access to credit were each mentioned by less than 10% of consumers. This finding was different from findings from previous EatSafe research (FES), where access to credit seemed to be a more prominent factor (13,14). Also in the FES, females more commonly took the time to compare among shops, compared to males. Overall, both studies agree that female consumers seem to be more discerning about food characteristics than males, when deciding what food to buy and where to buy it from.

When assessing a shop’s cleanliness, nearly three-quarters of consumers stated in an open-ended list that the cleanliness of the shop’s spaces (e.g., no dust and debris on surfaces and produce) and general tidiness is an important factor (Figure 7). Just over half of consumers reported that they check whether food is protected, either covered or in containers, when assessing shop cleanliness. One-third of consumers associate shop cleanliness with waste management, citing absence of garbage or the presence of designated waste receptacles as important. Whether food items were elevated off the ground is an attribute mentioned by 18.9% of respondents. Other characteristics, such as the absence of animals or insects, or the separation of raw and cooked products, were mentioned by less than 10% of fewer respondents.

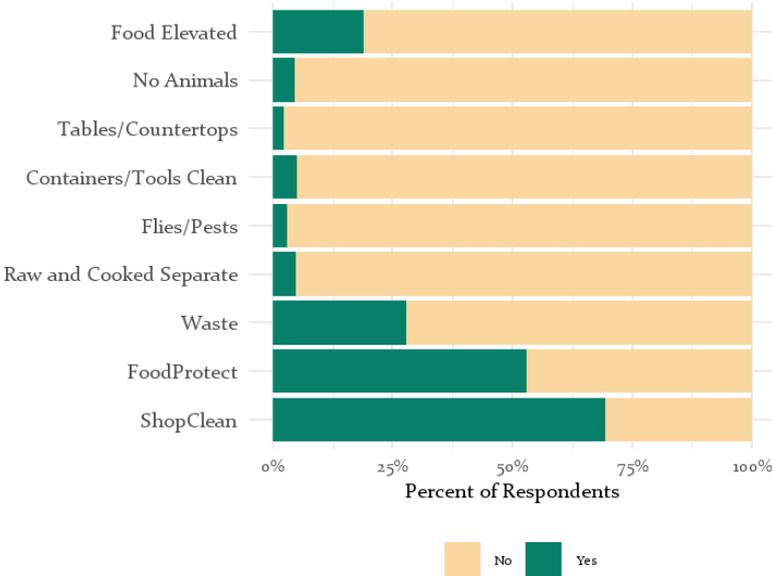


Figure 7. Characteristics Consumers Use to Assess Shop Cleanliness

Consumers reported high levels of general satisfaction with their shopping experience at the selected market. Only 8% of consumers were “not at all” or only “slightly” satisfied with their shopping experience. 29% of consumers reported specific reasons for dissatisfaction, the most

prevalent being the price of food (14% of consumers), that the market was too crowded (11%), and that the food was not fresh (9%). No consumer cited previous incidence of foodborne illness as a reason for dissatisfaction, and market safety, dirtiness, and trust in vendors were all cited by less than 5% of consumers (**Figure 8**). With respect to personal safety and the risk of harm in the marketplace, two-thirds of consumers reported that they feel “quite secure” or “very secure” (“4” and “5” on a 5-point security scale) shopping in the selected markets. There were no gendered differences in perceived security, suggesting that the safety of the marketplace environment is not disproportionately skewed toward one gender over another.

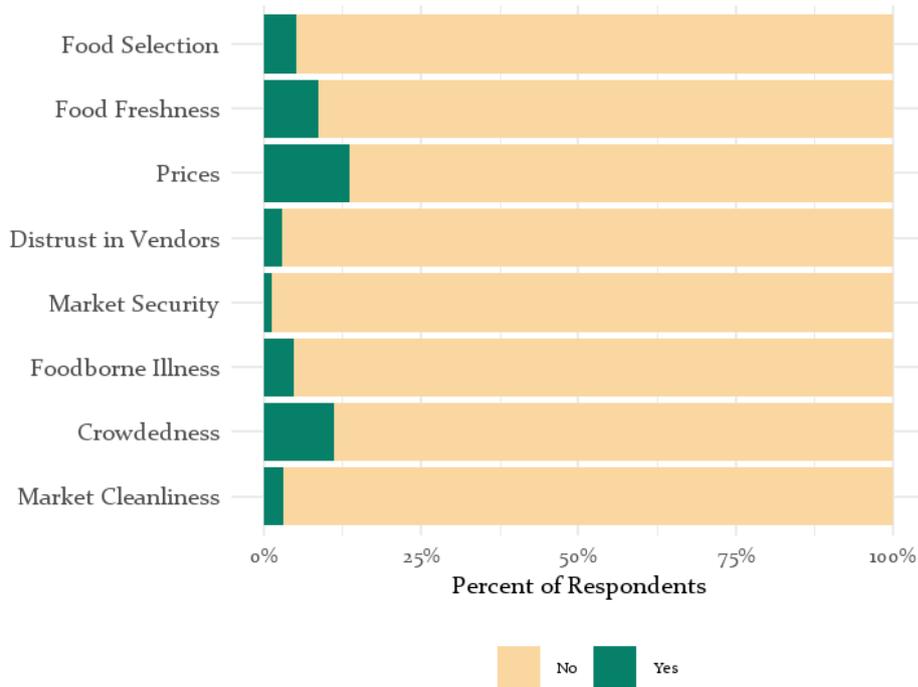


Figure 8. Characteristics of Consumer Dissatisfaction at the Market

3.4. CHOICES OF AND INTERACTIONS WITH VENDORS

Consumers cited multiple vendor attributes (independent from shop attributes) as important determinants of whether they would choose to purchase from the same vendor again in the future: food prices (69%), quality (56%)⁴, variety (31%), and cleanliness/safety (24%) were cited by the highest percentages of consumers, while other attributes were cited by fewer than 20% of consumers (**Table 2**). Overall, consumers’ considerations when deciding whether to purchase again in the future closely align with the criteria they use to compare among shops (described above), indicating that consumers do not disentangle vendor from shop in their purchase decision-making, but rather consider the vendor to be an aspect of and subject to the selection criteria for shops. However, a sizeable group mentioned attributes related to their relationship with or perception of the vendor, such as being comfortable with the vendor, vendor’s personality, and trusting the vendor (18%, 18%, and 17%, respectively).

⁴ Quality was self-defined in the survey and not explored in detail. Results from the FES indicate that the concept of food quality overlaps with safety. For example, consumers who saw insects on food said it was a sign of both food safety issues and poor quality. Dirt or sand on food was seen as a quality issue but not necessarily a safety one, while spoilage was perceived as a food safety issue.

Table 2. Vendor Characteristics that Influence Consumers to Return

CHARACTERISTIC	MALE		FEMALE		TOTAL	
	RANK *	N (%) **	RANK *	N (%) **	RANK *	N (%) **
Better prices	1.38	156 (67%)	1.4	168 (71%)	1.4	324 (69%)
Better quality	1.92	133 (57%)	1.72	128 (54%)	1.82	261 (56%)
Personal connection	1.88	8 (3%)	1.8	5 (2%)	1.85	13 (3%)
Comfortable (e.g., safety/security)	2	43 (19%)	1.95	40 (17%)	1.98	83 (18%)
No foodborne illness	2.2	5 (2%)	1.75	4 (2%)	2	9 (2%)
Vendor personality	2.16	38 (16%)	1.87	45 (19%)	2	83 (18%)
Better credit	2.18	28 (12%)	2.16	32 (13%)	2.17	60 (13%)
Convenience	2.09	11 (5%)	2.4	5 (2%)	2.19	16 (3%)
Food is clean/safe	2.05	57 (25%)	2.33	57 (24%)	2.19	114 (24%)
Better variety of foods	2.13	75 (32%)	2.27	71 (30%)	2.2	146 (31%)
Trust the vendor	2.17	46 (20%)	2.36	36 (15%)	2.26	82 (17%)

* Rank, used here as a proxy for salience, is defined as the order of mentioning an item, from 1=mentioned first to 3=mentioned third in a list of up to three.

** N and % correspond to the number and percent of respondents (out of the total) selecting this attribute in their list of up to three items

While there were only small differences in desirable vendor characteristics reported by male and female consumers, males were more than twice as likely to cite convenience as a key attribute (5% vs. 2% of females). Males also ascribed slightly higher value to food quality (57% vs. 54%) and vendor trust (20% vs. 15%) than female consumers. By contrast, female consumers more frequently (71%) cited price than males (67%). To assess the cleanliness of vendors, around half of consumers reported that they check the cleanliness of vendors' hands. Consumers exhibited similar trends in the rank of the desirable vendor attributes, with food price ranked highest (1.4 of a possible 3, with lower values corresponding to being listed first, i.e. a higher ranking) and food quality also ranking highly (1.82). Only 3% of consumers cited a personal or family connection with a vendor, but, when cited, it typically ranked highly in the list of attributes (1.85). Interestingly, the lack of prior foodborne illness (possibly attributed to the vendor), was only mentioned by 2% of respondents but ranked substantially higher when mentioned by female consumers (1.75) than by male consumers (2.20).

More than half (55%) of consumers reported that they “rarely” or “never” discuss issues pertaining to food quality with vendors at the market, indicating that this behavior is not presently a standard practice during vendor-consumer interactions. While only 3% of consumers discuss food quality “always” (e.g., during every or nearly every transaction), 41% of consumers discuss food quality with vendors “sometimes” or “often,” suggesting that many consumers are discerning about food quality and will engage in conversation with vendors. The frequency of conversation with vendors about food quality was relatively consistent across genders. More than half of surveyed consumers reported that they are the one who initiate these discussions about food quality (as opposed to the vendor or someone else nearby). A quarter of consumers indicated that the vendor or another staff person at the shop is the primary initiator of discussion, while 22% suggested these discussions are primarily initiated by another customer at the shop.

Consumers reported discussing the quality of several commodities with vendors (**Figure 9**). The commodities about which food quality is most often discussed were beef (33% of consumers) and fresh vegetables (30%), which is consistent with the elevated food safety risk associated with these commodities. The quality of maize and soybean products was discussed much less frequently (14% of consumers for each) than that of rice (30%) or cowpea (25%), indicating marked differences in perceived food quality and safety risks across types of grains and pulses. Fish, despite being a relatively high-risk commodity from a food safety perspective, was only cited by 16% of consumers. This may be attributable to the earlier finding that fish is usually sold live, allowing the consumer to visibly inspect the fish and judge quality themselves.

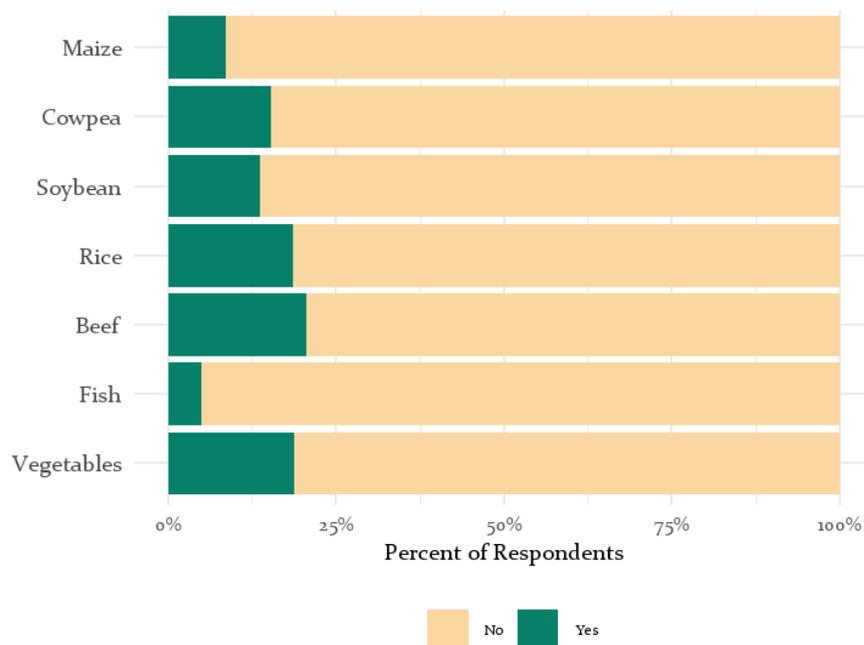


Figure 9. Commodities that Consumers Regularly Discuss Food Quality with Vendors

The most common complaints consumers made to vendors were related to the spoilage or shelf life of the food they purchased, which was cited by 38% of consumers. Price was also commonly cited (28%). Nearly a quarter of respondents reported that they most often complain to vendors about the taste of food. Considering the high prevalence of consumers' vocalization of complaints to vendors, it is relatively rare for consumers to decide to stop buying from certain vendors. Only 15% of consumers reported that they have stopped buying from vendors "often" or "very often" in the past year, while 28% reported that this happened "sometimes." A substantial percentage of consumers (57%) reported that they "never" or "rarely" had decided to stop buying from certain vendors, suggesting that, for most consumers, the option to stop buying from a vendor is rarely utilized, even if they have complaints about the food.

In cases where consumers previously decided to stop buying from a certain vendor (N=297 consumers), the most common motivating factors included food price (67%) or quality (58%). One-third of consumers decided to stop buying from a certain vendor because others had a better variety of foods, while 13% did so because of a lack of available credit. 10% of consumers were compelled to stop because of a lack of comfort with or trust in the vendor. Only 3 consumers reported that they at some point decided to stop buying from a certain vendor due to a foodborne illness incident.

Regarding trust, 17% of consumers reported that they either disagree or strongly disagree with the statement that they trust that what their vendors tell them about food is accurate, and a

quarter (25%) neither agreeing nor disagreeing. However, a majority of consumers (58%) either agreed or strongly agreed with the statement, implying that they trust what vendors say. The mean agreement score on a 1-5 agreement scale was 3.6 (± 1.0), i.e., slightly agreeing, with no significant differences by gender. A majority of consumers (62%) reported that they either agree or strongly agree that their vendors sell them food at fair prices, with this statement also yielding a mean of 3.6 (± 1.0) on the agreement scale, while a quarter of consumers neither agreed nor disagreed that vendors' prices are fair, and 14% either disagreed or strongly disagreed.

More consumers reported that they would prefer to purchase food from female vendors (50%) than male vendors (33%), while 17% had no preference for the gender of their vendors. There were no significant differences in vendor gender preference (indicated by a 1-5 scale) by gender, indicating that personal preferences for vendor gender are diverse and distributed evenly within and across sub-groups. A caveat of these findings is that these data are vulnerable to acquiescent response bias, wherein respondents may answer with the response that seems most acceptable, not necessarily the truth. Further research is needed to determine the extent of gender bias in vendor preference.

3.5. FOOD PURCHASING IN THE MARKET

Over half of consumers had high levels of satisfaction with the availability of places to purchase food (including and beyond traditional markets). A substantial majority (86%) were at least "moderately" satisfied with the selection of places to purchase food, but 14% were unsatisfied or only "slightly" satisfied. Consumers were also generally satisfied with the overall quality of the food they purchase at the market, with 83% reporting that they are "satisfied" or "very satisfied" with their purchased food. Other findings include:

- Consumers most frequently cited quality (48%), price (44%), variety (33%), and safety (32%) as the food attributes that they are most satisfied with at the market, with mean ranks of 1.5, 2.0, 1.6, and 2.0 out of 3, respectively;
- Interestingly, price (48%), quality (36%), and variety (24%) were also the attributes most consumers were *least* satisfied with. Food quantity (23%) and safety (20%) were also cited frequently; and
- 10-20% of consumers cited each of EatSafe's Key Commodities as being the *least* satisfactory in the market, indicating that none of the commodities are of uniformly poorer or better quality than the others.

Consumers did not consider visible food safety certification an important decision-making factor, with 82% of consumers either disagreeing with or feeling neutral about the statement that it is preferable to buy from a vendor with a food safety certification or license. However, 18% of consumers agreed with the statement. The display of food safety certification by vendors is not present in the selected markets, as far as known, and therefore it is likely that many consumers have never considered this factor as something that could influence food purchase decisions. These results are consistent with the food attributes consumers were most satisfied with in the market, highlighting the importance of these qualities – especially price and quality – as highly-salient factors in decision-making.

Freshness (65% of consumers), price (60%), safety (56%), and nutritional content (43%) were the food attributes cited by the most consumers as important drivers of purchasing decisions (**Table 3**). Freshness and price were often mentioned first or second in consumers' lists of up to

four attributes, with mean ranks of 1.6 for freshness and 2.0 for price. These results are consistent with the food attributes consumers were most satisfied with in the market, highlighting the importance of these qualities – especially price – as highly-salient factors in decision-making. When asked to specify the **most important attributes of foods that they consider when selecting foods for children under five years old, the most commonly cited attributes were safety, freshness, and nutritional content**, with all three mentioned in approximately the same frequency (~48%). Safety and nutritional content were more often reported by male consumers (both by over 50% of males), whereas female respondents allocated more importance to appearance (22% vs. 16% of males).

Table 3. Food Attributes Consumers Listed as Important for Purchase Decision-Making

ATTRIBUTE	MALE (N=232)		FEMALE (N=238)		TOTAL (N=470)	
	% (N _Y) *	RANK **	% (N _Y) *	RANK **	% (N _Y) *	RANK **
Freshness	62% (144)	1.50	69% (163)	1.60	65% (307)	1.55
Price	57% (132)	1.98	63% (149)	1.96	60% (281)	1.97
Nutritional content	45% (104)	2.35	40% (96)	2.39	43% (200)	2.37
Healthiness	32% (73)	2.32	33% (78)	2.44	32% (151)	2.38
Safety	63% (145)	2.40	59% (118)	2.44	56% (263)	2.42
Appearance	29% (67)	2.61	25% (60)	2.38	27% (127)	2.50
Appropriateness for recipes	2% (4)	2.75	2% (5)	2.40	2% (9)	2.56
Balanced/varied diet	6% (14)	2.64	6% (13)	2.85	6% (27)	2.74
My spouse is happy with the food I bring home	1% (3)	2.67	2% (5)	2.80	2% (8)	2.75
Ease of preparation	7% (15)	2.73	6% (13)	2.92	6% (28)	2.82
Taste	15% (34)	3.29	16% (39)	2.90	16% (73)	3.08
Other	2% (4)	2.00	1% (3)	2.33	2% (7)	2.14

* N_Y = # of respondents in their group (male, female, or total) who listed the attribute among their top 4.

** The mean rank (on a scale of 1-4) of the attribute among those who listed it in their top 4. Smaller numbers = higher ranking.

The importance for decision-making of several characteristics related to vendors' practices and the consumer-vendor interaction was assessed using a 1 to 5 scale from "Not at all important" to "Very important." Significant differences were observed in the relative importance of "vendor hygiene" and "seeing a vendor actively caring for their shop" (**Figure 10**). Consumers considered communication with other consumers as a significantly lower-importance decision-making factor than the others, while the importance ratings of knowing about food handling and origins, as well as communication with vendors, were not significantly different from the mean.

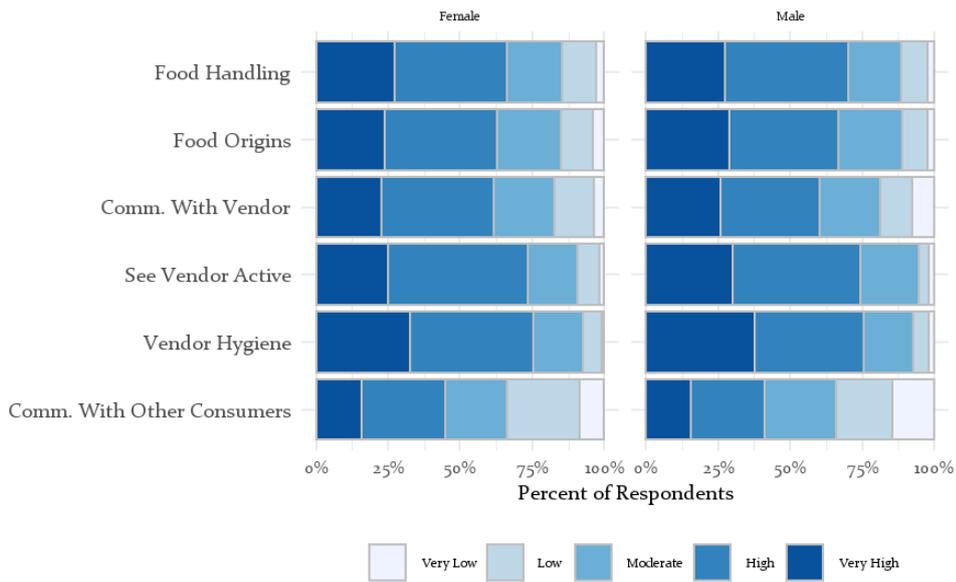


Figure 10. Importance of Vendor Practices for Consumers' Purchase Decision-Making

Consumers ranked four attributes of food (appearance, safety, taste, and nutritional value) in order of importance for food purchase decision-making. **Safety and nutritional value were most frequently ranked first** (see **Figure 11**), with mean rank values of 2.1 and 2.2 out of four, respectively. Food appearance (mean rank 2.6) and taste (3.1) were of lesser importance to consumers, signifying that more superficial characteristics are secondary to quality-related characteristics in influencing food purchases. The rank order of these attributes was the same across genders, suggesting that these preferences are consistent throughout the population.

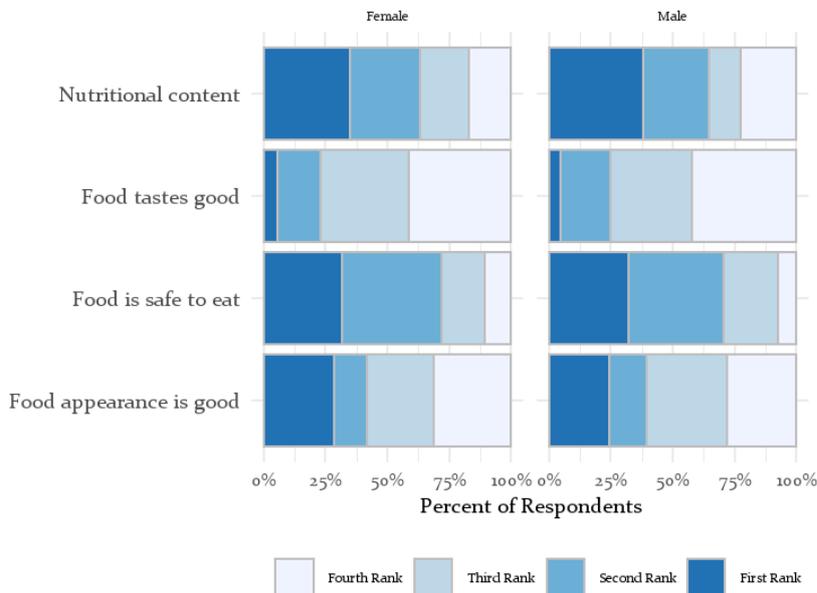


Figure 11. Importance of Food Attributes for Consumers' Purchase Decision-Making

3.6. HEALTH CONCERNS AND FOOD SAFETY PERCEPTIONS

When asked about how they would personally define “food safety,” 59% of consumers reported that food “safety” means that food does not cause sickness. A specific connection to stomach upset (28%) or diarrhea (13%) were reported, in all cases more commonly by male consumers than by females. Consumers’ definitions of “food safety” frequently referenced specific causal agents, such as the absence of harmful chemicals (40%) or germs/microbes (29%). Many consumers also linked food safety to positive food attributes: one-third reported that food safety is connected to the healthiness of food. Moreover, 18% of consumers made specific reference to nutrition as a part of their definition of “food safety.”

Most consumers (85%) agreed that they knew how to choose foods that are safe, indicating high levels of perceived self-efficacy in food safety decision-making. Over 80% of consumers were also confident that they have suitable options for buying safe foods at the market. Consumers also largely agreed that some vendors at the market sell safer foods (80%) and that some vendors care more about food safety (81%) than others – indicating that they acknowledge risk differentials among different vendors.

Most consumers seemed willing to invest time and money in identifying foods that they know are safe. A significant majority (85%) “agree” or “strongly agree” that they are willing to spend more time and money shopping if they knew that the food they purchased would be safer. On a 1-5 agreement scale, mean values for willingness to spend time and money were both 4.0 (± 0.8). There were no significant differences by gender in willingness to spend money or time on food safety, when analyzed on a 1-5 scale.

Consumers associated some foods with FBD more commonly than others (Figure 12). On a 1-5 scale of agreement with the statement that a commodity is linked to foodborne illness, cowpea, moi-moi (a cowpea-derived product), and soybean awara each scored significantly higher than the overall average (2.6), indicating that these commodities are most commonly perceived as high-risk. By contrast, fish, maize, and rice all scored below the average, suggesting that consumers perceive these commodities as safer.

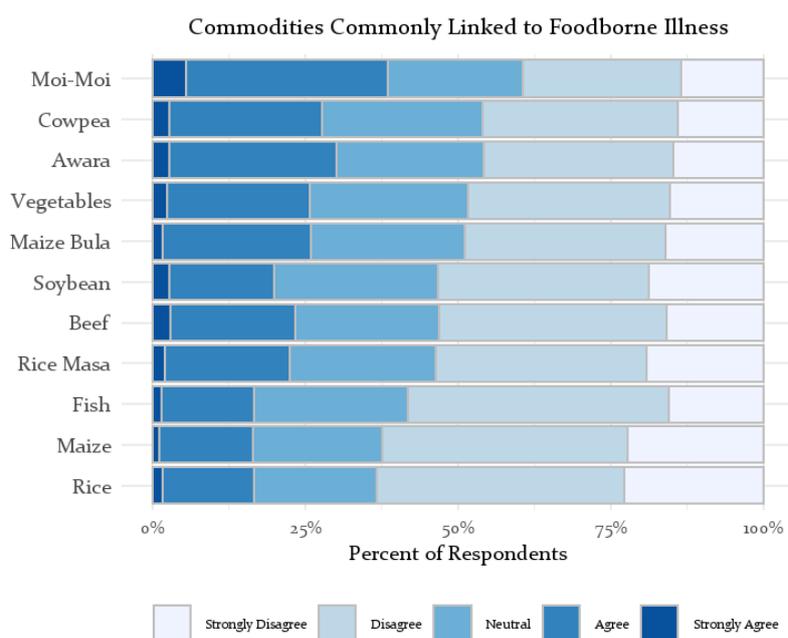


Figure 12. Perceived Risk of FBD Associated with EatSafe’s Key Commodities in Nigeria

Numerous underlying risk factors for foodborne illness were cited by consumers and linked to specific commodities (**Figure 13**). Stomach upset and diarrhea were the most commonly cited foodborne illnesses, and they were most commonly linked to consumption of cowpea (24% of consumers) and fresh vegetables (16%). The causes consumers attributed to these outcomes were variable by commodity: a majority reported that chemical contamination is the major risk factor for cowpea, while more diverse causes were linked to vegetable consumption. Around 5% of consumers also linked chemical contamination of cowpea to slow poisoning/toxicity. Preparation methods as a risk factor for foodborne illness were most frequently reported for beef, which suggests that consumers understand cooking/preparation to be a critical control point for minimizing disease risk.

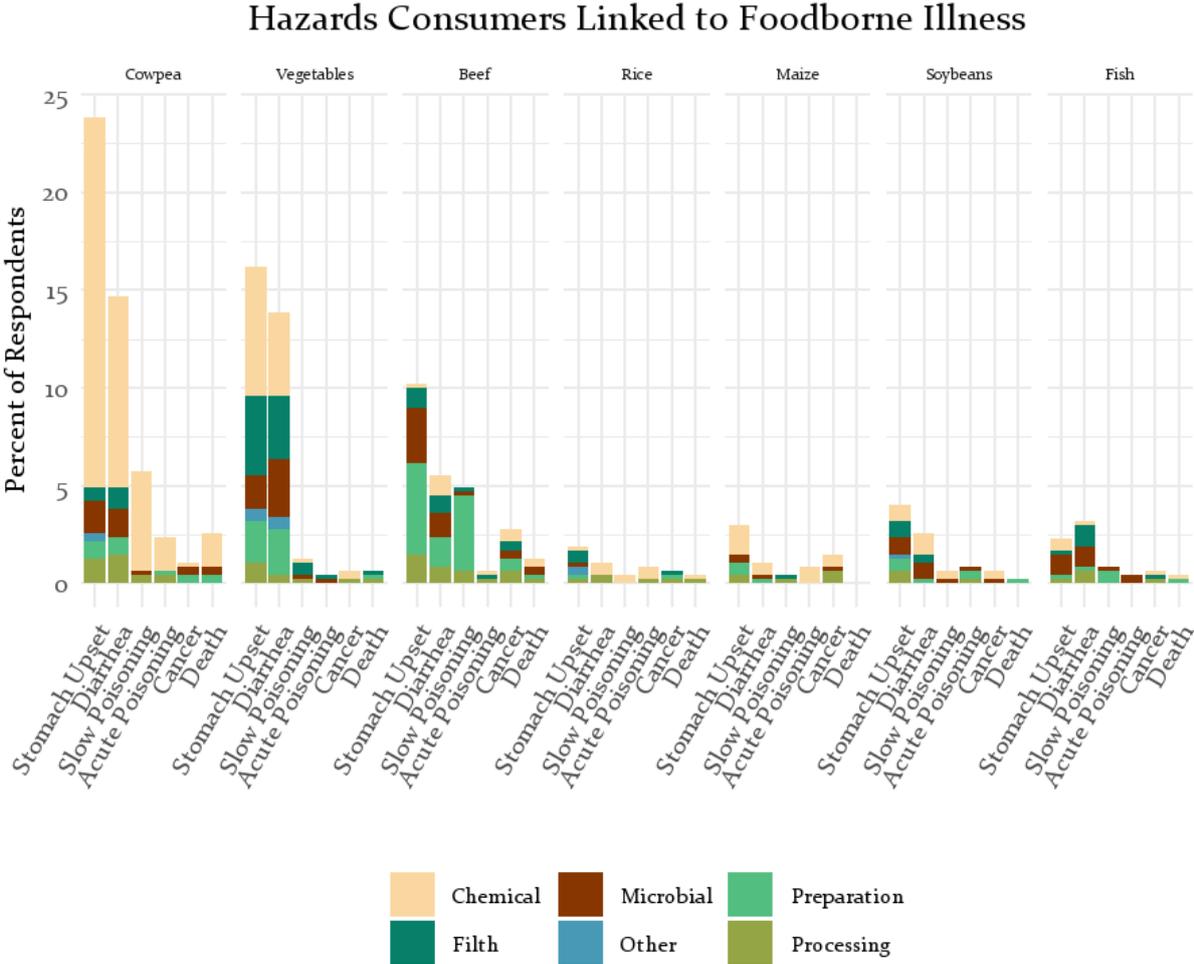


Figure 13. Commodities and Risk Factors Consumers Associated with FBD

Despite demonstrable knowledge of risk factors for foodborne illness and high levels of perceived self-efficacy in identifying safe foods, consumers reported substantial incidence of foodborne disease. 17% of consumers reported that someone in their household had gotten sick due to consuming unsafe food in the past year. A majority (70%) of consumers did not report foodborne illness, while 13% were unsure of whether an illness in their household was linked to unsafe food.

A range of food safety practices were performed at home for each of the EatSafe Key Commodities (**Figure 14**). Across all commodities, cooking and washing were the most frequently reported food safety measures practiced by consumers, each cited by more than

60% of consumers across commodities. Drying, a practice that can control the growth and spread of foodborne pathogens, was more commonly used to preserve grains and pulses (13-24%) than vegetables (4%) or meat/fish (3-5%). Approximately 15% of consumers reported that they ensure that foods are eaten promptly (e.g., before spoilage) as a food safety practice. A comparable percentage of consumers (12-20% across commodities) reported that they use extra cooking measures (e.g., longer, hotter, more thorough than usual, etc.) to ensure food safety, with only 5% of consumers using a method “other” than these for household food safety. Less than 5% of consumers reported that they do “nothing” to ensure food safety at home. This finding illustrates that while the protective qualities of ubiquitous practices such as cooking and washing are widely understood among consumers, some do not yet make the association between these practices and the safety of food.

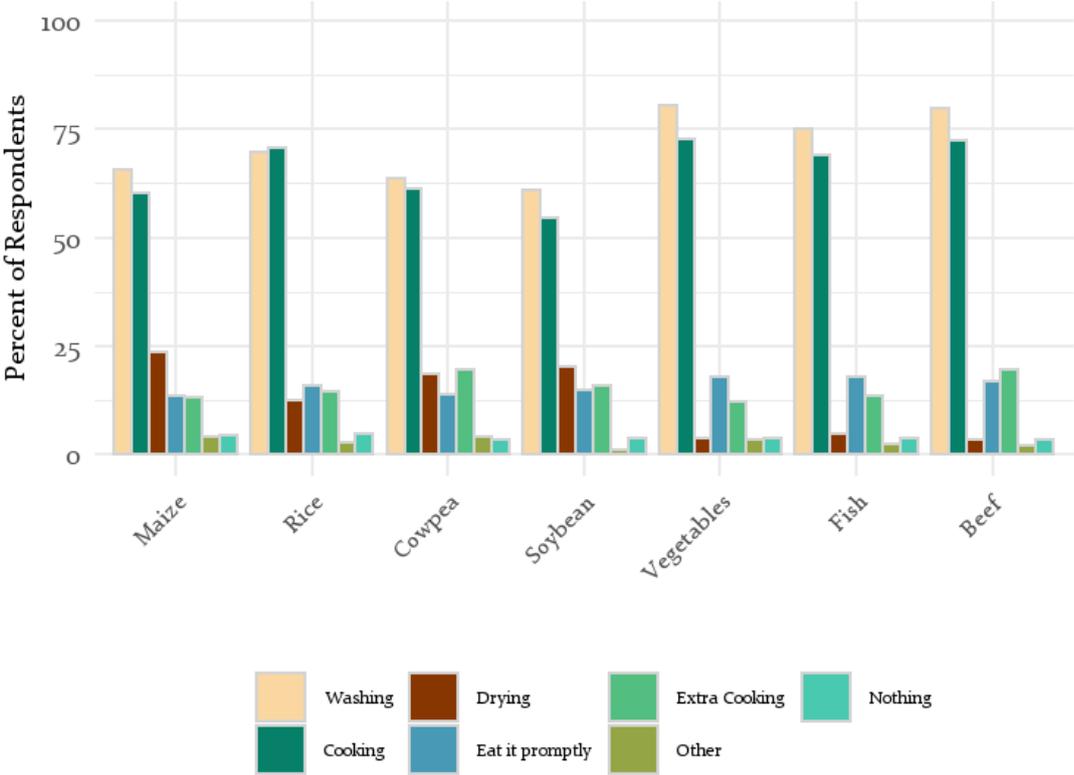


Figure 14. Consumers’ At-Home Food Safety Practices, by Commodity

On a scale of 1-5 from “not at all concerned” to “extremely concerned” about food safety, consumers perceived fresh vegetables to be the most concerning commodity, with a mean score of 2.8, followed by beef, fish, and cowpea (each 2.7), rice (2.6), and soybean and maize (both 2.5). A higher food safety perception score corresponds to a higher concern. The mean food safety concern levels for maize and soybean were significantly lower ($p < 0.05$) than the overall across commodities (2.6), while the level of concern regarding fresh vegetables was significantly higher ($p < 0.05$). On the other hand, there was considerable variability in concern scores, for all commodities, showing a wide range of perceptions across the consumer population.

It was uncommon for consumers to be “very concerned” or “extremely concerned” about the safety of the food they eat, comprising between 11% and 14% of consumers for each commodity. The consistency of this figure indicates that none of EatSafe’s key commodities are categorically understood to be high-risk foods in the consumer population. Compared to the

above finding that some foods are perceived as being more linked to foodborne illness than others, the relative uniformity exhibited in this measure of concern illustrates that consumers' knowledge of food safety risks does not necessarily translate to high levels of concern. This has possible implications as a driver of behavior change, for instance in terms of whether and how consumers express demand for improved safety in the market.

Consumers used a range of cues to assess whether a food is safe to eat, including:

- Approximately half of consumers use smell/odor to assess food safety
- Visual cues such as dirtiness (43% of consumers), blemishes (30%), desiccation (27%), and coloration (24%) were prevalent; and
- Texture was cited as an important food safety signal by 16% of consumers.

Consumers' mentions of food safety concerns associated with each commodity also reflected these cues (possibly reflecting an overlapping conceptualization of topics of concerns, e.g., contamination, with the cues used to detect them, e.g., odors). Taste and smell (which are signs of spoilage but not necessarily risk) were often cited as concerns for beef and fish, more than for the plant-based commodities. Pests and parasites were more commonly cited as food safety concerns for beef, fish, and fresh vegetables, than for grains and pulses. Consumers were much more concerned about chemical contamination in grains and pulses than in vegetables, beef, or fish, while freshness was also a key concern for these commodities. Very few consumers reported that they were concerned about shelf life (e.g., time before spoilage) as a food safety consideration; this was most prevalently mentioned with regard to rice (10%).

Most respondents (72%) reported that they have purchased a food in the past even if they weren't sure that it was safe. Among these consumers (N=339), over a quarter bought potentially unsafe food because the price was good, while 20% and 16% did so because they needed it to feed their family or had no other option, respectively. Some consumers indicated that they previously bought potentially unsafe food because they knew how to reduce risk either by cooking or washing (~12%). Reducing risk by washing was mentioned twice as often by males than females, while price was the opposite. Cowpea and rice (and their derived products) were most often purchased without being sure of their safety, cited by 25-36% of consumers.

Consumers perceived a range of actors throughout the market system, government, and value chain as having responsibility for ensuring the safety of food in the market (**Table 4**). Around half of consumers reported that ensuring food safety is primarily the responsibility of the federal government (51%) or the market management (49%). Both actors were ranked highly in terms of the order mentioned in a list of up to 3, with mean ranks of 1.2 and 1.6, respectively. The local government authority (LGA) was cited by 21% of actors and was highly ranked (1.7). More than one-third (37%) of consumers indicated that vendors are responsible for ensuring food safety, but this actor was ranked relatively lower in terms of the order mentioned (~2.0), suggesting that consumers feel that vendors bear only partial responsibility for ensuring the safety of their food products. Other actors were cited less frequently, and garnered lower ranks overall. Notably, 7% of respondents reported that consumers are responsible for food safety in the market; 3% reported that they, themselves, feel responsible for ensuring food safety – an attitude that was more commonly held by males than females, albeit at low frequencies.

Table 4. Actors Listed by Consumers as Responsible for Food Safety in the Market

ATTRIBUTE	MALE (N=232)		FEMALE (N=238)		TOTAL (N=470)	
	% (N _V) *	RANK **	% (N _V) *	RANK **	% (N _V) *	RANK **
Federal government	51% (119)	1.18	50% (120)	1.23	51% (239)	1.2
Market management	50% (117)	1.68	48% (113)	1.52	49% (230)	1.6
LGAs	21% (49)	1.65	21% (49)	1.67	21% (98)	1.66
Municipal government	5% (11)	1.82	2% (5)	1.4	3% (16)	1.69
Vendors	38% (88)	1.95	35% (84)	1.99	37% (172)	1.97
Civil society organizations	1% (2)	3.00	1% (3)	1.67	1% (5)	2.2
Food transporters	3% (6)	2.33	3% (6)	2.33	3% (12)	2.33
Consumers	9% (21)	2.67	6% (14)	2.21	7% (35)	2.49
Me/myself	4% (9)	2.33	2% (4)	3.00	3% (13)	2.54
Food producers/suppliers	8% (19)	2.63	9% (22)	2.91	9% (41)	2.78

* The number of respondents by group who listed the attribute among their list of up to 3.

** The mean rank (on a scale of 1-4) of the attribute among those who listed it in their list.

3.7. FOOD CONSUMPTION BEHAVIORS

Figure 15 shows the consumption of EatSafe’s seven Key Commodities, both purchased fresh/raw and prepared at home (left), and purchased as RTE (right) in the week before the interview.⁵ All commodities appear to represent important components of consumers’ diets. Of the home-prepared foods, soybean and fish were consumed less frequently. Over half of consumers were satisfied with the healthiness of their food, and at least “moderate” levels of satisfaction were reported by 89% of consumers.

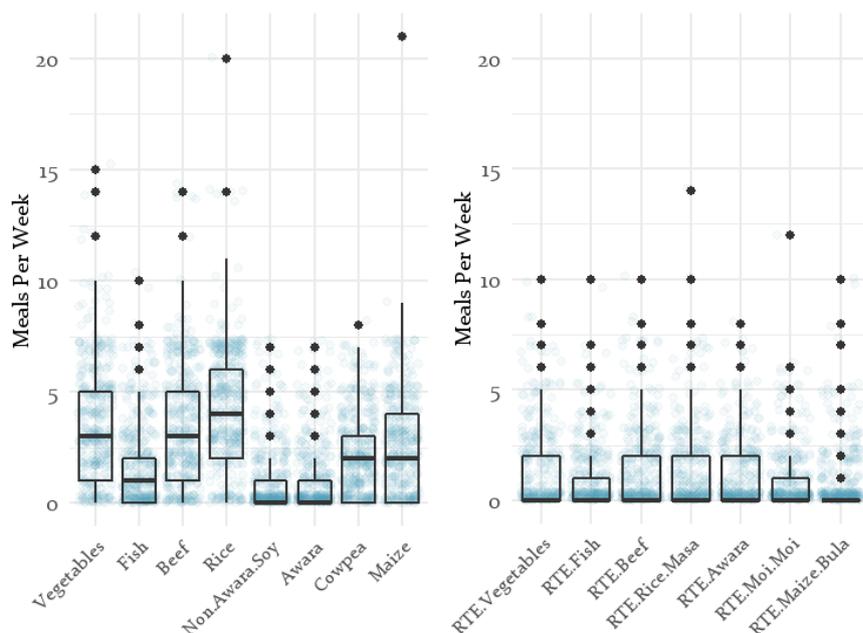


Figure 15. Consumers’ Consumption of Foods Purchased Fresh (Left) and as RTEs (Right)

⁵ Six outliers with values ≥ 30 meals/week were omitted as probable spurious observations.

Among the consumers who had children under five years old in their households (N=298, including 152 males and 146 females), 51% reported that young children “often” or “always” eat the same food as adults, while they “rarely” or “never” eat the same food as adults in 9% and 11% of households, respectively. Most consumers (66%) reported consuming RTE foods only occasionally (e.g., a couple of times per year or less), while much smaller proportions of respondents reported more frequent consumption of these foods. Daily or weekly consumption of RTE foods was only reported by 6% and 9% of respondents, respectively – suggesting that RTE foods are a relatively low-importance source of household food for most of the population, though a non-negligible proportion of the assessment population frequently consumes them. It should be considered that respondents were recruited based on their purchases of fresh commodities, which may in part explain the low frequency of RTE consumption observed.⁶

3.8. SOURCES OF INFORMATION

Most consumer respondents (79%) mentioned medical professionals (e.g., physicians or nurses) as the most trusted source of information about health issues, followed by the related category of community health workers (39%). Family members and experts on radio or television were mentioned by a sizeable minority (10-15%), while other categories (e.g., community members, religious or community leaders, and newspapers) were only mentioned by a small minority (1-3%). Modest but significant differences by gender were observed, with males trusting medical professionals and experts on radio or TV slightly more than females.

When it comes to sources of information that respondents’ access to find out if their food was safe, medical professionals (e.g., physicians or nurses) were mentioned most frequently (77%), followed by friends or family (32%), and a governmental agency responsible for food, environmental, or occupational health and safety (29%) (Table 5). Note that for this question, answer options were read out loud, including a “other” option that no respondent selected. Only slight differences by gender were observed: as for health issues in general, males seemed to trust medical professionals (79% vs. 74%) as well as information on food packaging (7% vs. 3%) slightly more than females.

Table 5. Sources of Information Consumers Access to Evaluate Food Safety

INFORMATION SOURCE	MALE		FEMALE		TOTAL	
	N	%	N	%	N	%
Friends or family	76	33%	73	31%	149	32%
Medical professionals (e.g., local doctor, nurse)	184	79%	176	74%	360	77%
Experts/journalists in newspapers, television, or radio*	19	8%	18	8%	37	8%
Agency for food, environmental and occupations health and safety	68	29%	70	29%	138	29%
The packaging or label on the food	16	7%	7	3%	23	5%
A famous person you like	7	3%	5	2%	12	3%

Note: % figures may sum to more than 100% because respondents could select more than one answer.

* This category includes two groups: experts (e.g., professionals) and non-experts (e.g., hosts or journalists). An error in scripting the data collection interface merged these two categories.

⁶ Consumers buying both fresh and RTE foods were included, though consumers buying only or predominantly RTE foods were excluded; so, this sample may not represent the market population.

Only 5% reported having a food issue they wanted to know more about. When asked more specifically if there was any *food safety* issue they wanted to know more about, 14% answered affirmatively. Food issues mentioned included stomachaches, nutritional content, and potential harm from chemicals applied on cowpeas, among others. When this subset of respondents was asked where they looked for food safety information, answers included medical professionals (60%) and friends or family (41%), followed by the agency for food and environment (9%).

Only 9% of respondents (N=40) were aware of organizations working on food safety and having a local presence (e.g., market, medical, and government actors). Government agencies included the the WHO, Kebbi State Ministry of Health, and the National Agency for Food and Drug Administration and Control (NAFDAC). Most items were mentioned by one or two respondents each, except NAFDAC which was mentioned by 10 respondents, and WHO by six. Over 40% of respondents that mentioned at least one organization reported engaging with it. Modes of engagement included active involvement in the organization (N=8), attending some meetings or knowing members of the organization (N=4).

3.9. MEDIA USAGE

This part of the survey inquired about which media consumers in the selected markets commonly use, to understand which channels could be effective in communicating messages during EatSafe’s intervention. This set of questions did not have a focus on food safety.

Internet use. Consumers reported a broad spectrum of internet use frequency. Approximately 30% reported had never used the internet, and another 30% reported using it every day. Some used it infrequently (19% “a few times per week” and 16% “most days but not every day”). No major differences in overall internet use were observed across genders, except for more females never using the internet (37% vs. 31% of males), and fewer using the internet every day (28% females vs. 34% males; **Figure 16**). While a comparison across markets is not robust due to the small number of respondents from the two smaller markets (46 and 24 respectively), it can be noted that in the smaller market a larger proportion never uses the internet (54%, compared to 34% and 28% the two larger markets) and a somewhat smaller percent uses the internet most days or every day (38%, vs. 47% and 52%).

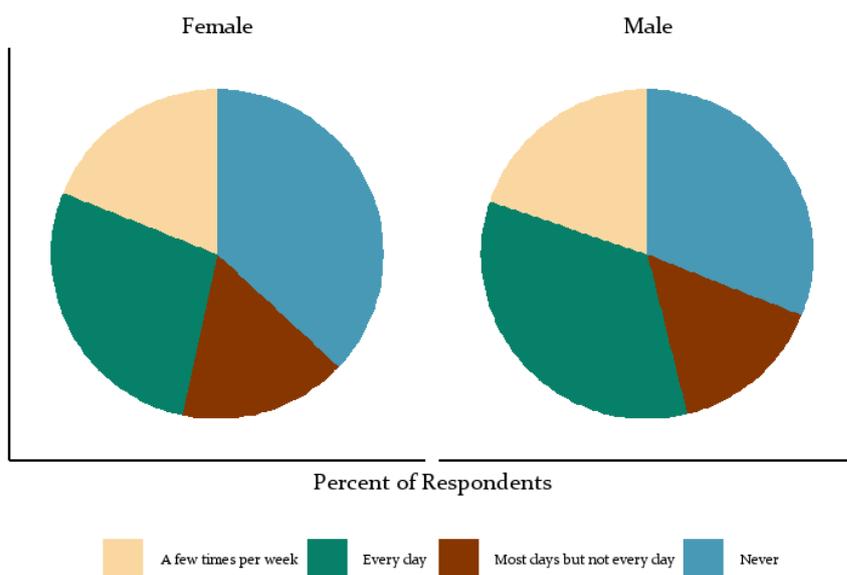


Figure 16. Consumers’ Internet Use Frequency, by Gender

Respondents were asked about the reliability of their internet connection to access a range of content or applications. In general, respondents scored their internet’s reliability as either very or somewhat reliable in similar proportion. Specifically, to access audio or radio, approximately half of respondents (excluding those answering “not applicable”) considered their internet very reliable (48% vs. 27% somewhat reliable and 25% not reliable). Proportions shifted slightly towards lower reliability to access videos (41%, 38%, and 20% respectively). Reliability to access WhatsApp or other chat platforms as well as Facebook were scored somewhat in between. Across consumers, the internet was primarily accessed via a mobile phone (96%) or home computer or tablet (each ~8%). Almost no access was reported from public spaces such as libraries or internet cafes (2% and 0.3%). Most frequently accessed apps included WhatsApp (78%) and Facebook (72%), followed by Google (46%), YouTube (29%), Twitter (17%), and Instagram (3%), with relative parity by gender.

Media used to obtain information. When asked what channels are used to obtain information beyond food safety, health, or other topics, a range of media were mentioned. TV news (39%), radio (22%), and online (17%) were the most prevalent sources of information reported by consumers (Figure 17). TV serials/non-news programs and newspapers (print media) were reported by 17% and 12% of consumers, respectively, while social media was less commonly cited as an information source (5% or 6% when including messaging apps). Trends were similar across genders. Across markets, more consumers accessed information via the radio in Market #2 (54%) compared to the other two (each approximately 20%). As expected from data on internet use, these consumers only occasionally mentioned seeking information online, instead relying more on TV news and radio.

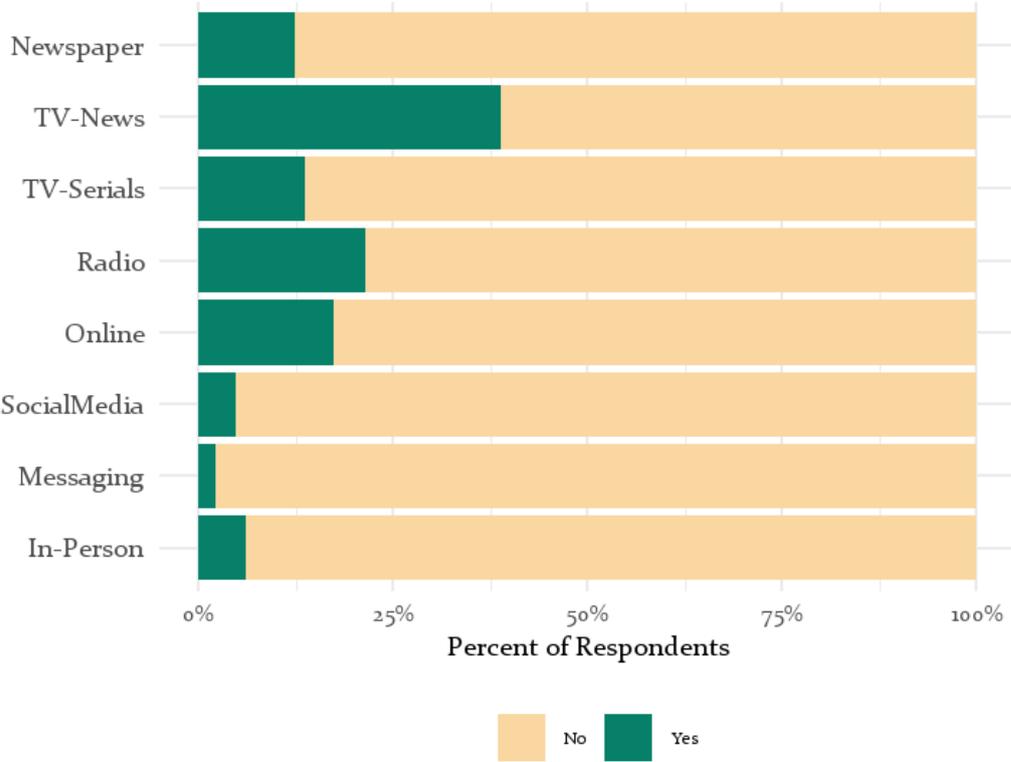


Figure 17. Media Channels Most Used by Consumers

Among users of specific channels, access frequency varied. Generally, people that use a channel use it frequently. Among followers of TV news (39% of all respondents), most watched

TV news daily (70%, similar across genders) or two to three times a week (22%). Among those using social media to obtain information (32%), most use it daily (76%), with 19% using it one to three times a week. Among those obtaining information via radio (27% of all respondents), 72% listened daily and 26% listed one to three times a week. Only 2% of consumers listened to radio every two weeks or once a month. Radio listeners reported a range of listening times: an hour or more (48%) and less than half hour (38%). More females listened less than a half hour than males (46% vs. 31% of males), and correspondingly, more males listened for over an hour (20% of females vs. 31%).

Among those accessing online news (23% of all), 88% do so daily, both males and females (93% vs. 83%). For users of fictional TV (17% of all), 63% watch every day, and 32% watched only two or three times a week. Over half of newspaper readers also reported reading every day (59%), more males than females, followed by those who reported reading newspapers once a week (24%), more females than males.

Media used for entertainment. When asked about source of entertainment, consumers most frequently mentioned fictional TV fiction (e.g., shows, films, series, or soap operas comprising 50% of respondents), followed by social media (36%), online videos (21%), and radio serials (18%). News, in-person word of mouth, and others were mentioned less frequently (12%, 10%, and 2%, respectively). Trends were similar across genders, with slightly more males listening to radio serials for entertainment (22% males vs. 15% females). Relatively more consumers in the Market #2 mentioned radio serials (42%, compared to 17% in the remaining two markets), which was the most mentioned source of entertainment for this smaller market. Conversely, TV fiction and social media were the most mentioned in Market #1 (53% and 36% of answers) as well as in Market #2 (39% each). Among consumers mentioning radio serials (18% of all, i.e., 86 out of 470), about half (51%) reported listening to them daily, followed by sizeable groups listening two or three times a week (29%) and once a week (17%). More males listen daily (57% vs. 43% females), while more females listen two or three times a week (24% males vs. 37% females).

4. VENDOR SURVEY FINDINGS

4.1. DEMOGRAPHICS OVERVIEW

A total of 478 vendors were surveyed, including 307 males and 171 females (**Table 6**). The gender imbalance in the sample was expected, given the relative scarcity of female vendors in these marketplace environments.⁷ Female vendors were intentionally over-sampled to provide robust perspective on their needs. Like the consumer population surveyed by EatSafe, most (~92%) vendors surveyed were Hausa and Muslim. Other prominent ethnic groups each of which constituted <5% of the vendor population. A small proportion was Christian (7%).

Table 6. Vendor Demographics

	MALE (N=307)	FEMALE (N=171)	TOTAL (N=478)
MARKET (p = 0.19)			
Market #1 (Largest)	269 (88%)	142 (83%)	411 (86%)
Market #2	29 (9%)	26 (15%)	55 (12%)
Market #3	9 (3%)	3 (2%)	12 (3%)
AGE (p < 0.001)			
Mean (SD)	37.0 (11.0)	28.5 (11.8)	33.9 (12.0)
Median (Q1, Q3)	35.0 (29.0, 45.0)	25.0 (19.0, 35.0)	32.0 (25.0, 42.0)
Min - Max	18.0 - 82.0	18.0 - 80.0	18.0 - 82.0
EDUCATION (p < 0.001)			
Pre-Primary	11 (4%)	2 (1%)	13 (3%)
Primary	40 (13%)	44 (26%)	84 (18%)
Secondary	121 (39%)	52 (30%)	173 (36%)
Higher	53 (17%)	12 (7%)	65 (14%)
None	82 (27%)	61 (36%)	143 (30%)
HOUSEHOLD SIZE (p = 0.03)			
Mean (SD)	9.3 (5.0)	8.3 (4.5)	8.9 (4.9)
Median (Q1, Q3)	9.0 (5.0, 12.0)	8.0 (5.0, 10.0)	8.0 (5.0, 11.0)
Min - Max	1.0 - 27.0	2.0 - 33.0	1.0 - 33.0
HOUSEHOLD ROLE (p < 0.001)			
Head of Household (HH)	253 (82%)	34 (20%)	287 (60%)
Not HH	54 (18%)	137 (80%)	191 (40%)
MARITAL STATUS (p < 0.001)			
Married	245 (80%)	88 (52%)	333 (70%)
Not Married	62 (20%)	83 (48%)	145 (30%)
ETHNIC GROUP * (p < 0.001)			
Hausa	301 (98%)	140 (82%)	441 (92%)
Igbo	4 (1%)	18 (11%)	22 (5%)
Yoruba	0 (0%)	8 (5%)	8 (2%)
Fulani	1 (0.3%)	0 (0%)	1 (0.2%)
Others	1 (0.3%)	5 (3%)	6 (1%)
RELIGION (p < 0.001)			
Muslim	301 (98%)	146 (85%)	447 (94%)
Christian	6 (2%)	25 (15%)	31 (6%)

⁷ Note that the 36% prevalence of female vendors surveyed is likely higher than the actual prevalence of female vendors in the market, given that EatSafe purposefully oversampled females.

4.2. HOUSEHOLD SOCIOECONOMIC STATUS

At the \$3.10/day international poverty line, the mean PPI for vendors was 20% (median: 15%; IQR: 27%). Female vendors had significantly higher likelihood of poverty than male vendors (**Figure 18**; $p < 0.001$), suggesting that female vendors in this population may be relatively more financially vulnerable. It should be noted, though, that probability of poverty was generally modest across both gender groups.

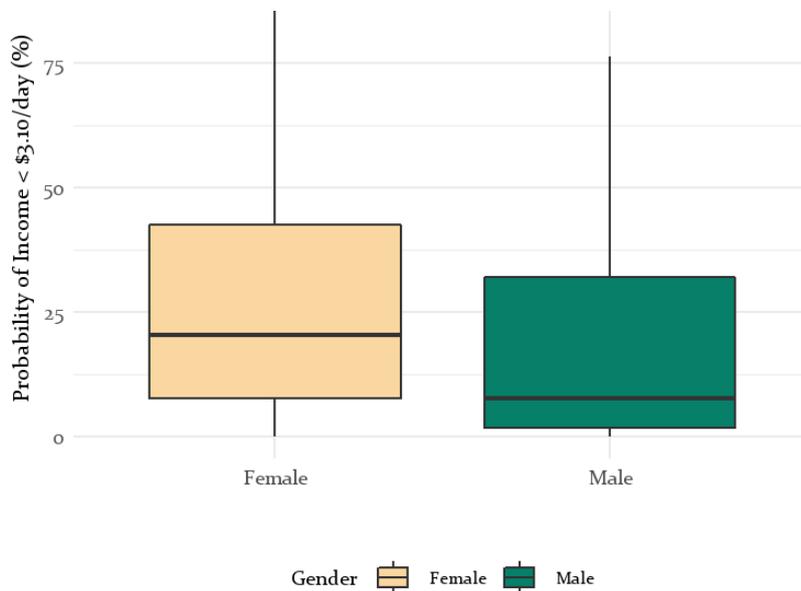


Figure 18. Vendors' Socioeconomic Status, by Gender

4.3. VENDORS' SHOPS AND BUSINESS CHARACTERISTICS

The average vendors' shop served 41 (± 45) customers per day, with male vendors' shops serving significantly more customers per day than female vendors' shops (49 vs. 27; $p < 0.0001$). Vendors reported on average that around half (45%⁸) of their daily customers were "regular customers," or those with whom the vendor often conducts business and may have trusting relationships. Male vendors had a significantly higher proportion of "regular customers" than female vendors, but the absolute difference is modest (47% vs. 42%; **Figure 19**; $p < 0.01$).

In the sections below, unless otherwise stated, findings did not differ significantly between female and male vendors.

⁸ Three spurious observations were omitted because the approximate number of "regular" customers per day estimated by the vendor exceeded the approximate number of total customers.

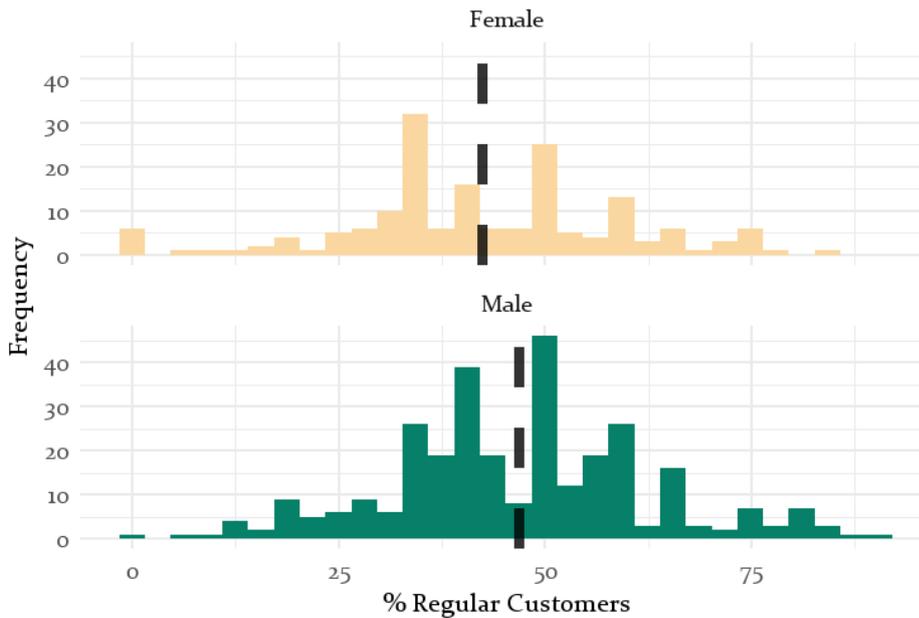


Figure 19. Prevalence of “Regular Customer” Relationships with Consumers, by Gender

EatSafe achieved commodity quotas for vendor enrollment, comprising 294 grains vendor (62%), 51 vegetable vendors (11%), 59 fish vendors (12%), and 74 beef vendors (15%). Gendered differences were observed in the commodities vendors sold, as 84% female vendors sold grains and legumes (**Figure 20a**); females constituted a minority of the vendor population in every commodity group (**Figure 20b**), especially fish and beef. This distribution is important in interpreting findings, as gender and commodity dimensions may confound each other.

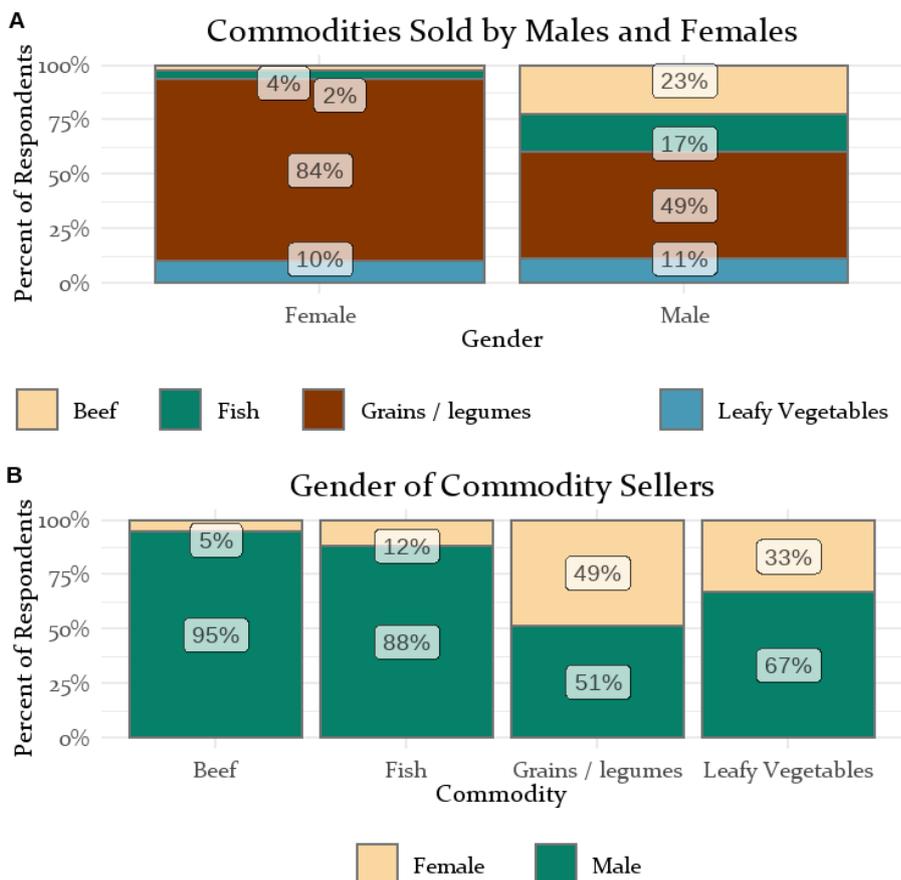


Figure 20. Commodities Sold, by Gender (A); Gender of commodity sellers (B)

The most common shop constructions were wooden stalls (30%), tables (28%), masonry (e.g., concrete, bricks; 22%), while <20% of vendors had impermanent or mobile shops. Significant gender-based differences were seen in shop types (**Figure 21**; $p < 0.0001$), with fewer female vendors having masonry stalls compared to male vendors.⁹

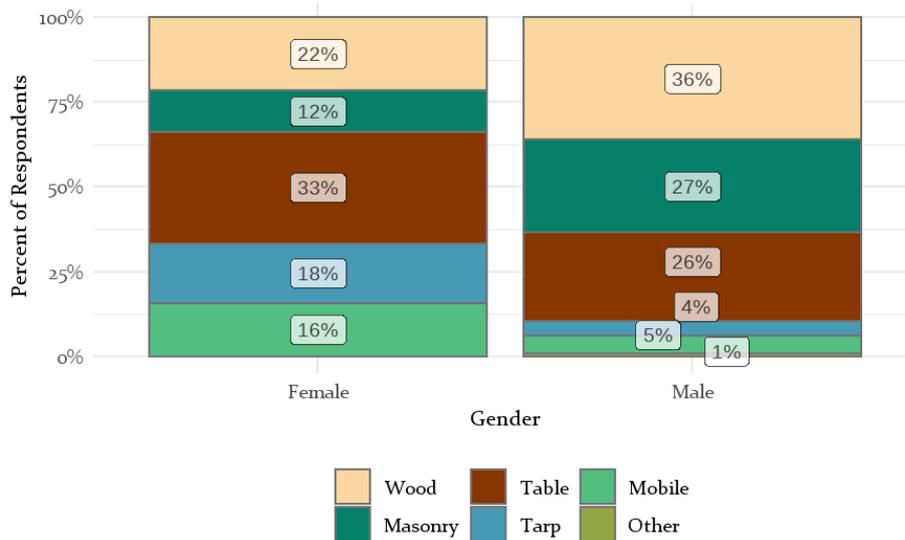


Figure 21. Vendors' Shop Structures, by gender

Nearly all (>99%) vendors' shops were operational every day or nearly every day. Most shops were open continuously during the market's operating hours, and operational all year. The markets typically open between 8 and 9 AM, and close between 6 and 7 PM. About two-thirds of vendors sold the same foods throughout the year, while 25% of vendors sold a variety of products corresponding to local cropping seasons. These trends were generally comparable across commodity types, but beef vendors had lowest levels of variation (**Figure 22**).

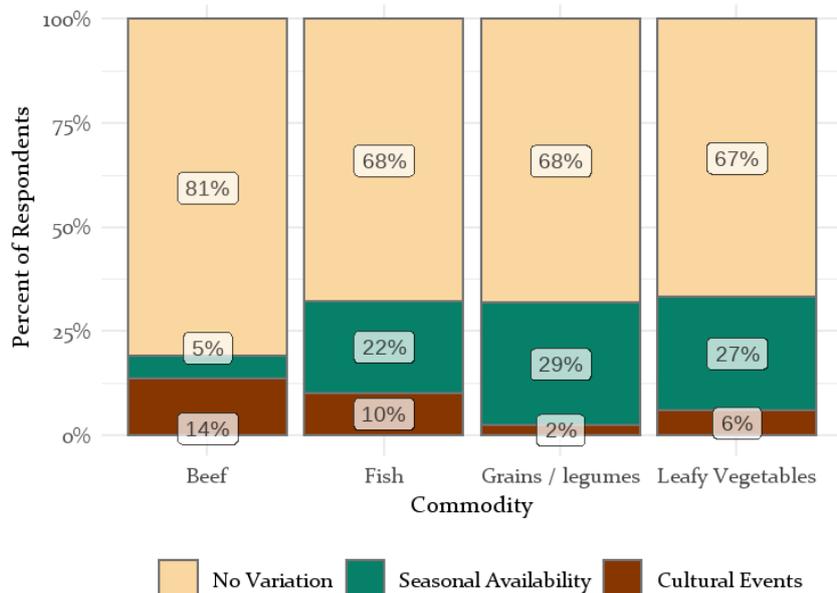


Figure 22. Reasons for Seasonal Variation in Commodities Sold by Vendors

⁹ The largest market was rebuilt recently after a fire, with masonry structures made available to many vendors, though some will be assigned in the near future – possibly during EatSafe's interventions.

Among the surveyed vendors, 91% self-identified as the owner of their shop, while another 7% reported that they were involved in shop management. Overall, these figures indicate that in the surveyed population the vast majority (98%) of vendors are personally involved in business decision-making for the shop.¹⁰ This could have positive implications for the role of this population in intervention uptake.

Most vendors (95%) reported that they had no prior experience working in other shops, though 14% of male vendors and 5% of female vendors reported engaging in other income-generating activities outside the shop. The most frequently cited source of income outside the shop was farming, which was reported by 9% of males and 6% of the total vendor population. Less than 2% of vendors reported other income-generating activities in retail settings.

Many vendors relied on the selected market, as 40% reported that they would cope without selling anywhere else if they were unable to sell their wares at the selected market. This response was significantly more prevalent among female vendors (49%) than among male vendors (35%; $p < 0.05$), suggesting that male vendors may have more options or flexibility within their business operations. Vendors reported that if they were unable to sell at the selected market, then they would sell their wares in neighborhood shops (21%), as informal/mobile vendors in their neighborhood (16%), or in other traditional markets (6%).

4.4. ATTITUDES AND BEHAVIORS IN THE MARKET

Most vendors (85%) reported being either “satisfied” or “very satisfied” with their personal experiences selling food at the selected market. Vendors’ personal choice to sell food at the selected market, as opposed to any other markets, was largely driven by projected profitability of their business. More than two-thirds (68%) of vendors reported that the quantity of customers is a top reason for selling at the market, and an additional 18% of vendors (totaling 85%) reported that revenues, specifically, was a top reason for selecting the selected market. In addition to profitability, many vendors reported that they sell at the selected market because it feels secure (40%). Market cleanliness was also reported by 28% of vendors as a reason for choosing the market. After probing for the importance of this factor, 79% of vendors reported that cleanliness might be a reason to select a market at which to sell. These findings should be considered together with the reality that vendors’ choice of market may be driven by habit and practicality that are unlikely to change.

Vendors appear generally proud of the businesses they maintain and the products they sell. A substantial majority (81%) of vendors said that they are satisfied with the way their shop looks when compared to the shops of other vendors. By contrast, 8% of vendors said they are dissatisfied with the way their shops look. This trend is echoed in vendors’ sense of pride around the products they sell, with 95% of vendors reporting that they agree with the statement “I am proud of the quality of the food I sell.”

Many vendors (89%) agreed with the statement “I am satisfied with how my shop operates.” Of the 11 vendors (2%) who disagreed, 100% were female vendors; though statistically significant ($p = 0.0009$), this difference represents a relatively small proportion of the vendor population. These findings further support the assertion that vendors are proud of their businesses and have a vested interest in their success.

¹⁰ Some respondents reported being in a junior manager role (4%) or an employee (2%).

Over three-quarters (76%) of respondents reported that the selected market was “clean” or “very clean”. However, 20% of vendors felt that the cleanliness of the market was “average,” a sentiment expressed significantly more often among female vendors than among male vendors (28% vs. 15%; $p < 0.005$). It is possible that female vendors have higher cleanliness standards, or that, due to circumstantial factors, female vendors may be confronted disproportionately by “unclean” aspects of the market. This elevated proportion of the “neutral” response in the rating scale among female vendors is consistent with what was observed for satisfaction with the vendors’ experience selling at the market. To qualitatively assess whether there was a neutral response bias either within or across genders, the distributions of responses were examined across a set of scale-based questions. Based on this assessment, it does not appear that female respondents disproportionately responded neutrally.

Perceptions of personal security, defined as safety from harassment and the risk of harm in the marketplace, were comparably high among surveyed vendors, with 87% reporting that they feel either “secure” or “very secure” while selling food in the market. 6% of vendors report that they feel either “insecure” or “very insecure.” The “neutral” response was rather uncommonly reported by vendors (7%). No significant difference in the perceived security was observed across genders.

Vendors’ shops, in general, appear to be governed by formal or informal expectations for proper conduct amongst their staff. Most vendors (84%) reported that [there are set rules or expectations in their shop for preserving the quality and safety of the food they sell](#), as well as maintaining cleanliness in the shop. These results suggest that there may be accountability mechanisms for existing food safety management within shops, potentially advantageous for intervention implementation. Perhaps associated with the widespread prevalence of shop-based expectations for cleanliness, 75% of vendors reported that they face no difficulty keeping their shops clean. A smaller proportion expressed neutral or affirmative feelings about difficulty maintaining cleanliness (15% and 11%, respectively).

Vendors varied in the way they deal with unsold produce at the market, though many reported that they store unsold produce at the shop (i.e., in the market) for sale the next day (68%) or to store unsold produce in their home for sale at a later date (23%). Comparatively few vendors have other approaches to dealing with unsold food, with a small proportions selling the same day outside the selected market or giving it away (both ~5%). Very few vendors reported that they throw away unsold produce (<2%), indicating that (i) vendors prioritize the profitability of their businesses and (ii) excess produce in the market could constitute a food safety risk, depending on commodity and storage conditions.

4.5. FOOD PROCUREMENT DECISIONS AND VENDOR-SUPPLIER INTERACTIONS

On average, vendors reported using 4.3 (± 4.6) food sources or “suppliers” to procure food for their shops. Only 2% reported that they had no suppliers, meaning that their products are solely or predominantly derived from self-provisioning activities.

Consistent with other findings on purchasing decision-making among consumers and vendors in this population, [price \(55%\) and quality \(50%\) were the most important characteristics of suppliers](#) that would make vendors want to purchase again in the future. Food cleanliness and safety were listed as an important supplier characteristic by 41% of vendors.¹¹ [Characteristics](#)

¹¹ This figure must be interpreted cautiously, as the corresponding survey question was administered after some priming on the topic of food safety

related to the personality of the supplier, or the vendor's relationship to them, were less commonly cited relative to price, quality, and safety of foods, suggesting that food attributes are paramount to relationships of trust in vendors' choice of food suppliers. For example, "trust" was cited by 29% of vendors, while "comfort" and "personality" were cited by 17% and 12%, respectively. Convenience/practicality of the supplier was cited rarely (2% of vendors), suggesting that accessible suppliers may be comparably convenient, or that the available pool of potential vendors is too limited to consider this factor in their decision-making.

Most vendors do not routinely discuss food quality with their suppliers, with only 46% of vendors reported discussing the quality of food with their suppliers either "often" (33%) or "always" (13%). A comparable proportion (46%) of vendors responded either "rarely," or "sometimes," while 8% of vendors reported that they "never" have conversations about food quality with their suppliers. Most (68%) vendors were usually the initiators of conversations about food quality with suppliers, suggesting a high degree of perceived attention to food quality in the surveyed population. A smaller proportion of vendors (19%) reported that their suppliers are usually the initiators of such conversations. The remaining 11% either had no such conversations or could not distinguish who usually initiates them.

A possible reason for the relatively low prevalence of conversations about quality with suppliers is that vendors' overall level of satisfaction with the food products they procure is high: 92% of vendors reported to be either "satisfied" or "very satisfied" with the food they purchase from their suppliers. Quality (64%) and price (53%) were most commonly cited when asked to name the food attributes that they are most satisfied with, in terms of what they purchase from suppliers – further confirming the importance of these attributes in purchase decision-making. Food cleanliness and safety were cited by 32% and 28% of vendors, respectively. Vendors reported a number of follow-up actions that they would take if they were worried that a particular food item may not be safe. The most common actions included making a complaint to the supplier (29%), returning the product (24%), or switching to another supplier (19%). Only 6% of vendors reported that they would take no action in such a situation. These findings indicate that vendors have a substantial amount of leverage in ensuring the safety and quality of the products they procure from suppliers.

Similar results were identified when asking which key food characteristics vendors consider purchasing decisions from suppliers: price (73% of vendors) and freshness (63%) were the most commonly cited factors. Safety was cited by 48% of vendors, likely an over-estimate as this survey question followed a priming deeper-dive into the vendors' understanding of food safety. Other attributes were less prominent, such as appearance and nutritional content, cited by 38% and 19% of vendors, respectively. Attributes related to consumers' ease of preparation and consumption were of much lesser importance in vendors' purchasing decisions: taste (12%), ease of preparation (11%), and appropriateness for recipes (2%).

Most vendors reported having favorable relationships with their suppliers, with 88% reporting they trust that what their suppliers tell them is accurate. Around 10% of vendors felt neutrally about this issue, and just 2% disagreed. Similarly, 89% stated that they agree that their suppliers sell them food at fair prices; 2% disagreed and 9% felt neutrally. An even stronger majority of vendors (92%) reported that they trust that their suppliers take actions to ensure the food they sell is of good quality. Accordingly, 91% of vendors feel confident in their ability to identify suppliers that sell high-quality foods. No significant differences were observed by gender for these variables, indicating that there does not seem to be a gender barrier to the establishment of trusting relationships with food suppliers. Vendors' high levels of trust with

suppliers, together with the high satisfaction with purchased food (reported above) is likely related to the fact that only 42% of vendors compare between different suppliers “often,” “very often,” or “always.” This finding indicates that vendors may be reliant on specific suppliers they have developed trust relationships with.

4.6. ENGAGEMENT WITH MARKET MANAGEMENT

Many vendors communicate with market management entities regularly, but at moderate frequencies. While 38% of vendors reported communicating with market management once per month, 29% reported that they “never” do so. This indicates that some vendors may seek or/and receive adequate support from market management. This gap may reflect gender, as significantly more female vendors “never” have contact with market management (49% compared to 18% of males), and significantly more males have “monthly” contact with management (45% compared to 26% of females; **Figure 23**; $p < 0.001$).

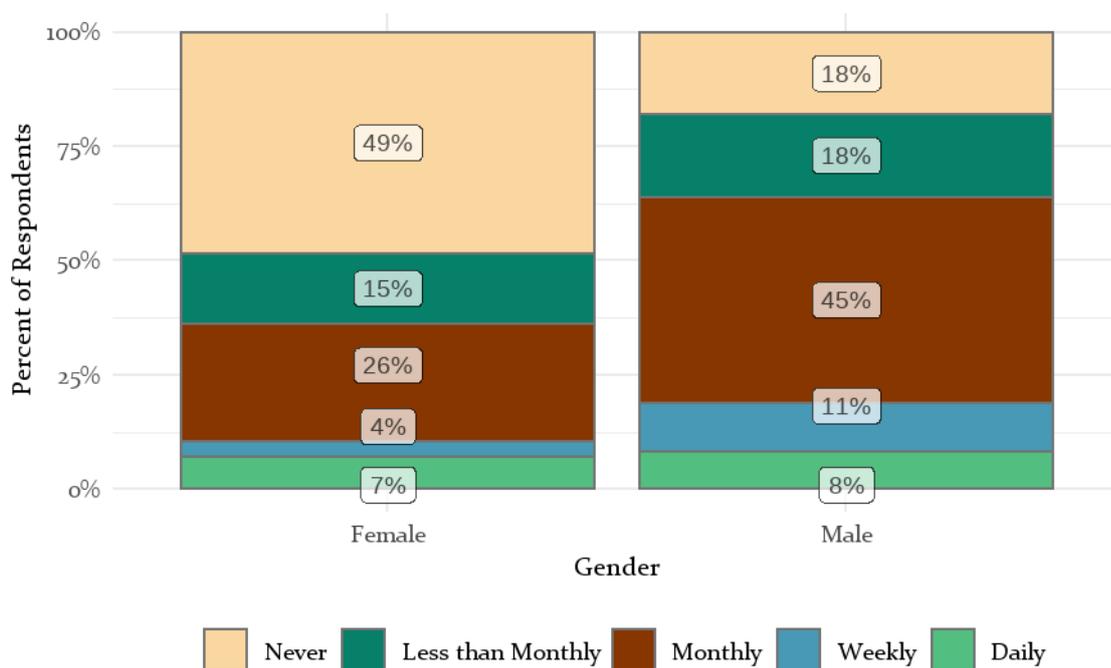


Figure 23. Vendors’ Frequency of Communications with Market Management, by Gender

Vendors reported a number of reasons for communication with market management, including paying rent (37%), organizational meetings (32%), service performance (27%), or regulation enforcement (20%) – the latter of which suggests that management entities perform regulatory roles for at least some shops in the market. The topics of conversation with market management reported by the most vendors included food prices (46% of vendors) and food handling practices (35%). Hygiene was also a common topic of conversation reported, including hygiene-related rules and practices (each ~26%).

Most vendors (75%) agree that it is the market management’s responsibility to ensure the safety of the foods sold at the market. While 17% of vendors felt neutral about the market management’s role in ensuring food safety, only 8% disagreed, suggesting that the belief that ensuring food safety is the market management’s responsibility is widespread. It is not known whether this belief influences vendors’ perceptions of their own personal responsibility to ensure the safety of the food they sell. While 64% reported that vendors generally have a

responsibility to ensure food safety, **only 12% of vendors listed themselves (“me/myself”) as having primary responsibility.**

Vendors were generally satisfied with the market management’s performance in maintaining conditions conducive to food safety in the market, as **80% believed the market management does a good job ensuring that the market is kept clean**, while only 5% of vendors disagreed with this statement. A **significantly higher proportion of females feeling neutrally about the issue** ($p = 0.002$) and a significantly higher proportion of male vendors reporting that they “strongly agree.” These findings constitute further evidence (adding to findings from the FES and from other survey questions in this assessment) that female vendors may either be more discerning about cleanliness, or they are disproportionately exposed to “unclean” aspects of the market environment.

Approximately three-quarters of vendors agreed that the market management makes sure that the foods that vendors sell are safe to eat, and that the market management helps vendors if they have a problem related to their shop. This, together with the above finding about the market management’s performance in ensuring market cleanliness, suggests that **vendors perceive the management to wield some monitoring or regulatory authority over vendors’ food safety-related conduct** – a finding with possible relevance for intervention programming. Similarly to the market cleanliness findings, many more female vendors (27% and 29% for ensuring food safety and helping with problems, respectively) felt neutrally about these topics than male vendors (14% and 13%), while significantly more male vendors (17% and 15% for ensuring food safety and helping with problems, respectively) “strongly agreed” with the statement compared to female vendors (6% for both statements).

Vendors perceived their markets’ management entities as providers of useful services that benefit their businesses (75% of vendors). Additionally, 70% of vendors reported that management provides assistance to vendors in improving the upkeep of their shop structures. This indicates that market management is present in vendors’ market experiences as both regulatory figures and supportive providers that facilitate business success. Both of these variables also exhibited significant **gendered differences** ($p < 0.001$ for both), with more female vendors feeling neutrally than males and more males reporting they “strongly agree.”

Most vendors (84%) agreed with the statement that market management ensures that vendors respect regulations, while only 6% of vendors disagreed and the remaining 10% felt neutrally. The lack of significant differences among genders, in light of the other significant differences in opinions on management, suggests that while female vendors feel less strongly about the performance and supportiveness of the management, both genders are similarly subject to compliance-related expectations. It is not possible to distinguish with the available data the *extent* of expected compliance (as it could be high, moderate, or low), but this finding suggests that there are no gendered expectations for compliance.

In addition to the market’s own regulatory duties, 82% of vendors agreed that it is important for the government to enforce minimum standards of food quality in the market. A minority (11%) feels neutrally about the importance of the government’s fulfilment of this role or considers it not important (7%).

4.7. INTERACTIONS WITH AND PERCEPTIONS OF CONSUMERS

Vendors appear confident in their understanding of consumers’ demands as it pertains to the way they manage their shops. **Half of vendors cited the price of food as a reason that would**

entice consumers to shop from them again, which is consistent with other findings that price is a driver of foremost importance. Other factors cited by approximately one-quarter of vendors included food quality and friendliness/kindness (both 26%). Honesty/trustworthiness, which was identified as an important driver in EatSafe's FES in this population, was mentioned by 8% of vendors as a reason customers might return in the future (13,14). Cleanliness was cited by only 7% of vendors as a reason customers might return in the future, indicating that this factor may be overshadowed by others in vendors' perceptions of consumers' preferences, or taken for granted once the vendor is seen (or sees above a "sufficiently clean" threshold).

There is some evidence that vendors' perceptions of consumers' preferences have been influenced, at least in part, by consumers' expression of demand – suggesting that EatSafe's theory of change is viable in the local context. Vendors reported several topics that their customers vocally complain about, and consistently with other findings on the prime importance of price as purchase choice driver, 67% of vendors noted customer complaints about the price of food. Other common topics included spoilage or shelf life (26%) and taste (21%). Though foodborne illness complaints appeared infrequently, cited by only 5% of vendors, it is possible that vendors may be reluctant to disclose history of complaints about this topic given its sensitivity – so the actual figure may be larger than what was reported.

Customers infrequently inquired about the origin of foods sold by vendors (e.g., production context, storage conditions, processing methods), with 85% of vendors reporting that this happened "never," "rarely," or "sometimes." When such inquiries about food origins were raised by customers, vendors reported that the customers are most interested in knowing about storage practices (43%) and when the product arrived at the market (34%). A relatively small proportion of vendors (13%) reported that their customers ask about how a product was harvested or slaughtered (such as *halal* practices). It is possible that adherence to such customs by vendors is explicitly or implicitly made clear to customer, so that asking is not necessary.

Over 60% of vendors reported they "sometimes" or "rarely" engaged in dialogue with their customers about the quality of the food they sell. Though not frequent, these conversations occur occasionally; only 9% of vendors reported that they "never" have conversations with their customers about food quality – a positive finding indicating that there is precedent in the selected markets for dialogue with customers about topics relevant to food safety, which may be leveraged in intervention programming. A significant gender-wise difference ($p < 0.001$) was observed in who initiated conversations about food quality. More female vendors reported initiating conversations with customers about food quality (32% vs. 21%), suggesting that female vendors perceive themselves as more active in initiating quality-related conversations with their customers than male vendors.

Similar to findings from the consumer survey, and as expected, vendors reported that it was uncommon for customers to request to see a certification that the food being sold is safe to eat. A majority (66%) of vendors indicated that this "never" or "rarely" occurs, while only 11% reported that this occurs "often" or "very often." At present, no known certification scheme or documentation is widely held by vendors in the selected markets. These findings indicate that, while presently rare, there is an existing practice of requesting and valuing certification of food safety in the marketplace. "Certification" was self-defined here, hence it is not known what specific aspects are most valued. This has potential implications for intervention design, in that it suggests both that a substantial fraction of vendors acknowledges that certification may factor into consumer demand, thus potentially adding value to their shop operations.

Over 90% of vendors reported that their customers tell them when they are satisfied with the food they have bought. Moreover, 68% of vendors agree that their customers' requests push them to improve their business operations. Most (94%) vendors agree that it is useful when customers tell them that they are dissatisfied – but there is also evidence that this takes an emotional toll on many vendors, as half of vendors reported that they get upset if a customer complains about the food they bought. These findings suggest that vendors take their consumers' input very seriously. Their feedback drives them to make improvements – but there is perhaps a threshold past which critical feedback may be damaging to vendors' morale or sense of pride for their business. In intervention programming it would be advisable to approach this issue delicately, such that consumer input reinforces *positive* feedback loops that minimize the risk of jeopardizing vendors' emotional wellbeing or trigger defensive behaviors.

82% of vendors reported that they take time to answer questions that customers have about foods, while only 13%, reported that they do not do this. In addition to vendors' willingness to answer questions, almost all vendors either agreed or strongly agreed that they are willing to put in extra effort to fulfil customers' requests. These findings nevertheless indicate that vendors care about and take actions to respond to consumers' demands.

Some gendered differences were observed in questions on vendors' interactions. Nearly two-thirds (63%) of vendors agreed that they are more comfortable talking to customers of their own gender than of the opposite gender, consistent across genders. This result affirms prior EatSafe research and suggests that gender mediates social norms in the market environment.

Aside from vendors' own personal comfort interacting with customers of other genders, most vendors (80%), both male and female, reported to “agree” or “strongly agree” that female customers make more requests than males about the food they want to purchase. This is consistent with earlier evidence from EatSafe's FES that female vendors may be more strategic shoppers, with perhaps more discerning attitudes in their food choices (13,14).

When asked to rate the importance of characteristics that can impact how the vendor conducts their business, 83% of vendors considered it to be of “high” or “very high” importance that their customers express questions and concerns about the food they sell (**Table 7**). This indicates that vendors are likely receptive to and appreciative of consumer feedback, confirming findings reported above. Similar ratings were observed on the importance that customers can see vendors actively take care of their shop and handle food. This finding was statistically different across genders, with a lower proportion of female vendors ascribing “very high” importance to this aspect, compared to males (30% vs. 18%; $p = 0.05$).

Almost 90% of vendors ascribed “high” or “very high” importance to looking neat and tidy while working at the shop, indicating that vendors perceive their own appearance as important to the success of their business. Over half of vendors noted the importance of displaying certification or credentials indicating the safety of foods. Given the existing evidence that almost no vendors display such certification *in practice*, it was unexpected that a majority of vendors ascribed high importance to this characteristic, pointing to a possible interpretation of this question as a hypothetical scenario. This finding suggests that vendors recognize the value of such displays and may use them if provided access and training.

Table 7. Vendors’ Perceived Importance of Consumer Interactions

CHARACTERISTIC	IMPORTANCE LEVEL				
	VERY LOW	LOW	MID	HIGH	VERY HIGH
Consumers express questions and concerns about the food they sell	0.6%	2%	15%	63%	20%
Consumers can see vendor actively taking care of the shop	0%	2%	15%	50%	25%
Consumers can see how food is handle in the shop *	0%	3%	17%	55%	26%
Vendor looks neat and tidy while on duty	0.2%	1%	10%	50%	39%
Consumers are told where the food comes from	2%	8%	21%	52%	18%
Display certification or credentials about the safety of foods sold	13%	12%	16%	41%	16%

* Significantly different responses between male and female vendors in chi-square test.

4.8. VENDOR PEER COOPERATION AND INTERACTIONS

Vendors were invested in their relationships with other peer vendors in the marketplace, with 87% reporting they trust other vendors in the selected market to help them if they need assistance at their shop. Far more male than female vendors (18% vs. 9%) “strongly agreed” with this statement, suggesting that, overall, males may have more trusted options for peer support than females in the market. This is understandable given the relative scarcity of female vendors in the population. Similar results were found for vendors’ trust that other vendors will be honest in how they conduct business, though a significantly greater higher proportion of female vendors felt neutrally about this topic than males. Further, 80% of vendors classified the ability to work together with or share responsibilities with other vendors as either “highly” or “very highly” important. This indicates a **strong sense of value ascribed to cooperative action among vendors**. Whether formally or informally, vendors have developed a social support system. Male and female vendors ascribed similar levels of importance to this principle.

Vendors look to one another for support when needed, but they do not seem highly reliant on one another for support in making business or management decisions. While almost half of surveyed vendors reported that they ask other vendors for help in making business or management decisions “sometimes” or “rarely,” only 11% reported that they “never” seek such support from their peers; this indicates that, even if infrequent, most vendors communicate with one another about business and management practices.

Vendors valued the concept of being a leader among their peers, as 79% of vendors, including nearly equal proportions of males and females, reported that they perceive the ability to be a good role model for other vendors as “highly” or “very highly” important. A similarly high proportion of vendors ascribed “high” or “very high” importance to the ability to share knowledge and skills with other vendors. These findings suggest that interventions geared toward enhancing vendors’ status or reputation in their community may be tractable.

4.9. HEALTH CONCERNS AND FOOD SAFETY PERCEPTIONS

General health concerns: Two-thirds of vendors did not report any major health concerns with respect to their own households. Chronic and infectious diseases like cancer, hypertension, malaria, or Covid-19 were infrequently reported. Symptoms potentially linked to foodborne disease were cited as health concerns by small proportions of respondents, including diarrhea (4% of vendors), stomach pain/ache (8%), cholera (3%), food poisoning (2%). These results indicate that 1) most vendors do not have major health-related concerns for their households, and 2) food safety-related health concerns are present but at low prevalence in the population.

Food safety knowledge and experiences: A majority of the survey respondents (80%) reported that they had at least one food safety-related concern for their household – a proportion that was statistically similar across both male and female vendors. Approximately half of the vendors reported food safety concerns related to acute gastrointestinal health outcomes (e.g., stomach problems, diarrhea). Some vendors reported concerns about acute or slow toxicosis (14% and 8%, respectively). Ten percent of vendors reported concern that the consumption of unsafe food may lead to death.

Only 11% and 7% of vendors reported that they or someone in their household had experienced a serious illness related to consuming unsafe food and water, respectively, in the past year. This finding affirms prior evidence that both consumers and vendors in this population are capable of understanding the causes of disease and possibly distinguishing among food- and water-borne causal factors.

Vendors cited specific signs or “cues” indicating whether food is safe or not, with the most frequently cited including visual or olfactory stimuli (Table 8). Textural cues were also cited (e.g., wilting, desiccation), which may reflect similar biological or physicochemical processes.

Table 8. Cues Vendors Use to Determine the Safety of Foods

CUE	MALE	FEMALE	TOTAL
VISUAL AND OLFACTORY			
Odor	175 (57%)	88 (51%)	263 (55%)
Blemishing	62 (20%)	31 (18%)	93 (19%)
Discoloration	105 (34%)	69 (40%)	174 (36%)
Filth	121 (39%)	73 (43%)	194 (41%)
TEXTURAL			
Wilting	33 (11%)	15 (9%)	48 (10%)
Desiccation	54 (18%)	32 (19%)	86 (18%)
Staleness	43 (14%)	19 (11%)	62 (13%)
Off Texture	53 (17%)	35 (20%)	88 (18%)
OTHER			
Damage to Packaging	15 (5%)	9 (5%)	24 (5%)
Other	3 (1%)	1 (1%)	4 (1%)
Don't Know/Not Sure	10 (3%)	7 (4%)	17 (4%)

Linkages between FBD and Key Commodities: 28% of vendors linked fresh vegetables to foodborne illness. For animal-sourced foods, 24% of vendors agreed that it is common to get sick from eating beef, while 19% reported the same for fish.

Vendors perceived grains and legumes as relatively low-risk commodities from the standpoint of foodborne illness. Only a small proportion of the vendor population believed that was common to get sick from eating maize or rice (6% and 13%). The perception of foodborne illness risk attributable to both rice and maize differed significantly across genders. Over half of male vendors (55%), compared to 44% of females, “strongly disagreed” with the statement that maize is associated with foodborne illness, while the trend was reversed for rice, with 20% of males vs. 33% of females).

While EatSafe previously identified cowpea as a food perceived as “high risk” in the target population from a food safety standpoint (13,14), in this assessment 64% of vendors either “disagreed” or “strongly disagreed” with the link between cowpea and foodborne illness. Although less than expected, vendors did perceive the link between cowpea and illness at higher rates than any other plant-sourced raw commodity. Soybeans, a commodity purchased and consumed relatively infrequently compared to the other foods, was not perceived by vendors to be particularly linked to foodborne illness, as 70% disagreed with the linkage.

Vendors also linked RTE foods with FBD. Awara, a tofu-like food made from soybean, was linked to illness by 25% of vendors. This finding was significantly different by gender, with more male vendors than females agreeing with the linkage. Similarly, 31% of vendors linked moi-moi, a cowpea-based food, to illness, with significant differences in responses between male than female vendors (30% vs. 17%). Relatively smaller proportions of vendors agreed with foodborne illness linkages between maize bula and rice masa (both 14%), perhaps reflecting the relatively low perceived risk associated with their constituent raw commodities.

Perspectives on food safety in the market: Nearly all vendors felt confident in their 1) ability to find suppliers that sell safe foods and 2) knowledge of how to choose foods that are safe from their suppliers, suggesting vendors have a high degree of perceived self-efficacy in sourcing foods that they consider to be safe. Similarly, 95% of vendors indicated that they were willing to spend both more time and money sourcing foods if they know that the products they purchase would be safer, suggesting that vendors are discerning about the quality of the food that they buy. These findings suggest that vendors recognize the value – including monetary – of “safe” foods.

A majority of vendors believed that some vendors 1) sell food that is safer than others (75%) and 2) care more about food safety than others (84%), confirming the expectation that vendors perceive a differential in the extent and effectiveness of food safety-promoting practices among their peers.

Vendors reported that they perform a number of cleaning operations at their shops in order to maintain good hygiene, including over half who report washing their hands and wiping or cleaning floors. Handwashing frequency, as reported, was significantly higher among male vendors than among female vendors ($p = 0.006$), with males washing their hands on average seven times per day compared to six for female vendors ($p = 0.02$). Approximately 20% of vendors reported cleaning their tools, utensils, and work surfaces with a cloth, collecting garbage, and cleaning food containers. It was not as common for vendors to clean their utensils with water/detergent (16%).

Vendors reported consciously taking actions to maintain the cleanliness of food. Over 60% of vendors reported covering food to keep it clean. Over one-quarter reported that they keep flies and insects away, and 15% indicated they wash produce in water.

Only 7% of vendors reported not doing anything to maintain the cleanliness of food. Among this subset of vendors who did not take any such actions (n=35), 74% sold grains and pulses – indicating that vendors of these commodities are less active in ensuring the cleanliness of their produce. This is consistent with prior knowledge that these commodities are perceived as low risk. Half of the surveyed vendors reported they had not procured any food safety-promoting tools or equipment for their shop in the past year. Among those who had procured at least one tool, plastic containers, leather sacks, tables, and knives were the most reported.

Vendors listed several actors as having responsibility for ensuring that foods sold in the market was safe to eat, including market management and vendors (each cited by approximately 65%), government actors and regulatory authorities (each approximately 40%), and food producers and suppliers (27%). By contrast, only 11% of vendors reported that consumers have some responsibility for ensuring that the food is safe. 12% of vendors reported that they (the vendor respondent) personally felt they play a role in ensuring food safety in the market. These results elucidate vendors' belief system around food safety accountability, with possible implications for design and messaging in the intervention programming.

4.10. SOURCES OF INFORMATION AND MEDIA USAGE

Sources of information: Vendors accessed a range of sources of information about food safety, including friends and family and medical professionals (each mentioned by approximately 40% of vendors), government agencies (24%), famous persons or local religious leaders (17%), and internet or social media and traditional media (each 8%). This finding has possible implications for the viability of proposed media interventions. In terms of which information sources are most *trusted*, irrespective of how frequently they are used, [medical professionals and friends/family](#) were the most commonly cited sources (by approximately 30% of vendors), followed by information from government agencies (18%).

Only 4% of vendors could name a specific food safety-related issue that they wanted to learn more about or that they had questions about.¹² This suggests that, at present, vendors' interest in food safety may general, or/and that they may lack the language to articulate key concerns.

[Ten percent of vendors could name an organization with local presence that works on issues relevant to food safety](#), including non-governmental organizations (e.g., Save the Children), government programs (e.g., Sanitation Committee, Community Health Workers, Environmental Health Workers), and government agencies (in particular, the Nigeria Agency for Food and Drug Administration and Control (NAFDAC). Two vendors cited EatSafe itself as being one such organization, and eight vendors cited Ipsos (the survey administrator).

Only 4% (n=17) of vendors reported that they had any personal involvement with an organization working on food safety-related topics. Among those vendors, three-quarters were males who sold grains and legumes. Nine vendors engaged with these organizations by attending meetings, while only one vendor reported being “actively involved in the works of the organization.” This suggests that the baseline level of [vendor involvement in organizations related to food safety is low](#).

Media channels and usage: [More than two-thirds of vendors reported that they “never” use the Internet](#), while one-quarter reported using it at least once per week. Half of the vendors who

¹² Topics included: linkages between certain commodities and illness (n=3 vendors), causes of certain diseases (n=2), nutritional properties of foods (n=2), curiosity about the World Health Organization; n=1).

access the Internet are online for less than half an hour per day, though 30% report using it for over two hours per day (30%). Nearly all vendors (97%) reported accessing the Internet on their mobile phones, with significant use of social media and web surfing platforms, such as WhatsApp (73% of vendors), Facebook (57%), and Google (35%).

The reliability of vendors’ Internet connectivity varied. Half of vendors reported that their Internet connectivity was “very reliable” for streaming audio or radio, although this was significantly higher among male vendors (p = 0.004). By contrast, only 31% of vendors indicated that their Internet connectivity was “very reliable” for streaming video.

The most prevalent source of information vendors reported was in-person “word-of-mouth” communication, which was cited by half of all respondents and was significantly more prevalent among females than males (65% vs. 43%; **Table 9**). Radio was cited by 44% of vendors, while 24% of vendors reported television news programs as information sources. Other sources of information were likely consumed for other purposes (e.g., entertainment).

Table 9. Information Sources Vendors Use, by Gender

SOURCES	MALE		FEMALE		TOTAL	
	N	%	N	%	N	%
In-person*	97	43 %	77	65 %	174	50 %
Radio	145	47 %	66	39 %	211	44 %
Tv news	83	27 %	33	19 %	116	24 %
Social media	30	13 %	5	4 %	35	10 %
Online	19	8 %	8	7 %	27	8 %
Messaging apps	16	7 %	3	3 %	19	6 %
TV film, series, soap opera	15	5 %	10	6 %	25	5 %
Newspapers	10	3 %	3	3 %	13	3 %

The sources of information with the highest proportions of “daily” users were radio (85% of radio-listening vendors), television news (72%), and online (67%) (**Table 10**). About half of newspaper-readers read the newspaper daily. Vendors also reported using media platforms for entertainment purposes, as one-third of vendors each reported viewing television (films, serials, soaps, etc.) and listening to radio serials.

Table 10. Vendors Sources of Information, by Gender

SOURCE	FREQUENCY	MALE	FEMALE	TOTAL
NEWSPAPER	Daily	60 %	0 %	46 %
	2-3 times/wk	10 %	33 %	15 %
	Weekly	0 %	33 %	8 %
	2-3 times/mo	20 %	0 %	15 %
	Monthly	10 %	33 %	15 %
	<i>Total n</i>		<i>n = 10</i>	<i>n = 3</i>
TV NEWS	Daily	71 %	73 %	72 %
	2-3 times/wk	25 %	15 %	22 %
	Weekly	2 %	9 %	4 %
	2-3 times/mo	1 %	3 %	3 %
	<i>Total n</i>	<i>n = 83</i>	<i>n = 33</i>	<i>n = 116</i>
RADIO	Daily	88 %	79 %	85 %
	2-3 times/wk	7 %	20 %	11 %
	Weekly	6 %	2 %	4 %
	Monthly	0.7 %	0 %	0.5 %
	<i>Total n</i>	<i>n = 145</i>	<i>n = 66</i>	<i>n = 211</i>
ONLINE	Daily	58 %	88 %	67 %
	2-3 times/wk	21 %	0 %	15 %
	Weekly	16 %	13 %	15 %
	2-3 times/mo	5 %	0 %	4 %
	<i>Total n</i>	<i>n = 19</i>	<i>n = 8</i>	<i>n = 27</i>
IN PERSON	Daily	47 %	44 %	46 %
	2-3 times/wk	23 %	30 %	26 %
	Weekly	10 %	12 %	11 %
	2-3 times/mo	16 %	12 %	14 %
	Monthly	4 %	3 %	3 %
	<i>Total n</i>	<i>n = 97</i>	<i>n = 77</i>	<i>n = 174</i>

5. CONSUMER-VENDOR COMPARISONS

5.1. ATTITUDES AND BELIEFS

In general, beliefs and preferences about food, hygiene, and vending practices were consistent across consumers and vendors in the selected markets (**Figure 24**). Though both groups believed vendor hygiene and visible maintenance of shops were important, 10% of consumers rated these characteristics as low importance. Interestingly, >75% of vendors believed it is important that consumers express the concerns or questions they have about food, higher than the 61% of consumers who considered such expression important.

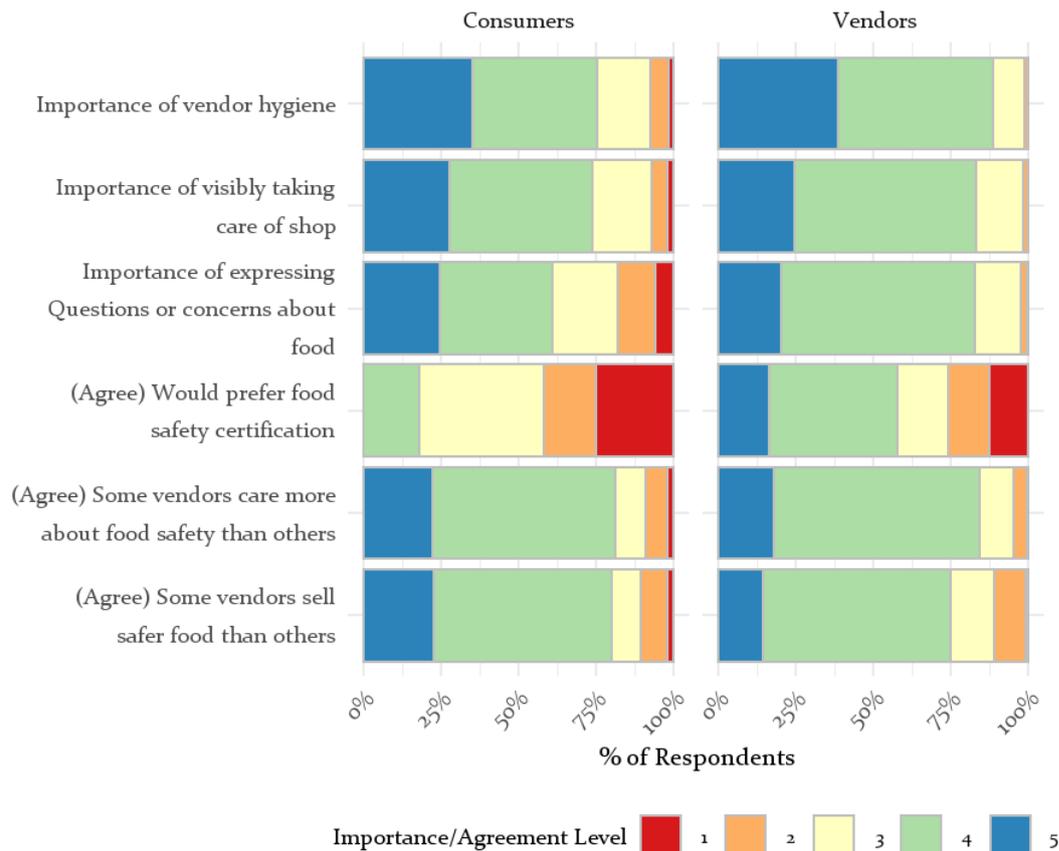


Figure 24. Comparison of Vendors and Consumers Food Safety Beliefs

While consumers mainly disagreed or felt neutrally when asked about whether they would prefer to purchase from vendors with food safety certification, 58% of vendors reported they would prefer to have visible food safety certification at their shops. This contrast suggests that, at present, vendors value visible certification more than consumers – an understandable and promising finding given the lack of current certification schemes in the selected markets.

Vendors and consumers acknowledged the substantial heterogeneity among vendors in the safety of the food they sell. Less than a quarter of respondents in both populations did not believe that there is variability in food safety across vendors. Similarly, over 75% of respondents in both populations acknowledged that some vendors care more about food safety for others, implying potential for progress in attitude change. Taken together, these results indicate that both consumers and vendors believe there is room for improvement in the safety of foods available in the market. Further, both populations can identify gaps in good food safety practices that may be filled.

5.2. FOOD SAFETY PERCEPTIONS

All seven of EatSafe's Key Commodities were perceived as being linked to foodborne diseases by substantial proportions of consumer and vendor respondents, affirming that the commodities selected are tractable targets for improving food safety. Across commodities, consumers more often reported foods to be linked to foodborne illnesses than vendors did. For example, while over half of consumers reported that cowpea was commonly linked to illness, this linkage was only cited by less than a quarter of vendors. While it is plausible that vendors may be more hesitant to disclose negative aspects related to foods they sell, this difference could also reflect a greater understanding of or confidence in proper food handling practices among vendors than consumers.

Trends emerged in the relative risk associated with EatSafe's Key Commodities that were consistent across the consumer and vendor populations, namely:

- Raw (i.e., non-RTE) grain and legume products are generally regarded as safe;
- RTE products are perceived as relatively unsafe, compared to raw/fresh goods or foods prepared at home; and
- Vegetables, fish, and beef are thought to have moderate or high levels of risk.

Regarding safety, both populations expressed high levels of confidence or perceived self-efficacy in identifying foods and food sources (vendors, suppliers, etc.) that are sufficiently safe. There is evidence that consumers and vendors are discerning of food safety characteristics, and that safety is an attribute of food that they have knowledge about and value to a certain extent.

Importantly, consumers demonstrated a nuanced understanding of the linkages between foods and health outcomes, even tying those outcomes to specific underlying hazards or causal agents. While these results indicate a promising level of knowledge and attention to food safety, they also point to some key gaps in food safety-promoting behaviors in the market. Both vendors and consumers can improve the effectiveness of communication about food safety and other quality attributes, which may further empower consumers to obtain safe foods. Moreover, there is little evidence that food safety is considered a "marketable" or profit-generating attribute of food by either vendors or consumers—suggesting a low baseline level of expressed demand and, consequently, much potential for behavior change.

6. VENDOR OBSERVATION FINDINGS

A total of 50 vendors were observed, of which 70% (n=35) were male and 30% (n=15) were female. The average vendor age was 36 years, with female vendors slightly older than males (i.e., 39 and 35 years, respectively). All vendors were able to complete the observation period uninterrupted on the first attempt. One-third of observed vendors sold two of EatSafe's Key Commodities (i.e., maize and cowpea) (**Table 11**). RTE foods were rarely present (6%) in the observed vendors' shops.¹³

Table 11. EatSafe's Key Commodities in Nigeria Sold by Observed Vendors

EATSAFE KEY COMMODITY	% OF VENDORS SELLING COMMODITY
Beef	30%
Aquaculture fish	30%
Fresh vegetables	20%
Soybeans	10%
Rice	10%
Cowpeas	8%
Maize	6%

The observed vendor was the sole operator in 38% of shops. The majority of shops had at least one other staff member present during the observation period, with 34% and 26% of shops having one and two staff, respectively. Though female vendors' shops had fewer staff compared to male vendors' shops, the difference was not statistically significant. Similarly, no significant differences were detected in the number of staff present across commodity categories (p=0.22). A small number of shops (8%) sold non-edible products in addition to food, while the majority of vendors sold only food items. While vegetable (11%) and grain and pulses vendors (9%) were slightly more likely to sell non-food items, the prevalence of non-edible products sold by the observed vendors was relatively consistent. Beef and fish vendors were least likely to sell non-food items (7% for both).

6.1. SHOP INFRASTRUCTURE

The structure and configuration of vendors' shops is relevant to food safety, as it influences the likelihood of spoilage or cross-contamination events that can compromise the safety of products. The majority (~70%) of observed vendors' shops had roofs and were in fixed locations, with the most common shop composition being masonry (44%) or wooden (24%) structures (**Figure 25**). One-sixth of vendors used uncovered but non-mobile structures (e.g., tables or uncovered stalls), with remaining vendors operating mobile or semi-mobile shops without fixed structures (e.g., carts, baskets, containers, or tarpaulin mats). While masonry structures were the most prevalent shop structure among vendors of beef, fish, and vegetables (constituting approximately half of vendors in each category), vendors of grains and pulses most often operated their shops out of wooden structures (55% of shops) rather than masonry structures (18%). A minority of vendors across commodity categories used tables or stalls without roofs (9-22%) and mobile or semi-mobile structures (carts, baskets, or containers). Least common, tarpaulin mats were occasionally used by fish vendors (7%).

¹³ This is expected given that vendors were enrolled based on the sale of fresh commodities, while primarily selling RTE foods was an exclusion criterion.

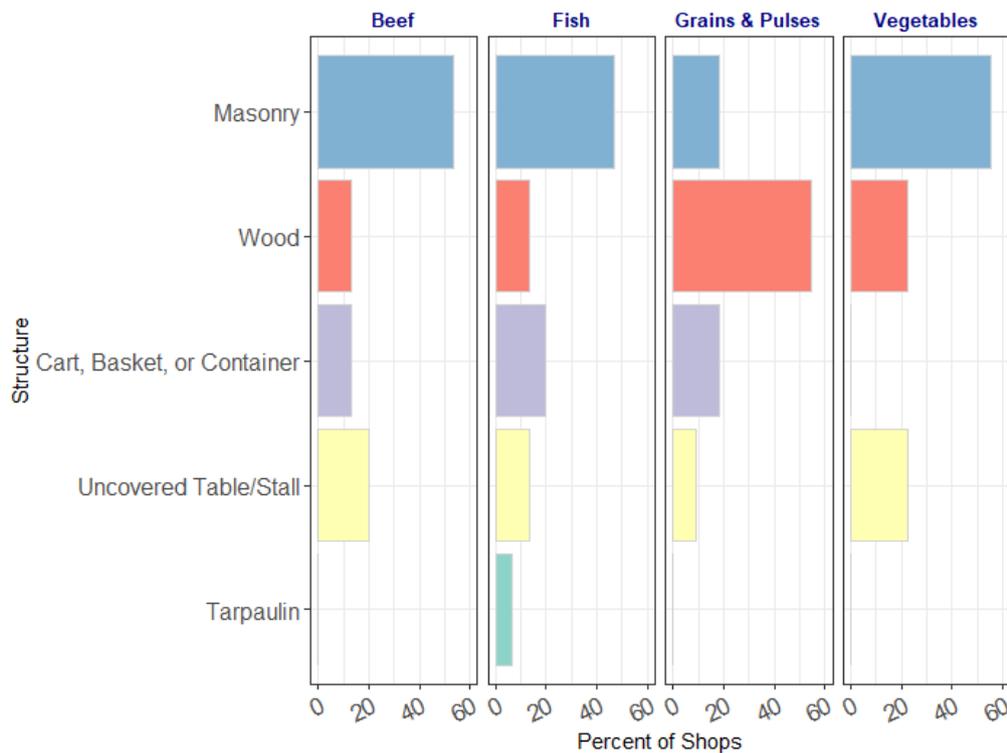


Figure 25. Shop Structures of Observed Vendors, by Commodity

Food storage practices are critical for preventing food spoilage and contamination, including by dirt, foodborne pathogens or chemical toxins. Most shops (86%) had elevated surfaces (e.g., counters, carts, or tables), including 100% of grains/pulses and vegetable vendors' shops, 73% of fish and 80% of beef vendors' shops. Accordingly, 74% of shops had all of their food products elevated off the ground, while 14% and 12% had some or no available products elevated off the ground, respectively. Vendors who sold grains and pulses (55%) and fish (67%) less frequently elevated their products off the ground, compared to vendors of vegetables (89%) and beef (87%).

Among vendors observed, 56% had wooden counters or tables, most commonly among vegetable vendors (78%) and grains/pulses vendors (64%), while beef and fish vendors utilized wooden countertops comparatively less often (40% and 53%, respectively). One-third of vendors used concrete slabs or countertops, though beef vendors (60%) used those more frequently than vendors in the other commodity categories.

Wooden cutting boards were present in 22% of shops and were less common in fish and beef vendors' shops (13% for both) than in vegetable and grains/pulses vendors' shops (33% and 36%, respectively). A small number of observed vendors (6%; N=3) had no working surface present at their shops, one of whom sold grains and pulses and the other two sold fish. Countertop coverings or tablecloths were rarely observed (2%).

Keeping food covered can protect it against contamination, and also serves to extend shelf life and preserve quality for many commodities. While it is relatively uncommon in traditional market settings to cover food, doing so can be an effective way to limit contamination and mitigate risk of foodborne illness. [The majority of vendors \(88%\) had their food products exposed without coverings.](#) When food coverings were present, they were primarily plastic (6%, n=3)- or paper (2%, n=1).

Most vendors (82%) had no means for keeping their products cool or refrigerated. Spraying with water and keeping food in the shade were utilized by 6% of vendors to keep food cool. Only 2% of observed vendors kept perishables on ice. Refrigeration was not observed in any of the vendors' shops.

6.2. VENDOR-CUSTOMER TRANSACTIONS

The average observed shop conducted 6 (± 4 , ranging from 0 to 26) transactions with customers during the observation period, with no statistically significant variation across commodity categories (**Figure 26**). Most shops conducted between 2 and 10 transactions per hour; only one vendor (beef) conducted over 20 transactions during the observation period. Two vendors, both selling grains and legumes, did not complete any transactions.

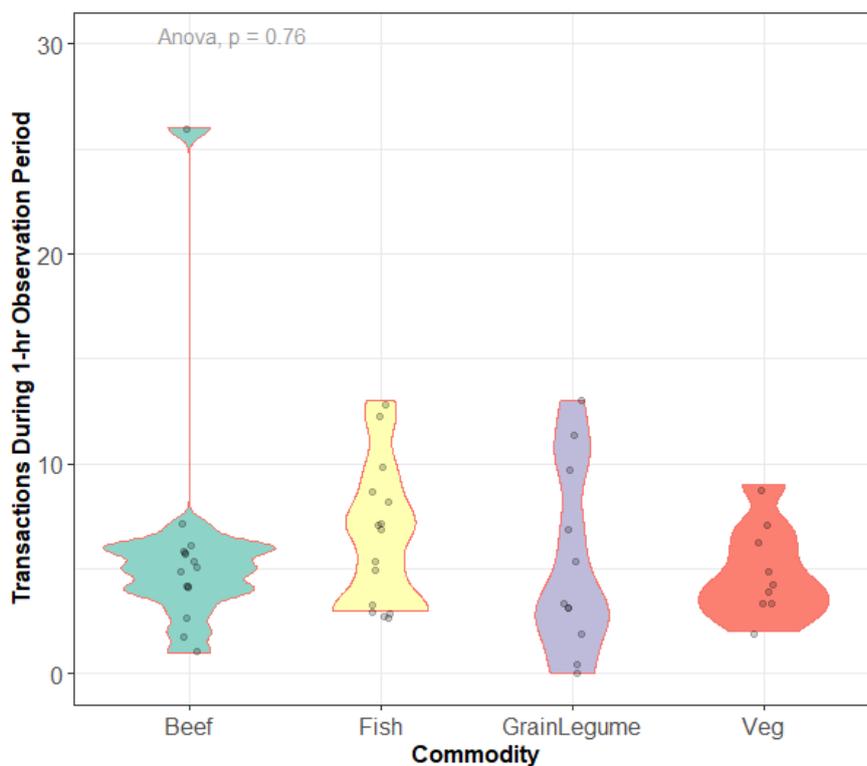


Figure 26. Transactions Completed by Observed Vendors, by Commodity Type

6.3. SHOP HYGIENE

Environmental hygiene practices are important to minimize the risk of contamination. Direct vendor observations found several vendor practices that could be improved, as well as promising evidence of vendor's efforts to maintain hygienic conditions.

Only 40% of vendors wiped surfaces with dry cloths, towels, or sponges. The use of water or cleaning solution to wipe surfaces was observed in only 20% of shops.¹⁴ When vendors used dry cloths, towels, or sponges to wipe surfaces, wiping occurred approximately once during the

¹⁴ Utilization of cloths soaked with water or/and cleaning solution was not observed in any shops that sold grains. This is likely advantageous for food safety, as excess moisture can create conditions conducive to mold or bacterial growth in stored grains. In all other commodity groups, dry and wet towels were used at comparable frequencies (20%-50% of vendors' shops).

observation period, though some vendors wiped up to five times. Similar trends were observed in the use of water or cleaning solution to wipe surfaces: the total number of wiping events was less than one on average, with a maximum of three wiping events in the observation period. Some vendors (14%) used the same towel to wipe multiple – a behavior that was more common among beef vendors (20%) than vendors of other commodities.

Vendors wiped surfaces and objects at varying frequencies by observed vendors (**Table 12**), with countertops (44%), cutting boards (26%), and floors (10%) wiped at varying levels. Knives were the most commonly wiped tool (46% of vendors), while other objects in the shop (e.g., cutlery, containers, etc.) were wiped by fewer than 10% of vendors. Interestingly, a small percent (6%) of vendors used a cloth to wipe food products. While this practice could in some cases remove soil or dust from food, it also increases the risk of cross-contamination. Although use of a previously unused “clean” cloth to clean different surfaces and tools is best practice to avoid cross-contamination, **vendors frequently reused cloths for wiping different surfaces**, tools, and food; for example, half of vendors were observed wiping their knives and countertops, and of those only about 15% used a clean, unused cloth to perform these actions. Across all wiped surfaces and objects, clean cloths were used for 29% of observed wiping events. Differences between commodity groups and the number of total times vendors wiped surfaces or objects were not significant.

Table 12. Prevalence and Frequency of Wiping Surfaces and Objects with a Cloth

SURFACE/OBJECT	PREVALENCE	# OF WIPING EVENTS PER HOUR	
		MEAN (\pm SD)	MIN, MAX
SURFACES			
Countertop surfaces	44%	0.96 \pm 1.3	0, 4
Cutting boards	26%	0.58 \pm 1	0, 3
Floors	10%	0.12 \pm 0.4	0, 2
OBJECTS			
Knives	46%	1.14 \pm 1.6	0, 7
Spoons or forks	2%	0.04 \pm 0.3	0, 2
Food containers	6%	0.16 \pm 0.8	0, 5
The food itself	6%	0.12 \pm 0.5	0, 2

Only 4% of shops were observed to have dogs in close proximity to the shop (i.e., within one meter), all of whom were meat vendors – suggesting that meat commodities are more likely to attract animals that can spread foodborne pathogens or serve as vectors of zoonotic diseases. Only one dog lingered within two meters of a single vendor’s shop for more than 15 contiguous minutes, suggesting that it is rare for vendors to allow animals near their shops for extended periods of time. In no case was a domesticated animal observed making direct contact with vendors’ food products.

6.4. FOOD WASTE AND CONTACT PRACTICES

Waste management by vendors and market management is important to prevent the growth of microbes and pests that can contaminate foods. Rubbish is collected daily at Market #1 at four locations within the market, while Market #3 has infrequent (quarterly) waste collection services and Market #3 has none. **The most common method of food waste management observed by vendors was to toss scraps on the floor** (54% of vendors). Fewer vendors used waste

receptacles at their shops, such as bags (42%) or bins (6%), and no vegetable or fish vendors used designated waste bins to remove waste in their shops.

While the majority (88%) of observed vendors' shops did not have high-risk foods (e.g., fish, meat) in contact with lower-risk foods (e.g., grains, legumes, and fresh vegetables), contact was observed in 12% of shops.

6.5. FOOD HANDLING PRACTICES

Proper food handling practices are instrumental to vendors' management of food safety risks in their shops. Handling, which comprises contact with, placement, packaging, cleaning, and arrangement of products, among other actions, encompasses numerous critical control points for preventing cross-contamination and minimizing the risk of transmitting disease-causing pathogens. Ninety percent of vendors most commonly handled food products with bare hands during transactions with customers, as opposed to with gloved hands or with tools (both 0%). Bare-hand contact was exhibited 4.8 (maximum 15) times by vendors on average during the observation period, corresponding to the total number of transactions conducted. Food products were rarely washed by the observed vendors before giving them to a customer.

The use of gloves and tools by vendors and their customers to handle food was relatively rare and exhibited commodity-specific trends:

- Gloves for handling food during transactions were not observed in any shop, though 2% of vendors (all grains and legumes vendors) used gloves when preparing or arranging foods.
- None of the vendors were observed using tools (e.g., tongs, spoons, ladles, etc.) to prepare or arrange food except for during transactions with customers.
- Tools to pick up food without directly touching it were available for vendors' use in 20% of shops and for customers' use in 14% of shops. These tools were least prevalent in grains/pulses shops, with only 9% having tools available for vendors' use and none having tools available for customers' use.
- Among other commodity categories, tools were available for vendors' and customers' use in approximately 30% of vegetable and beef shops, with a significantly lower proportion in fish shops (13% for vendors and 7% for customers).
- Meat and fish vendors often used the same tool(s) to handle both raw and cooked meat or fish without first washing or sanitizing the tool, at an average of 2 (± 4) times during the observation period among vendor who exhibited this behavior.

Most vendors packaged their food products before giving them to a customer. The most prevalent packaging method was plastic/nylon bags, which were used by more than 70% of vendors in all commodity categories except fish (53%). Paper bags/wrappings were used by 20% of vendors, ranging from 0% of grains/pulses to 33% of beef vendors. Butcher paper was another commonly used packaging material (8%), ranging from 0% of fish to 13% of beef vendors. Twice customers provided their own packaging, while only one vendor (beef) completed transactions without providing any packaging to the customer.

6.6. VENDOR HYGIENE AND HEALTH

The health and hygiene of vendors is an important determinant of the risk of foodborne or infectious diseases in the marketplace, as pathogens can spread from ill or unhygienic food

handlers to the food. Proper grooming and attire can also reduce contamination. Nearly two-thirds of observed vendors (66%) did not wear clothing conducive to safe food handling in their shops. Aprons, face masks (likely corresponding to the ongoing COVID-19 pandemic), and hair coverings were worn by 32%, 4%, and 2% of observed vendors, respectively. Most observed vendors (66%) had short, clean fingernails, while 34% of vendors did not. Having short, clean fingernails was much more common among vendors of beef (80%) and vegetables (89%) than among vendors of grains/pulses (46%) and fish (53%). Most vendors (96%) did not have any exposed cuts or wounds.¹⁵

Behaviors such as eating, smoking, or spitting, if conducted at a vendor's shop, can transmit disease-causing pathogens or contaminants to customers and compromise the safety of food. Key findings pertaining to these behaviors included:

- Only one vendor was observed smoking cigarettes while stationed at the shop;
- Half (50%) of vendors were observed eating food at the shop, and among those vendors (N=25) this behavior was observed 1.6 (± 0.6) times on average
- Around two-thirds (68%) of vendors performed personal hygiene other than hand-washing (e.g., washing face, brushing teeth, shaving) while stationed at their shops. On average, these behaviors were observed 1.4 (± 0.5) times, respectively, during the observation period;
- 64% of vendors were observed spitting. Vendors who were observed spitting (N=32) spat 2.1 (± 2.2) times on average during the observation period; and
- Differences in these behaviors across commodities were not significant.

Less than half of the observed vendors washed their hands during the observation period, likely corresponding to limited availability of hand-washing facilities in/near vendors' shops. The most common hand-washing method (38% of vendors) was washing with water only (i.e., no soap or sanitizer), at an average of 2.9 (± 3.2 ; minimum 1 and maximum 15) times during the observation period. Only one vendor (beef) washed their hands with water and soap, who completed this action 12 times during the observation period. Some vendors (12%) cleaned their hands by wiping with a towel or cloth, at an average of 2.3 (± 1.8) times. One vendor (vegetable) used hand sanitizer twice during the observation period. The differences in these behaviors were not significant across commodity groups, nor by gender of the vendor ($p=0.47$).

Observers periodically assessed hand and countertop cleanliness at ten-minute intervals, scoring vendors on a 1-5 scale. Average values for both cleanliness scores were high, with mean scores of 3.4 (± 0.6) and 3.7 (± 0.8) for countertop and hand cleanliness, respectively, across vendors. Despite generally high scores for both indicators, hand cleanliness scores were significantly higher than vendors' countertop cleanliness scores ($p=0.02$). Commodity-wise comparisons showed significant differences in both countertop and hand cleanliness ($p=0.03$ and $p=0.04$, respectively) across commodity categories (**Figure 27**). Beef vendors had significantly lower mean cleanliness scores compared to the grand mean (across all commodities) for both indicators, while scores were significantly above average for vegetable and grains and pulses vendors. Fish vendors' countertop and hand cleanliness scores were not significantly different from the grand mean, signifying average levels of cleanliness among these vendors.

¹⁵ Two vendors, one each for grains and vegetables had a visible wound that was not appropriately covered or bandaged.

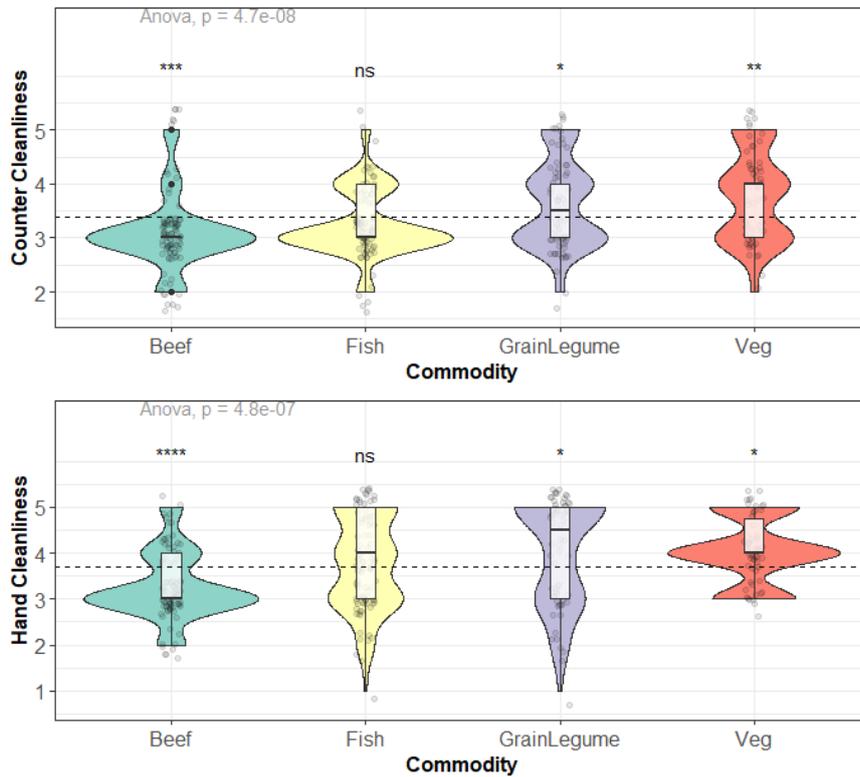


Figure 27. Average Hand- and Countertop-Cleanliness Scores, by commodity¹⁶

A significant positive correlation (0.67; $p < 0.0001$) was identified between hand and countertop cleanliness across vendors (Figure 28), indicating that personal hygiene behaviors may be linked to shop hygiene behaviors (“clean vendors clean their shop”).



Figure 28. Positive Relationship Between Vendors’ Hand- and Countertop-Cleanliness

¹⁶ Cleanliness was scored on a 1-5 visual scale from “Not at all clean” to “completely clean.” Significance tests for each group represent comparisons to the grand mean (hashed line)

Vendors appeared to be in good health during the observation period, as 78% of vendors did not exhibit visible symptoms of infectious disease, though 18% and 20% were observed sneezing and coughing. Among the vendors who coughed or sneezed during the observation period (N=14), 21% walked away from their shop (>2 meters) to cough or sneeze. The differences in these behaviors were not significant across commodities.

6.7. VENDOR-CONSUMER INTERACTIONS

Customers often engaged with the food directly, as opposed to relying on the vendor exclusively to select the food items for them. Engaging with the food took a range of forms. It was very common for customers to look at or point to food without touching it, nearly twice as common as touching food directly with bare hands (66% vs. 36% of shops). In contrast, it was relatively less common for a customer to use gloves or tools to handle foods directly, though this was still observed in a slim majority of shops (8%). There was little variation across commodity categories in the relative frequencies of these behaviors, with the exception of the use of tools/gloves, which was only observed in three beef shops and one vegetable shop.

When conducting transactions with customers, vendors often handled money (i.e., physical notes or coins) and food simultaneously. Money can harbor pathogens and other contaminants, so handling food and money simultaneously is a risk factor for transmission of disease. In the majority of cases (88% of vendors), money was handled with the same bare hands as the food products being sold. On average, bare hands were used to handle money in >99% of transactions. Though some vendors (16%) used separate hands to handle money and food products; this occurred during only 5% of observed transactions. In 6% of shops, all beef and fish, a second person (i.e., who hasn't touched the food) handled the money. Mobile money (contactless) platforms and gloves were never observed during transactions with customers.

Conversations on topics such as safety, healthfulness, cleanliness, and freshness of foods, were heard in 42% of shops (Table 13). Conversations initiated by customers were observed in 42% of shops, while conversations initiated by vendors were observed in 38% of shops. In all shops wherein vendors had initiated conversation, consumer-initiated conversations were also observed. The total numbers of customer- or vendor-initiated conversations about food safety-related topics were not significantly different by either commodity category or vendor gender.

Table 13. Food Safety-Related Topics Discussed in Vendor-Consumer Interactions

TOPIC	% OF SHOPS DISCUSSED IN	
	V INITIATE	C INITIATE
Safety or healthiness of food (combined)	28 %	26 %
Freshness of food	24 %	26 %
Cleanliness of food	14 %	14 %
Food was just prepared	4 %	4 %
Absence of contaminants or toxins (non-pesticides)	2 %	4 %
Absence of pesticides	0 %	0 %
Total (any topic)	38 %	42 %

Percentages indicate the percent of shops in which discussion about the topic was initiated by vendors or consumers, respectively. The same shop may be counted in multiple rows if conversations on different topics took place there.

Safety/healthiness and freshness were the topics of conversation most often discussed, being the subject of conversation at 24-28% of total shops. Safety or healthiness of the food

was a topic more commonly initiated by fish vendors (40% of all fish vendors) than by vendors of other commodities (18-27% across commodities), while food freshness was consistently initiated by vendors of all commodity categories (20-27%). Consumers most frequently initiated conversations about the safety or healthiness of food with fish vendors (33%), while consumers at grains/pulses shop were least likely to initiate conversation about the safety and healthiness of the food (18%). Consumers initiated conversation about this topic in 22% and 27% of vegetable and beef vendors' shops, respectively.

Food cleanliness was also a frequent topic of discussion, initiated at equal frequencies by consumers and vendors (14% of all shops). Vegetable vendors most frequently initiated conversations about the cleanliness of food (33%). As consumers initiated these conversations most often and at equal prevalence for beef and vegetable shops (~20%), this could signify that beef vendors are not aware of consumers' cleanliness concerns or that they may be less inclined to discuss without prompting by consumers. Fewer vendors and consumers initiated conversations about specific food safety-related topics (e.g., toxin contamination and time since preparation).¹⁷

6.8. POSITIVE RESULTS FROM CORRELATION ANALYSIS

Several significant relationships were found to exist between variables (**Figure 29**).¹⁸ The number of waste disposal events was significantly correlated with the number of times a previously unused "clean" cloth was used. This result suggests that **vendors who more actively maintain the cleanliness of their shop are also more active in waste management.**

¹⁷ Toxin conversations were initiated by vendors in one vegetable shop, but by consumers in two fish shops. Time since preparation conversations were initiated by both groups in two shops (fish and grains).

¹⁸ Variable descriptions are summarized in Table A1. Numbers shown are Pearson correlation coefficients. Ellipse shape corresponds to the direction (angle) and magnitude (roundness) of the correlation. Higher positive correlations are shaded in deepening blues, while higher negative correlations are shaded in deepening reds. Blank cells indicate correlations that were significant. Variables that were dependent on or linked to transactions were normalized by the number of total transactions conducted at the shop during the observation period.

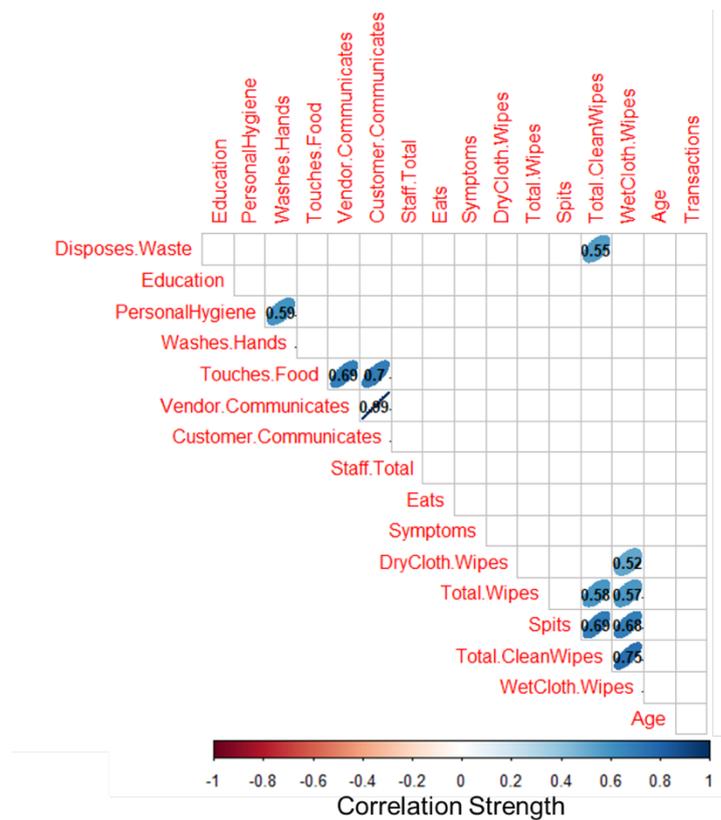


Figure 29. Correlogram of Relationships Between Behaviors Exhibited by Vendors

The number of times wet cloths were used to wipe surfaces was positively correlated with i) the number of times dry cloths were used; ii) the number of times previously-unused “clean” cloths were used; and iii) the total number of wipes conducted. The number of times “clean” cloths were used was also associated with the other wiping actions, except the number of times dry cloths were used. The prevalence of correlations among these actions suggests that **wiping behaviors are mutually reinforcing**.

The number of times wet cloths and “clean” cloths were used for wiping were positively associated with the number of times a vendor was observed spitting while working. The number of times vendors washed their hands was correlated with other types of personal hygiene (e.g., brushing teeth, washing face, etc.). While interpretation is not straightforward, and spurious correlations do happen, it is possible that vendors who spit frequently or conduct other potentially-risky personal hygiene activities understand the risks associated with their behavior and, to compensate, take additional cleaning measures to minimize risk.

The strongest correlation observed in the analysis was between the number of times vendors and consumers initiated conversations about a food safety-related topic, respectively. This relationship affirms existing evidence from the FES (13,14) which indicated that **verbal communication about food safety-related topics (including freshness, healthiness, and cleanliness) is prevalent in the marketplace environment**. It should be noted that, in the FES, consumers associated freshness and related attributes more readily with food *quality*, not necessarily to safety *per se*. Conversations about food safety-related topics, when they occur, tend to be multi-lateral interactions that involve both customers and vendors. These variables were also strongly associated with the number of times vendors touched their food to arrange or prepare them – indicating a relationship between vendors’ proactivity or attention to detail and the extent to which they engage with their customers about food safety-related issues.

6. CONCLUSIONS

By including results from extensive cross-sectional surveys with consumers and vendors along with direct observations of vendors' practices, this assessment provides a rich understanding of food safety in traditional food markets in Kebbi State, Nigeria. Insights and recommendations from the **consumer survey** include:

- Both males and females shop in the markets, and spouses share food purchasing decisions in the household. Hence, consumer-facing interventions should consider both females and males.
- Overall, responses to the survey were similar across genders.
- While religious values were not investigated in the survey, findings of the survey analysis support the hypothesis that similar interventions may be effective across religious groups.
- A range of SES was observed in the group, with the average PPI score being relatively high, indicating that most consumers in the markets had adequate household resources. Price of food was the most cited factor driving food purchasing choices, for both groups. It may be prudent to assume that consumers may not be able or willing to pay a significant premium for safer food.
- Consumers usually shop at one market, and do not compare across markets. Proximity is ranked among the highest reasons to shop at a market, together with food prices and food quality. Also, cleanliness is not an important reason to choose a market, for most.
- Market selection is based primarily on price, quality, and variety. Appearance and cleanliness of shops were mentioned by a quarter of consumers.
- Patterns of shop/vendor choices seem complex. Some consumers (27%) often or always compare shops before deciding where to buy, but most do so only sometimes or less often. "Regular customer" relationships with vendors are relatively common, reported by 25% of consumers. In contrast, vendors reported that 45% of their customers, on average, are regulars.
- Consumers rarely stop buying from a specific vendor completely due to grievances with them: interventions nudging consumers toward a positive feature may be more effective than those "driving away" from negative features of a shop/vendor, unless perceived as extreme.
- Interventions should leverage cues consumers already use to decide if food is safe; prevalent ones include smell/odor; visual signs such as blemishes, desiccation, or color; and texture. These are consistent with cues used by vendors.
- Consumers already express demand for safe food, in the form of conversations with vendors or complaints, as highlighted by both the survey and the observations; this channel of communication could be leveraged and improved.
- Medical professionals are the most trusted source of health and food safety information. Messages from this category are likely to carry weight. However, other influential figures, even if not directly associated with health, could impact consumer behaviors. Vendor observations highlight current practices, across commodities, as a starting point to devise context-specific, actionable, and reasonable goals for improvement in the context of EatSafe interventions.

Insights related to the **vendor survey** include:

- Vendors surveyed are primarily Hausa (92%), and male (64%). In terms of SES, vendors had a slightly higher probability of poverty (mean of 20%, based on a \$3.10/day threshold) than consumers (mean of 16%). Notably, female vendors had a ~10% higher probability of poverty than male vendors.

Gender

- Female vendors constitute the minority of vendors across commodities, with no or very few female vendors of beef and fish, a substantial minority of vegetable vendors, and more representation among grain and legume vendors. Most (84%) of the surveyed female vendors sell grains or legumes.
- Most vendors (80%), both male and female, agree that female customers make more requests than males about the food they want to purchase, consistently with other findings.
- The majority (63%) of vendors are more comfortable talking to customers of their own gender. This result affirms prior EatSafe research and suggests that gender mediates social norms in the market environment.
- Most vendors communicate with market management, although at low or moderate frequency, with female vendors having less communications.

Vendor attitudes and practices, including on food safety

- Vendors of both genders place a strong value on collaboration among vendors, and have trust in each other's support when needed, while making independent business decisions.
- Vendors have a sense of pride related to the quality of the food they sell. They also see themselves as leaders and role model for other vendors.
- In terms of food safety knowledge and attitudes, while only a few vendors reported health concerns related to FBD when asked in general terms, when asked more specifically about concerns related to food safety, half reported concerns over acute gastrointestinal illness. 11% reported that they or someone in their household experienced a serious illness related to consuming unsafe food in the past year (compared to 17% for consumers).
- Vendors, as consumers, use cues to determine the safety of foods, most commonly involving characteristics that can be seen or smelled.
- Vendors reported intentionally taking actions to maintain the cleanliness of food and report several relevant practices such as cleaning tools, utensils, and work surfaces with a cloth, collecting waste, and cleaning food containers (20%).
- Nearly all vendors felt confident in their ability to find suppliers that sell safe foods and in their knowledge of how to choose foods that are safe from their suppliers. Vendors seem to rely on a small set of trusted suppliers, rather than frequently comparing across suppliers. Dialogue with suppliers on food quality is also uncommon, possibly due to longstanding trust relationships, although feedback to suppliers by way of complaints or returning product was reported by about a quarter of vendors.

Shop operations and market management

- Shops operate continuously, and mostly do not change commodities sold through the year.

- Most vendors (84%) set rules for their shop, including related to quality and safety of the food and cleanliness of the shop environment.
- No shop has refrigeration, and only a small minority of vendors keep perishable foods on ice. Reconnaissance visits also found no evidence of central refrigeration facilities in any of the three markets.
- Vendors are generally satisfied with the market management, whom they see as provider of useful services as well as an authority able to uphold market regulations.
- Most common topics of vendor conversation with market management include food prices, food handling practices, as well as hygiene-related rules and practices.
- Most vendors (75%) believe it is the market management's responsibility to ensure the safety of foods sold at the market. While 64% agree that vendors have food safety responsibility, although only 12% mentioned themselves as having primary responsibility.

Consumer choice and communications

- Vendors believe that the primary factor that would lead a consumer to buy again from them is price. Food quality and vendor's friendliness/kindness were mentioned by a sizeable minority, while only a minority (7%) cited cleanliness.
- Dialogue between consumers and vendors on topics relevant to food safety occurs for most vendors, although not frequently; 9% of vendors report such conversations never occur. When customers bring complaints, the most common reasons are price (67%), shelf life (26%), and taste (21%).
- Vendors generally care about and respond positively to customer questions or even complaints about food characteristics, agreeing that customer feedback is useful to know and pushes them to improve their business. 82% report taking time to answer customers' questions about food. However, there is also evidence that criticism can exert an emotional toll on vendors, with half reporting that they get upset if a customer complains about the food they bought.

Information sources

- Radio is a commonly used information channel (44% of vendors), more so than for consumers, and one third of vendors reported listening to radio serials. Television and internet were also mentioned as sources of information (although only one third reported using the internet), while only a few mentioned printed news.
- Sources of information on food safety that vendor report accessing include friend and family (40%) and medical professionals (40%) – these two being the most trusted – followed by government agencies (24%), famous person or local religious leader (17%), while internet and social media (8%) and media outlets (7) were less common.
- Only a minority (10%) could name a local organization working on issues relevant to food safety, highlighting a gap in perceived resources.

Box 1. Insights to Inform Intervention Design and Future Studies under EatSafe

EatSafe aims to generate evidence and knowledge to improve the safety of nutritious foods in traditional markets by increasing consumer demand for safe food. Central to EatSafe's work is understanding (and potentially shaping) the motivations, attitudes, beliefs, and practices of consumers and vendors. EatSafe should consider the following findings during intervention design.

Consumer survey:

- Both females and males purchase food at the market for their households.
- Consumers surveyed are predominantly Hausa (80%), with minority representation from more than 8 other ethnic groups. The main religions represented in the group are Muslim and Christian (79% and 21%). Consumers are well educated, and above the extreme poverty line.
- Most consumer households (65%) have refrigerators; all have at least one type of cooking stove; nearly all have toilets or latrines in or near the house.
- Consumers do not seem to routinely compare markets: they usually shop at only one or two markets and are longstanding customers. Prices, proximity of the market to home, quality of the food, and food variety are the top factors driving consumers' choice of market.
- Demand for increased market cleanliness may be low: most consumers perceive the selected market as adequately or very clean.
- Comparing across shops is not very prevalent: only about one fourth of consumers "often" or "always" compare shops before deciding where to buy food. On average, consumers have a "regular customer" relationship with approximately one-fourth of their vendors.
- Appearance and cleanliness of vendors' stalls are criteria used to compare shops for a quarter of respondents, but price and quality are much more salient factors.
- Consumers associate food safety with acute gastroenteric illness and know the main types of causal agents. However, none of EatSafe's key commodities were considered high-risk by consumers.
- It is common for consumers to discuss issues related to food quality or safety/healthiness with vendors at the market, based on findings of both the survey and direct observations.
- Consumers of both genders access information across many sources, of which TV news, social media, and radio were the most popular – indicating media could be leveraged to convey food safety messages.

Vendor survey:

- Individual shops and markets as a whole have working rules, which could be leveraged and reinforced within a food safety brand intervention.
- Similarly to consumers, the market is already perceived as clean by most vendors; hence interventions based on general market appearance – and possibly shop appearance - may not be perceived as a significant improvement.

- Cooperation and mutual help are important values for vendors, as well as pride in being a vendor and a role model for peers. These values can be leveraged in interventions.
- “Regular customer” relationships exist for a portion of the population and are reported more commonly by vendor than consumers. A food safety brand could leverage the benefits of loyalty and trust.
- There is some evidence that vendors’ perceptions of consumers’ preferences have been influenced, at least in part, by consumers’ expression of demand – suggesting that EatSafe’s theory of change is viable in the local context.
- Consumers and vendors talk about topics relevant to food safety periodically, including complaints. EatSafe can leverage these conversations, with cues or practices most relevant to food safety. Vendors seem to value consumers’ feedback and report taking time to answer questions.
- Females are perceived by vendors of both genders as making more requests, confirming previous FES findings, pointing at baseline differences in demand expression and food purchasing strategies by gender.
- Vendors very infrequently ask questions or make requests relevant to food quality or safety to their suppliers. However, about a quarter of vendors report expressing demand to suppliers in the form of complaints, returning product, or switching to another supplier.
- Vendors, similar to consumers, use cues to determine the safety of foods, including characteristics that can be seen or smelled. Most vendors are confident that they can select safe foods from suppliers.
- While vendors also did not specifically identify any focus commodity as high-risk, a substantial proportion linked fresh vegetables, beef, and fish to foodborne illness. Grains and legumes were seen as low risk. RTE forms of cowpea (moi-moi) and soybeans (awara) were linked to foodborne illness by a substantial proportion of both vendors and consumers.
- The market management can be an effective ally in market-based interventions, as it is seen by vendors as providing useful services and as an authority that is both effective in enforcing regulation and keeping the market clean, and responsible for food safety. These beliefs are stronger in male vendors than females.
- Vendors communicate with the market management, but not very frequently, and female vendors communicate significantly less than male vendors. These findings suggest that over-relying on the market management for communicating with vendors during interventions may introduce gender biases.
- There is little evidence that food safety is considered a “marketable” or profit-generating food attribute by either vendors or consumers. Even so, many vendors (58%) would prefer to have a visible food safety certification displayed at their shops, if available.
- Vendor access information somewhat differently than consumers. Radio is a commonly used information channel (44% of vendors). Person-to-person (50%) and TV (24%) are also common information channels. “Online” and printed media are infrequently mentioned.
- Medical professionals and “friends and family” are the most trusted source of food safety information (selected by 40% each, compared to 77% and 32% for consumers).

These sources can be featured in interventions, such as speakers or staff at an informational stand or during trainings, as well as via mass media.

Vendor observations:

- The vast majority of vendors display their food without any covering.
- Refrigeration was not observed in any of the shops. Shade and spraying with water were used by a minority (6%) of vendors.
- While food waste is commonly left on the ground, half of vendors observed also use bags or bins. Vendors that more actively maintained cleanliness by wiping surfaces were also more active in food waste management.
- Most shops did not have high-risk foods (e.g., meat, fish) in contact with lower-risk foods (vegetables, grains and legumes).
- Almost all vendors handle food with bare hands. Tools to pick up or handle food were available in a fifth of the observed shops but were not used.
- Meat and fish vendors often used the same tools to handle both raw and cooked meat or fish without first washing or sanitizing the tool.
- Transactions with customers usually did not include food safety measures: a third of consumers touched food, though most only looked or pointed at it. Consumers only used tools to handle food in a few shops. Almost all vendors handled food and money with the same bare hands.
- Vendor personal hygiene was overall good, but handwashing was limited.
- Some observed behavior could lead to food contamination, such as long or dirty fingernails, spitting, performing personal hygiene other than handwashing, or sneezing or coughing near the food.

7. REFERENCES

1. Grace D. Food Safety in Low and Middle Income Countries. *IJERPH*. 2015;12(9):10490–507.
2. Kirk MD, Pires SM, Black RE, Caipo M, Crump JA, Devleeschauwer B, et al. World Health Organization estimates of the global and regional disease burden of 22 foodborne bacterial, protozoal, and viral diseases, 2010: a data synthesis. *PLoS medicine*. 2015;12(12):e1001921.
3. Havelaar AH, Kirk MD, Torgerson PR, Gibb HJ, Hald T, Lake RJ, et al. World Health Organization Global Estimates and Regional Comparisons of the Burden of Foodborne Disease in 2010. von Seidlein L, editor. *PLoS Med*. 2015 Dec 3;12(12):e1001923.
4. Tschirley D, Reardon T, Dolislager M, Snyder J. The Rise of a Middle Class in East and Southern Africa: Implications for Food System Transformation: The Middle Class and Food System Transformation in ESA. *Journal of International Development*. 2015 Jul;27(5):628–46.
5. Cortese RDM, Veiros MB, Feldman C, Cavalli SB. Food safety and hygiene practices of vendors during the chain of street food production in Florianopolis, Brazil: A cross-sectional study. *Food Control*. 2016 Apr;62:178–86.
6. Gadaga TH, Samende BK, Musuna C, Chibanda D. The microbiological quality of informally vended foods in Harare, Zimbabwe. *Food Control*. 2008 Aug;19(8):829–32.
7. Muyanja C, Nayiga L, Brenda N, Nasinyama G. Practices, knowledge and risk factors of street food vendors in Uganda. *Food Control*. 2011 Oct;22(10):1551–8.
8. Alves da Silva S, Cardoso R de CV, Góes JÁW, Santos JN, Ramos FP, Bispo de Jesus R, et al. Street food on the coast of Salvador, Bahia, Brazil: A study from the socioeconomic and food safety perspectives. *Food Control*. 2014 Jun;40:78–84.
9. Grace D, Silvia A, Mutua F, Kristina R, Lindahl J, Amenu K. Food safety investment expert advice: Burkina Faso, Ethiopia, Nigeria [Internet]. International Livestock Research Institute; 2018. Available from: <https://cgspace.cgiar.org/handle/10568/91963>
10. Jaffee S, Henson S, Unnevehr L, Grace D, Cassou E. The Safe Food Imperative: Accelerating Progress in Low-And Middleincome Countries [Internet]. Washington, DC: World Bank; 2019. Available from: doi:10.1596/978-1-4648-1345-0
11. Ortega DL, Tschirley DL. Demand for food safety in emerging and developing countries: A research agenda for Asia and Sub-Saharan Africa. *Journal of Agribusiness in Developing and Emerging Economies*. 2017 Jan;7(1):21–34.
12. Chamhuri N, Batt PJ. Exploring the Factors Influencing Consumers' Choice of Retail Store When Purchasing Fresh Meat in Malaysia. *International Food and Agribusiness Management Review*. 2013;16.
13. Nordhagen S, Lee J, Onuigbo-Chatta N, Okoruwa A, Monterrosa E, Lambertini E, et al. "Sometimes You Get Good Ones, and Sometimes You Get Not-so-Good Ones": Vendors' and Consumers' Strategies to Identify and Mitigate Food Safety Risks in Urban Nigeria. *Foods*. 2022 Jan;11(2):201.
14. Nordhagen S, Lee J, Onuigbo-Chatta N, Okoruwa A, Monterrosa E, Lambertini E, et al. What Is Safe and How Much Does It Matter? Food Vendors' and Consumers' Views on Food Safety in Urban Nigeria. *Foods*. 2022 Jan;11(2):225.
15. Okojie PW, Isah EC. Food hygiene knowledge and practices of street food vendors in Benin City, Nigeria. *International Journal of Consumer Studies*. 2019 Nov;43(6):528–35.
16. Aluko OO, Ojeremi TT, Olaleke DA, Ajidagba EB. Evaluation of food safety and sanitary practices among food vendors at car parks in Ile Ife, southwestern Nigeria. *Food Control*. 2014 Jun;40:165–71.

17. Andy E, Mangai, Kayong E, Afoi B, Goshit J, Kasang N, et al. Assessment of Practice of Food Safety and Hygiene among Food Vendors within Jos North Local Government Area of Plateau State, Nigeria. *International Journal of Medical and Health Research*. 2015;1(2).
18. Chukuezi C. Food Safety and Hygienic Practices of Street Food Vendors in Owerri, Nigeria. *Studies in Sociology of Science*. 2010;1(1).
19. Agwu ACO, Akpan UE, Obiageli UIF, Kalu IO, Nkwa AA, Okorie EA, et al. Assessment of Food Hygiene Practices in Abia State, South East Nigeria. *American Journal of Food, Nutrition and Health*. 2018;8(3).
20. Ezenwoko AZ, Awosan KJ, Oche MO, Makusidi MA, Abubakar BG, Raji IA. Knowledge and Practices Related to Food Hygiene among Food Handlers in Sokoto, Nigeria. *International Journal of Tropical Disease & Health*. 2017;26(1).
21. Odipe OE, Olalekan RM, Sanchez ND, Funmilayo AA, Edewor OP, Lateefat HM, et al. Assessment of Environmental Sanitation, Food Safety Knowledge, Handling Practice among Food Handlers of Bukateria Complexes in Iju Town, Akure North of Ondo-State, Nigeria. *ACTA Scientifica Nutritional Health*. 2019;3(6).
22. Iwu AC, Uwakwe KA, Duru CB, Diwe KC, Chineke HN, Merenu IA, et al. Knowledge, Attitude and Practices of Food Hygiene among Food Vendors in Owerri, Imo State, Nigeria. 2017;5.
23. Lawan UM, Iliyasu Z, Abubakar S, Gajida AU, Abdussalam A. Personal and food hygiene practices of subsistence food vendors operating in Kano metropolis, northwestern Nigeria. *International Journal of Medical Science and Public Health*. 2015;4(2).
24. Adebowale OO, Kassim IO. Food safety and health: a survey of rural and urban household consumer practices, knowledge to food safety and food related illnesses in ogun state. *Epidemiology Biostatistics and Public Health*. 2017;14(3).
25. Awoyemi AO, Ajiboy MN, Adesiji GB, Kayode AO. Food safety knowledge among farming households in Irepodun local government area, Kwara State, Nigeria. *Agricultural Science and Technology*. 2019;11(2).
26. GAIN. Global Alliance for Improved Nutrition. Global Alliance for Improved Nutrition. 2020. Consumer and Vendor Perspectives on and Practices Related to Food Safety in Nigeria: A Review. A USAID EatSafe Project Report. 2020;
27. Nordhagen S. Consumers' and Vendors Perspectives on Food Safety in Nigeria: A Review. Geneva; 2020.
28. Arnade C, Calvin L, Kuchler F. Consumer Response to a Food Safety Shock: The 2006 Food-Borne Illness Outbreak of E. coli O157: H7 Linked to Spinach. *Review of Agricultural Economics*. 2009 Dec;31(4):734–50.
29. Guh S, Xingbao C, Poulos C, Qi Z, Jianwen C, von Seidlein L, et al. Comparison of cost-of-illness with willingness-to-pay estimates to avoid shigellosis: evidence from China. *Health Policy and Planning*. 2007 Nov;23(2):125–36.
30. Ortega DL, Wang HH, Olynk NJ, Wu L, Bai J. Chinese Consumers' Demand for Food Safety Attributes: A Push for Government and Industry Regulations. *American Journal of Agricultural Economics*. 2012 Jan;94(2):489–95.
31. Kish L. Sampling Organizations and Groups of Unequal Sizes. *American Sociological Review*. 1965;30(4):564–72.

8. APPENDICES

8.1. APPENDIX I: DETAILED SURVEY METHODOLOGY

Study Location. Within Kebbi State, the assessment focused on urban traditional markets. The geographic focus was determined in consultation with key local stakeholders, based on local priorities and alignment with existing programs, in addition to project-specific criteria. The following criteria were used to select the chosen geographic area: the city being within a Feed the Future Zone of Influence; undernutrition being prevalent in the state; commodities being widely consumed in the city; and the city and state having sufficient security to allow for the work to take place safely.

Key Commodities: EatSafe’s Key Commodities in Nigeria are grains (rice, maize, cowpea, soybean), aquaculture and wild fish, fresh vegetables, and fresh beef. EatSafe identified these seven commodities in close consultation with USAID and key local stakeholders. In general, EatSafe’s seven commodity categories have high inherent nutritional value, are accessed via traditional markets for domestic human consumption, and are sold directly to consumers. Though fresh vegetables and beef are not currently key commodities for Feed the Future Nigeria, EatSafe included them in this assessment because they are commonly at high risk for contamination. The focus of the assessment is on raw or fresh commodities, purchased to be prepared and consumed at home. Given that ready-to-eat (RTE) foods within the seven Key Commodities were widespread in the selected markets, RTE foods were occasionally included as relevant to understand consumers’ purchase choices.

Inclusion and Exclusion Criteria, by Participant Group

CONSUMERS	VENDORS
INCLUSION CRITERIA	
<ul style="list-style-type: none"> • Be 18 years of age or older; • Have primary or shared responsibility for purchasing food for their household; • Shop at a target market at least once in the average month; • Purchase at least one EatSafe Key Commodity at a target market, and preferably three or more; and • Able and willing to give informed consent. 	<ul style="list-style-type: none"> • Be 18 years of age or older; • Sell food within the boundaries of the target market at least one day per week; • Sell at least one Key Commodity¹⁹ at least, on average, once a week; • Be a primary vendor (i.e., being physically present for at least half of average business hours in a week, interacting directly with consumers during transactions, and/or being a primary decider of shop operations (e.g., supplier decisions, tools/equipment usage, food arrangement); • Having sold food at the selected market for at least 3 months; and • Able and willing to give informed consent.
EXCLUSION CRITERIA	

¹⁹ The Key Commodity(-ies) should be a main product and a sizeable portion of what the shop sells, not only a niche product. It is acceptable if the grains and legumes in the seven Key Commodities are sold among several other products.

- Be a food vendor at the target market;
 - Be a vendor or hawker of street or RTE foods;
 - Be a vendor or hawker selling outside the boundaries of the market;
 - Plan to resell purchased food (excluding purchasing for neighbor or relative);
 - Plan to move away from or stop shopping at the market in the next two years;
 - Be a participant in the EatSafe Focused Ethnographic Study (FES);
 - Have a household member already enrolled (preference for enrolling person with primary responsibilities);
 - Not being able to communicate verbally in English or Hausa; and
 - Not being willing to share contact information for follow-up.
- Plan to move far or stop selling food at the market in the next two years;
 - Be a participant in FES Phase 2 (and vice versa); participants in FES Phase 1 can be eligible if needed for target sample size (but will be noted in data);
 - Have a vendor in the same food vending business already enrolled in the survey (preference for enrolling person with primary responsibilities);
 - Have a business that sells only snacks or food that is not brought and consumed at home;
 - Not being able to communicate verbally in English or Hausa; and
 - Not being willing to share contact information for follow-up.

Sample size calculation: Using a descriptive cross-sectional survey design, EatSafe assumed an expected prevalence of positive food safety attitudes and behaviors to be between 25% and 50% in the target population at baseline. Given that the actual prevalence is hitherto unknown in the target population, the absolute precision required for the estimate was assumed to be 5%. The required effective sample size was calculated using the equation (31):

$$n = \frac{Z\alpha^2 \times p(1 - p)}{d^2}$$

where n = the minimum desired sample size; $Z\alpha$ = the standard normal deviate (1.96 at 5% alpha level); p = expected prevalence of attitudes and behaviors in the population (assumed between 25% and 50%); and d = the required absolute precision, assumed to be 5%.

Under the 25% prevalence scenario, the required sample size (including a 20% adjustment to account for possible missing data/loss to follow-up) was estimated as 288 (+20%) = 346. Under the 50% prevalence scenario, the required sample size was estimated as 461 respondents.

Data Management: Prior to survey administration, comprehensive training and piloting programs were undertaken for each component of the assessment. Trainings familiarized enumerators with the survey instruments, contents, and data collection/aggregation systems and included the following activities:

- Preassessment to determine overall knowledge about food safety and nutrition;
- Overview of the EatSafe research program;
- Overview of objectives of the quantitative formative assessment survey;
- Review of survey instruments in English and Hausa including mock sessions, a pilot test, debrief sessions for the different teams engaged on the survey; and
- Post-training assessment of the entire survey team.

There were 62 data collectors trained in total, comprising three groups, including:

- Consumer and Vendor Surveys: 20 enumerators, four supervisors, and two quality control (QC) officers;
- Vendor Observations: 10 enumerators, two supervisors, and one QC officer.

In addition to the data collectors, supervisors, and quality control officers trained for data collection for the main research activities, a team of 20 recruiters, two supervisors, and two quality control officers were trained virtually to undertake the recruitment activities, involving the administration of a brief enrollment questionnaire. During the recruitment activity training, enumerators were briefed on the recruitment specifications (e.g., inclusion and exclusion criteria) and enrollment quotas. The training program culminated in an *in situ* pilot, wherein the validity and cognitive clarity of the instruments was evaluated in the target population. The survey instruments were updated and finalized after incorporating input from the pilot activities.

Data Quality Assurance: Following data collection, a number of data quality assurance procedures were undertaken to ensure consistency and accuracy of data collected in the field. Specific expectations were constructed based on the format, content, and logic of each survey question, including:

- If a response was required, the value of the response variable should not be missing;
- If the question should be skipped for a respondent based on their response to an earlier question, then there should be no value for that question;
- If the question is meant to be asked only to a relevant subset of respondents (based on response to a previous question), then it should be missing for all respondents who are not part of that subset, and should be present for respondents who are part of the subset.

Numeric, categorical, and ranking-type questions have unique sets of assertions based on the allowed response (single or multiple selections, format, length, etc.). For numeric values, the responses should be consistent with the type of number asked (e.g., positive/negative, integer/decimal, percent, etc.). When multiple response options are pre-specified, respondents' values for the question must correspond to one or more of those options, or "other." When "other" is selected, the variable for verbatim specification of "other" should be populated with a response. If ranking of responses (i.e., in order of mention) was recorded after multiple-selection, the ranked responses should correspond to only the options that the respondent indicated. These assertions were checked using code in Stata that documents how many respondents *pass* the assertion, how many *fail*, and if they fail, generates a Microsoft Excel worksheet listing the assertion that was tested, both its notion and the way it was coded, and lists the values of the variables that do not conform to the expectation. Inconsistencies were flagged, reviewed, and updated as needed.

Data Collection: Interviews were conducted in respondents' homes whenever possible. If it was not possible to conduct the interview in the respondents' homes, interviews were conducted in a space free of distractions and outside the perimeter of the selected market. The interview could be conducted in English or Hausa, as per the preference of the respondent. All respondents gave explicit consent to participate in the survey and explicit consent to be contacted for follow-up data collection if needed. Consent was recorded by the enumerator digitally in the data collection form. Each survey interaction, including preamble, consent statements, and questionnaire administration, lasted approximately between 60 and 90 minutes

in total. Recontact after the interview via phone call was conducted in rare cases to address or clarify data inconsistencies.

Survey Questionnaire: Identical data collection and analysis methods were used in the consumer and vendor surveys. Participants were administered a semi-structured, questionnaire-guided survey including the following modules, per participant group:

CONSUMERS	VENDORS
Module 1: Respondent demographics, socioeconomic status (SES), and shopping habits;	Module 1: Respondent demographics, socioeconomic status, and business characteristics;
Module 2: Practices and behaviors in the marketplace environment, including market selection, vendor selection and communication, and food purchase decision-making;	Module 2: Practices and behaviors in the marketplace environment, including market selection, supplier selection and communication, interactions with consumers, and food safety and hygiene;
Module 3: Perceptions of and attitudes about the market, including core beliefs about markets, foods, food safety, and gender roles/biases;	Module 3: Perceptions of and attitudes about the market, including beliefs about markets and market management, foods, food safety, and gender roles/biases; and
Module 4: Sources of information, media usage, and entertainment; and	Module 4: Sources of information, media usage, and entertainment.
Module 5: Food consumption/acquisition habits	

Key types of survey questions utilized throughout the survey modules included:

- *Numeric or percent:* Respondents estimate or recall specific values to the best of their abilities;
- *Open-ended list (ranked):* When related to beliefs or attitudes, respondents were asked to create open-ended lists of up to 3 or 4 items (depending on the question), without prompting, based on their perspectives. A mean ranking was computed for each item based on the rank order of each item when mentioned in respondents' lists. Respondents' answers were recorded using a list of pre-specified answer options, and "other" options were recorded verbatim; and
- *5-point scales:* Scales of agreement (e.g., "how much do you agree with the statement that..."), scales of importance (e.g., "how important is it to you, that..."), and scales of frequency (e.g., Never-Always) were used regularly throughout the survey. Pre-survey piloting confirmed that the 5-point scale format (as opposed to 3-point, etc.) was cognitively acceptable in the assessment population.

PPI: A previously developed Nigeria-specific Poverty Probability Index (PPI) was used as an indicator of SES (43,44). The PPI is based on ten indicators of wealth/poverty, including the number of household residents; the number of rooms and mattresses; the roofing material of the dwelling; the type of toilet facility accessed; the type of cooking stove(s) possessed; ownership of mobile phones, televisions, and motorized vehicles; and whether and how farming is practiced. The PPI is scored on a 100-point scale, where higher values indicate higher SES (i.e., lower probability of poverty).

Data Analysis: Statistical analyses were carried out using the Stata software (StataCorp. 2021. Stata Statistical Software: Release 17. College Station, TX: StataCorp LLC.). All means were reported with standard deviation (\pm SD). Summary statistics for each data type include:

- Summary descriptive statistics (mean, SD, median, and range) of numerical data, across the total population and by sub-group (e.g., gender, religion);
- Pearson correlation coefficients and p-values for pairwise associations between SES indicators (e.g., components of the PPI). A Bonferroni correction was applied to all p-values in the correlation matrix to adjust for multiple comparisons;
- Distributions of scale data (e.g., “importance,” “agreement,” and “frequency” scales from 1-5) and proportion of respondents at each scale point, across the total population and by sub-group; and
- Proportion of respondents citing each answer option for single- and multiple-selection questions, across the total population and by sub-group. Multiple-selection questions allowed up to either three or four selections per respondent, depending on the question, and the order of mention (1-3 or 1-4) was summarized as a mean rank. Chi-square tests were performed to determine whether there were differences in proportions across sub-groups. Tests yielding statistically significant ($p \leq 0.05$) results were subjected to post hoc pairwise analysis to determine the categories for which sub-groups yielded significantly different results

Analysis of variance (ANOVA) was performed to determine significant differences in numeric data (including scales) across categorical answer options. If ANOVA yielded statistically significant results, *post-hoc* Tukey tests for pairwise comparisons were used to determine which categories were significantly different from one another. For variables where responses were on 1-5 rating scales, *post-hoc* pairwise t-tests against the grand mean (across all categories) were used to determine which categories were significantly above or below average. T-tests were used to compare means between genders (male and female) for numeric data. These disaggregated analyses can inform whether an intervention could be viable or more effective for one sub-group vs. another. We highlight differences in gender in alignment with USAID and GAIN’s focus on gender as both determinant of intervention effectiveness, and as key leverage for progress.

Fisher’s exact tests were used to determine significant differences in proportional responses by gender to all categorical variables with binary answer options (e.g., “Yes” or “No”). This test was also applied to each individual answer option in multiple-selection questions, such that each answer was treated as a separate binary question. Chi-square tests evaluated gender-based differences for categorical variables with more than two answer options. A significance level of $p \leq 0.05$ was used as a significance threshold for all comparisons. Data visualizations were generated in R, and statistical tests were conducted in either R (45) or Stata software.

6.1. APPENDIX 2: VENDOR OBSERVATION METHODOLOGY

Vendor Recruitment and Selection: Vendors eligible for enrollment in the assessment are defined as key staff of a market shop or stall, that regularly perform key vending operations which may include those relevant for food safety (such as restocking and arranging food for display, temporary storage for the day or shift, preparing food if relevant, conducting transactions with customers, upkeeping the stall, cleaning the stall and any tools through the day, storing the food at closing time). Only vendors interfacing directly with consumers were included. Only one vendor per shop/stall/business were enrolled (note: in this document the term “vendor” is used to indicate a person, not the shop or vending business). Ownership of the business *per se* was not a discriminant for eligibility, i.e., owners, managers, and employees in a food vending business can be eligible. However, to be eligible vendors needed to both be “hands on” in performing day-to-day vending actions, and have decision power on how the shop operates, such as which suppliers to buy from, how food is arranged, when and how the shop is cleaned, how customers are treated, and how to handle any consumer complaints. In practice, shop managers or owner-managers are most likely to fulfil these roles. Vendors was stratified by commodity (e.g., beef, fish, grains/pulses, and fresh vegetables) and by gender.

Vendor Observation Checklist: The data collection tool for scoring direct vendor observations was developed by GAIN, with feedback from consortium partners. The checklist includes characteristics of the shop or stall that are directly related to hygiene and food safety, as well as vendor behaviors related to shop management and interaction with customers. The checklist was informed by existing guidelines for food safety and hygiene in traditional food markets.

Recruitment: EatSafe selected a stratified random sample of 50 vendors enrolled in the largest of the three markets for observation. The sample was stratified by commodity group, with 10 vendors each in the “grains and legumes” and “fresh vegetables” groups and 15 vendors each of beef and fish (see [Appendix 1](#) for inclusion criteria). To enroll vendors in the larger group, a short questionnaire was developed based on inclusion and exclusion criteria. Based on quotas (stratification by market, commodity, and gender), vendors were approached at the market with an introduction to the assessment and what participation entailed was provided verbally. This preliminary questionnaire was administered using a computerized interface. Consent was also obtained during this interaction. Given the relatively small total number of vendors, no further selection of vendors from the sampling frame was needed (e.g., no randomized selection from a larger group). The enrollment questionnaire is available as part of the Supplemental Materials.

In addition to giving consent to be enrolled in the larger group, vendors selected for the direct observation study were also provided the terms and general purpose of the observation, without mentioning specific topics that could bias the behavior of the vendor. The full text of the preamble that was read out loud to the vendor is included in the Vendor Observation tool (Supplemental Materials, available upon request).

Data Collection Process: Observations took place at vendors’ shops at the market from July 7-14, 2021, between the hours of 10:00 AM and 7:00 PM; each observation lasted 60 contiguous minutes.²⁰ Prior to the observation period, the observer completed a brief

²⁰ If the observation period was interrupted or rescheduled, it would restart as soon as possible until 60 contiguous minutes of observation could be completed. EatSafe maintained records on whether vendors’ observation periods were interrupted or rescheduled for any reason.

assessment of the vendors' demographic information and shop characteristics (i.e., shop structures, equipment, staff presence, etc.) digitally using a mobile tablet. Following this initial assessment, the observers were stationed within approximately two meters from the shop, without interacting with the vendor once the observation period. The observer completed a paper checklist of five modules, including Shop Hygiene, Food Handling, Vendor Hygiene, Vendor Health, and Vendor-Consumer Interactions. Periodic observations of hand cleanliness and countertop cleanliness were made every ten minutes using visual cleanliness scales from 1-5. As this was a visual rating, "cleanliness" was scored based on absence of physical filth, dust, juices, or debris, which could be seen from the observers' standpoint. Presence or absence of standing juices on vendors' surfaces was also recorded at ten-minute intervals.

Paper forms were transcribed into digital format, then scanned and archived for reference. Data were assessed for completeness and quality based on a set of custom queries coded specifically for this dataset, similarly to the approach used for the surveys. The correctness of data transcription from the paper checklist to electronic format was checked by the data collection firm. Corrections made were noted and made available in a Quality Assurance/Quality Control report.

Data Analysis: Summary statistics for shop characteristics and observation count data were computed in Stata (StataCorp. 2021. Stata Statistical Software: Release 17. College Station, TX: StataCorp LLC.), with assessments of number and percent of observed vendors in each category for categorical variables and prevalence (percent of vendors with non-zero counts) and distributions (mean, SD, range) for count data. Analysis of variance (ANOVA) tests were used to evaluate significant differences in observed actions and behaviors across the four commodity categories: 'grains & legumes' (rice, maize, cowpea, and soybean), 'beef,' 'fish,' and 'fresh vegetables.' While vendor selection was based on three commodity groups (with meat and fish being together), in practice 15 vendors each were included for the meat and fish categories, thus making it possible to separate these two groups for the analysis. For all significant ANOVA tests, *post-hoc* comparisons were conducted to ascertain the directionality and magnitude of observed differences across commodity groups. Welch's T-tests (assuming unequal variance) were used to make comparisons by gender (male and female). A p-value less than or equal to 0.05 was used as a threshold for statistical significance in all tests. It is important to note that this assessment was designed as a small-scale descriptive study, and as such it was not powered to detect small or moderate differences across gender or commodity category. While statistical tests to assess the significance of differences across groups were attempted, and are reported here, the lack of detection of a significant difference does not mean that such difference does not exist. Conversely, significant differences detected despite the small sample size can be considered valid.

A correlation-based approach was used to appraise associations between selected variables (**Table A1**). Variables that were dependent on or linked to transactions were normalized based on the total number of transactions conducted by the vendor, such that the normalized value represents the frequency of actions *per transaction*. **Table A1** specifies whether each variable was normalized. Pearson correlation coefficients and P-values for the corresponding significance tests were computed using the `rcorr()` function in the R programming environment (45). P-values were adjusted to account for multiple comparisons using the Bonferroni method. A correlation matrix was generated using the `corrplot()` R function to visualize the strength and directionality of statistically significant correlations.

Table A1. Key Variables Used for Correlation Analysis

VARIABLE	DESCRIPTION
DEMOGRAPHICS	
Age	Vendor age at the time of observation
Education	Educational attainment scored on a scale of 1-5, where 1 = "none" and 5 = "post-secondary"
SHOP OPERATIONS	
Number of staff	The number of staff (excluding the observed vendor) present at the shop during the observation period
Number of transactions	The total number of transactions conducted during observation period
SHOP HYGIENE (NORMALIZED BY # OF TRANSACTIONS)^a	
Surface wipes – dry cloth ^a	The number of times the vendor wiped any surface (countertop, table, cutting board, etc.) with a dry cloth
Surface wipes – wet cloth ^a	The number of times the vendor wiped any surface (countertop, table, cutting board, etc., excluding the floor) with a wet cloth, with or without detergent
Total wipes of surfaces and objects with a cloth ^a	The number of times vendor used a cloth (wet or dry) to wipe any surface (countertop, table, cutting board, etc., including the floor), or object (e.g., utensils, containers, food, etc.) in the shop
Total wipes of surfaces and objects with an unused "clean" cloth ^a	The number of times vendor used a "clean" (e.g., previously unused) cloth to wipe any surface (countertop, table, cutting board, including the floor), or object (e.g., utensils, containers, food) in the shop
Waste disposal ^a	The number of times the vendor discarded food waste using any method (e.g., bags, bins, drop on the floor, etc.)
VENDOR HYGIENE	
Eating	The number of times the vendor ate food while stationed at the shop
Spitting	The number of times the vendor spat while stationed at the shop
Personal hygiene on the job (other than hand-washing)	The number of times the vendor was observed performing personal hygiene activities at the shop (e.g., brushing teeth, shaving, washing face, etc.), other than handwashing
Hand-washing	The number of times the vendor washed their hands by any method, (water with/without soap, sanitizer gel, or cleaning with a towel)
VENDOR-CONSUMER INTERACTIONS (NORMALIZED BY # OF TRANSACTIONS)	
Vendor-initiated conversation about food safety ^a	The number of times the vendor-initiated conversation with a customer about a food safety-related topic, such as cleanliness, quality, healthiness, contaminants, etc.
Customer-initiated conversation about food safety ^a	The number of times a customer-initiated conversation with the vendor about a food safety-related topic

^a Normalized variables are signified with a superscript "a." Normalization was performed for actions that are always or often dependent on interactions with customers, in order to compare across shops with varying levels of patronage. Raw counts were divided by the number of transactions conducted, such that the normalized value reflects actions performed on a *per-transaction* basis.