



Fish at Lompoul landing site, Senegal. Photo credit: Juan Vilata Simon.

FEED THE FUTURE BUSINESS DRIVERS FOR FOOD SAFETY

Cooperative Agreement No. 720BFS19CA00001

CONSUMER AWARENESS OF PAH CONTAMINANTS IN SMOKED FISH IN SENEGAL

Technical Learning Note

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Disclaimer

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OVERVIEW

Fish is an important contributor to the Senegalese economy and diet, with Senegal having one of the highest consumption rates of fish in Africa (29 kg/person/year according to a 2017-2018 study; ANSD, 2020). It serves as important protein source for many because of its low cost and its high availability. Due to its perishable nature, fish are commonly processed after capture to increase the longevity of products. In 2018, over 38,924 tons of fish were processed in Senegal, worth an estimated \$47,523,252 USD (Ministere Despecheset De L'Economie, 2019). As with any food product, fish consumption comes with an associated risk of potential contamination. Foodborne pathogens undermine the health and well-being of hundreds of millions of people across the globe each year. Inadequate food handling practices and poor infrastructure across supply chains increase health risks to consumers, in addition to being root-causes of pre-consumer loss and waste in the overall food system. Seafood products are no exception to these vulnerabilities, whether fresh or processed.

The most common type of processed fish in Senegal is smoked or braised, comprising roughly 65% of processed fish. These smoked and braised fish products are referred to as *methora* and *keccax*.¹ While smoking and braising help preserve fish, many traditional smoking and braising practices result in chemical contamination that is potentially harmful to human health (Essumang et al., 2013). Specifically, it can result in products containing polycyclic aromatic hydrocarbons (PAHs) which are known carcinogens in high levels (ATSDR, 2009; Essumang et al., 2013).

In the Spring of 2020, Feed the Future Business Drivers for Food Safety (BD4FS) undertook a Food Safety Situational Analysis (FSSA) of the artisanal seafood sector in Senegal and confirmed that traditional smoking of fish remains a common practice among artisanal processors and that consumer awareness of the potential health hazards was thought to be low (FES, 2020). To further investigate this food safety concern, BD4FS conducted an in-depth literature review which focused on the health risks associated with consuming smoked products, the different types of smokers and the levels of PAHs produced by each smoker, and the costs and financing options for adopting modern smokers that produce lower PAH levels. This research was published as the Technical Learning Note, [Fish smokers and polycyclic aromatic hydrocarbon \(PAH\) risks in Senegal](#) (FES, 2021).

Feed the Future Business Drivers for Food Safety (BD4FS), funded by USAID and implemented by Food Enterprise Solutions (FES), is a multi-country effort working to accelerate the adoption of food safety practices in local food systems. BD4FS is partnering with local agri-food actors – growing food businesses (GFBs) - to codesign and implement incentive-based strategies, thereby strengthening their capacities and enabling them to be agents of positive change in the effort to reduce the risk of food contamination, mitigate pre-consumer food loss, and strengthen the overall food system. By focusing on the role of GFBs in improving food safety, BD4FS contributes to USAID's knowledge base, strategies, and methodologies for business-level assistance in food systems. The BD4FS mission is to provide technical assistance and capacity building, develop best-practices and lessons learned, and generate success for entrepreneurs working to improve food safety.

To understand the dynamics among women fish processors who are responsible for the production of the vast majority of smoked and braised seafood products in Senegal, BD4FS also undertook an ethnographic study utilizing focus group discussions, key informant interviews, and direct observations. This second study sought traditional local knowledge from fish processors about their default smoking and braising practices and explored barriers to the adoption of new smokers that produce lower levels of PAHs. The findings from this ethnographic research were published as a Technical Learning Note, [Barriers to Adopting Safer Fish Smoking Practices among Senegalese Artisanal Processors](#) (Sene and Hatzipetro, 2021). One significant finding from both the FSSA and the ethnographic study was that women processors were aware that their processing sites were not sanitary, and they reported that if they could get better prices for their products they could then afford to improve conditions and adopt better technologies.

It is with this context that BD4FS initiated a third study to better understand consumers awareness and perceptions of food safety risks associated with PAHs. The program was particularly interested in learning whether consumers with greater awareness have a stronger willingness to pay and could be the market drivers for a sustainable shift in smoking and braising practices among women fish processors. In the Spring of 2021, BD4FS conducted a survey among Senegalese consumers of *methora* and *keccax* to assess: (1) their purchasing preferences, (2) PAH awareness and concerns, and (3) willingness to pay for a safer product. The study findings summarized in this report are stratified by socio-economic status (SES) of respondents to evaluate if consumer awareness and willingness to pay was affected by income levels.

¹ *Methora* are smoked at low heat in smoker ovens; and *keccax* are braised at very high temperatures in an oven or on the floor (when processors do not have ovens or braisers) and then trimmed and spread on racks to dry in the sun for several days. These processes are described in more detail in the FES technical Learning Note on focus group discussions with women fish processors: <https://agrilinks.org/sites/default/files/media/file/BD4FS-PAH-Focus-Groups-TLN-2021.1028-FINAL.pdf>.

METHODOLOGY

The FES research team developed a qualitative and quantitative survey to collect information on basic demographic information, purchasing preferences, food safety knowledge, and willingness to pay from consumers of smoked and braised fish products in Senegal. Through a competitive bid process, the Senegalese market research company, Dadch&Co, was hired to conduct the survey. To determine the socioeconomic status (SES) of survey respondents, Dadch&Co used the World Bank Living Standards Measurement (LSM; SAARF, n.d.). Survey questionnaires were administered using Computer-Assisted Personal Interviews (CAPI), a face-to-face data collection method in which trained interviewers (enumerators) used tablets to record answers given during interviews; and Survey CTO was used as the data collection software. The survey team consisted of 12 qualified individuals (10 enumerators and 2 supervisors) who were fluent in both French and the predominate national language, Wolof. Prior to implementation, the survey questionnaire was field tested and refined according to feedback from enumerators.

Survey sampling focused on markets in urban Dakar, with a targeted sample size of 400 respondents. This region was selected as it is highly populous, it is one of the main distribution channels for *methora* and *keccax*, and because of its proximity to the survey enumerators. The Dakar region houses four departments - Dakar, Guédiawaye, Pikine, and Rufisque - and each department is further broken down into districts. The sampling design targeted eight households for each district within the four departments. The survey region and total number of surveys targeted per department are summarized in Table 1.

Enumerators approached potential participants at random from pre-identified markets that sell smoked or braised fish products in each district. Individuals who agreed to take the survey were asked a series of filtering questions in order to select the primary person responsible for purchasing food for the household and those who purchase *methora* and *keccax*. Only individuals who met those criteria proceeded to participate in the full survey.

Surveys were conducted over a week during April 2021. Data were exported from the Survey CTO platform to Microsoft Excel. After cleaning and discarding invalid surveys, a total of 396 remained.

Table 1. Targeted and actual sample size and distributions for the four Dakar departments.

| Department | Target | Actual |
|--------------|------------|------------|
| Dakar | 144 | 141 |
| Guédiawaye | 40 | 40 |
| Pikine | 128 | 125 |
| Rufisque | 88 | 90 |
| Total | 400 | 396 |



Source: Wikimedia Commons.

SURVEY RESULTS

The survey was designed to assess: (1) consumers' preferences for *methora* and *keccax*, (2) knowledge and awareness regarding PAHs, (3) food safety concerns for *methora* and *keccax*, and (4) willingness to pay for a safer product. Demographic information (eg, age and gender) and data to classify respondents according to socioeconomic status (SES) were also collected to evaluate their role in consumer preference, awareness, and willingness to pay. The SES questions were included, in part, due to the popular and prevalent perception in Senegal that *methora* is reserved for the higher SES consumers and *keccax* predominantly consumed by lower SES groups (Dr. B Sene, personal communication, Dec 2020). As such, survey results are stratified by SES.

Demographics and Socio-Economic Status

Socio-Economic Status (SES)

Based on responses to the LSM questions, three SES categories emerged among the 396 respondents: High SES, Middle SES, and Low SES. The Middle SES group had the highest representation with 232 participants classified as part of this group, followed by the Low SES with 97 individuals, and the High SES group which had 67 individuals.

Age

Ages of respondents ranged from 18 to 55 and followed a relatively normal distribution, with the highest percent of participants (20%) falling in the 35-39-year-old range (Figure 2). When broken down by SES, data reveal that most of the High SES group (61%) were younger than 35; while most of the Low SES group were 35 or older (70%) (Figure 3).

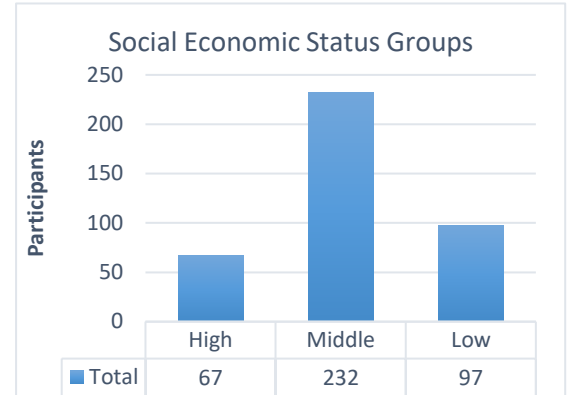


Figure 1. Total participants in the survey.

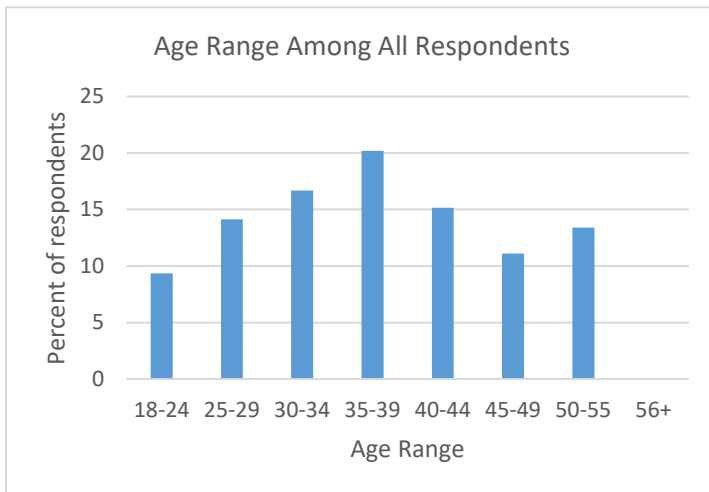


Figure 2. Age range of all survey respondents.

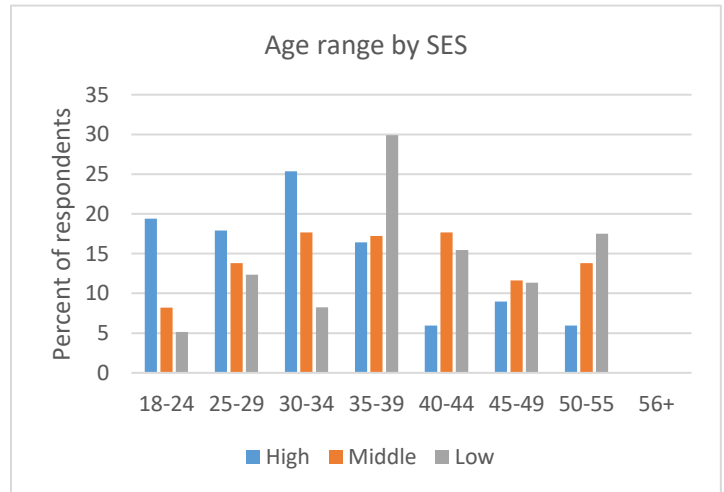


Figure 3. Age range of respondents broken down by SES.

Gender

To identify individuals at the markets who met the study criteria, enumerators asked potential participants a series of screening questions. One of which asked if they were the primary person responsible for household food purchases. Only those who responded “yes” were asked the remainder of the survey questions and are counted among the 396 respondents. The overwhelming majority of the 396 respondents were female (97%), and this trend held true across all SES groups (Figure 4). In other words, women are primarily responsible for purchasing household food in Senegal.



Figure 4. Responsibility for household food purchases by gender and SES.

SES by Market Location

As intended in the survey design, Dakar had the largest number of respondents (141) followed by Pikine (125), Rufisque (90), and Guediawaye (40) (Table 1). Within those departments, Dakar had the highest number of High and Middle SES respondents and Pikine had the largest number of Low SES respondents (Figure 5).

Purchasing Preference

Preference for *Methora* versus *Keccax*

When it comes to purchasing processed fish for their home, most respondents reported that they purchase both *methora* and *keccax* (roughly 80% for each SES), with a larger percentage of High SES respondents (13%) reporting that they purchase only *methora* than Middle and Low SES groups (Figure 6).

Purchasing Frequency

For all three SES groups, the majority of respondents (65%) said that they purchased *methora* at least 1-3 times per month (Figure 7). The High SES group had the largest percentage of respondents reported that they purchase 1-3 times a month (75%). The Low SES had the highest percentage of respondents that said they did not purchase *methora* at all (17%). Both Middle and Low SES groups had a small percentage of respondents (<1%) say that they purchase *methora* 12 or more times a month.

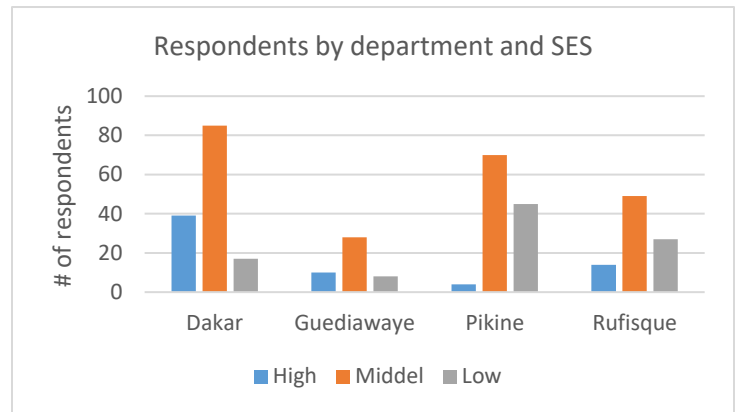


Figure 5: Survey respondents in each department, broken down by SES.

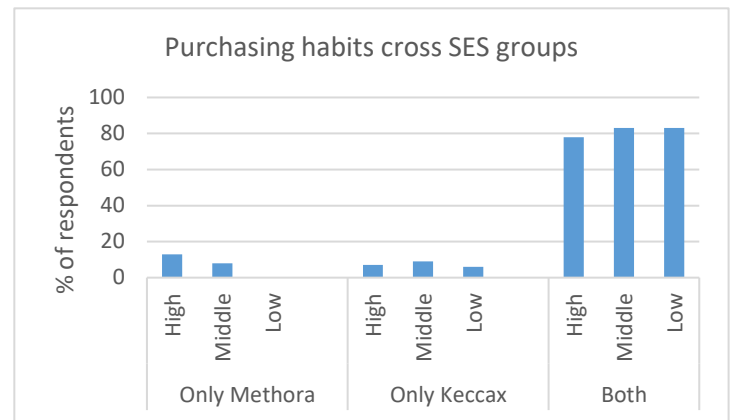


Figure 6: Comparison of Purchasing habits across SES

Similar to *methora*, the majority of respondents (67%) in all SES groups reported purchasing *keccax* 1-3 times per month (Figure 8). The High SES group had the largest percentage of respondents that said they did not purchase *keccax* at all (14%). No respondents from the High SES group reported purchasing *keccax* 12 times or more.

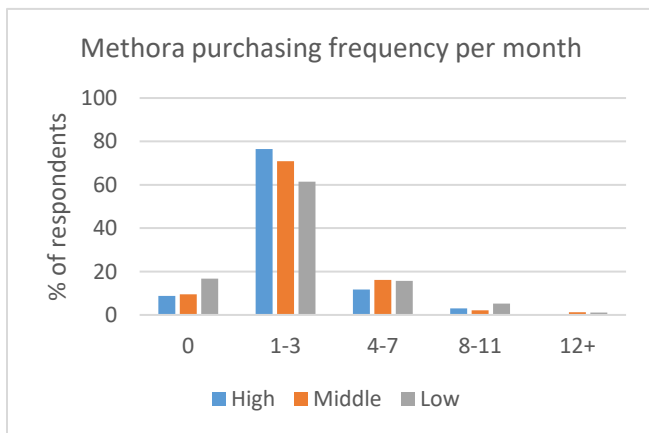


Figure 7: Comparison of *methora* purchasing frequency across SES.

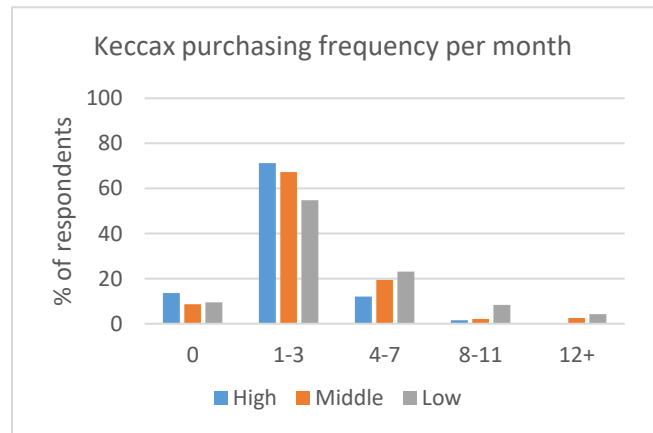


Figure 8: Comparison of *keccax* purchasing frequency across SES.

Preferred Purchasing Unit

For the preferred purchasing unit of *methora*, all SES groups reported that their most preferred purchasing unit was by grams (Figure 9). For the Middle and Low SES groups, these preferred units were the overwhelming majority. The least popular purchasing unit for the Low SES group was kilogram (5%). Depending on size of the pieces for sale, or if offered as whole fish, money appears to be a constraint to purchasing. Purchasing by gram or weight allows the consumer greater purchasing flexibility within their household budgets.

For the purchase of *keccax*, there was no clear majority preference for the purchasing unit (Figure 10). The High SES group preferred to purchase their *keccax* by kilogram by almost a two to one margin, whereas Middle and Low SES groups preferred to purchase their *keccax* by piece.

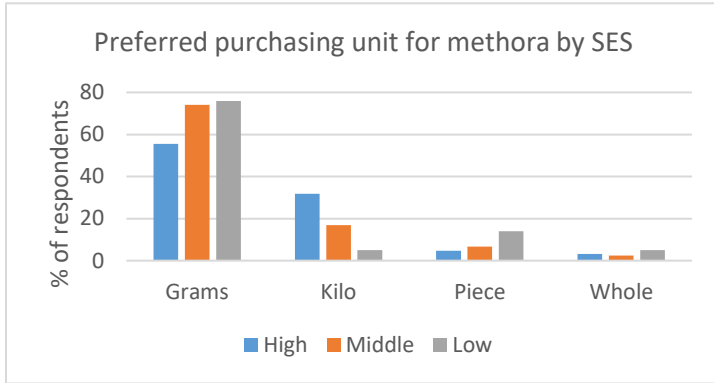


Figure 9: Comparison of preferred purchasing units for *methora* across SES.

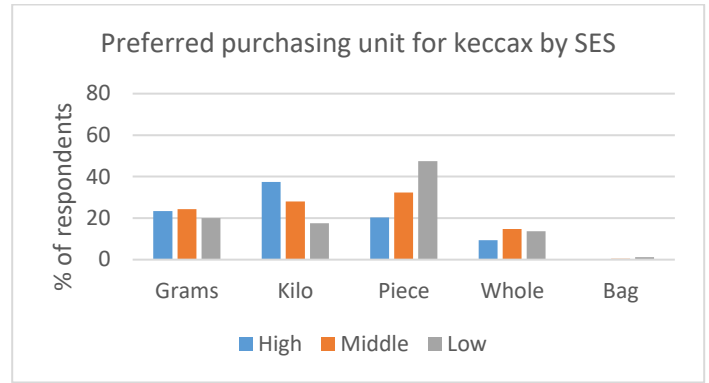


Figure 10: Comparison of preferred purchasing units across SES.

Vendor Preference

Most respondents did not indicate that they have a preference for purchasing *methora* or *keccax* from a particular location or vendor. Among those who did indicate a preference, more respondents reported that they purchase *methora* from the same vendor on a regular basis (35%), whereas they are less likely to purchase *keccax* from the same vendor (about 22%), with slight variability by SES. When asked why they purchase *methora* from the same location, the top reasons reported were *quality* and *habit*, followed by *personal connection* (defined as friend or family member), *client*, and *hygiene* (Figure 11). The top reasons reported for purchasing *keccax* from the same vendor were *hygiene*, *neighbor*, and *client*, followed by *quality* (Figure 12).

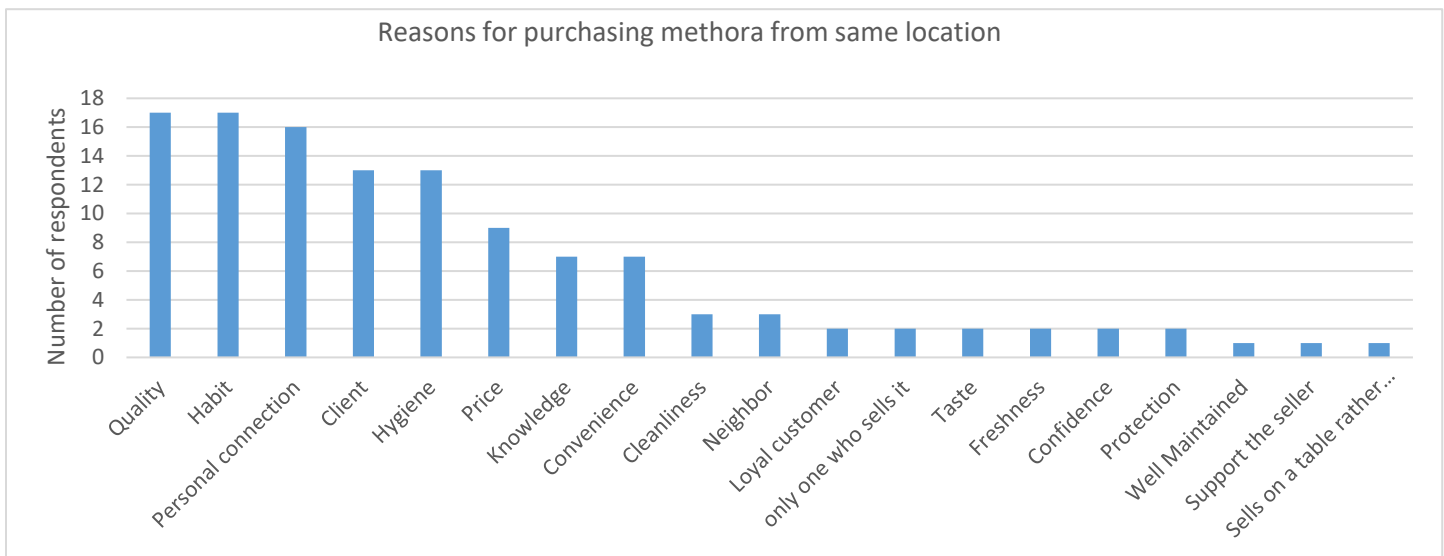


Figure 11: Reasons for purchasing *methora* from the same location on a regular basis.



Figure 12: Reasons for purchasing keccax from the same location on a regular basis.

PAH Awareness and Food Safety Concerns

PAH Awareness

Prior to being provided information on PAHs, respondents were asked if they had food safety concerns about either *methora* or *keccax*. A majority of respondents reported that they had no food safety concerns (over 70% for each SES). Among those who responded that they had concerns, *hygiene* was by far the top concern reported for both products. PAHs were not listed among their concerns, and further prompting revealed that there was overall low awareness of PAHs among all SES groups. When asked directly, less than 5% of all respondents reported that they were aware of PAHs.

Prior to responding to the remaining survey questions, respondents were read a brief description about PAHs and the potential health risks they pose.

Level of PAH Concern

After listening to the short description, respondents were then asked to rate their level of concern for PAHs in both products on a scale of 1 – 10, where 1 = least concerned and 10 = most concerned. Over half of the respondents rated their concern as very high (9 or 10) for both *methora* and *keccax*, with little notable variability among SES groups (Figures 13 and 14).

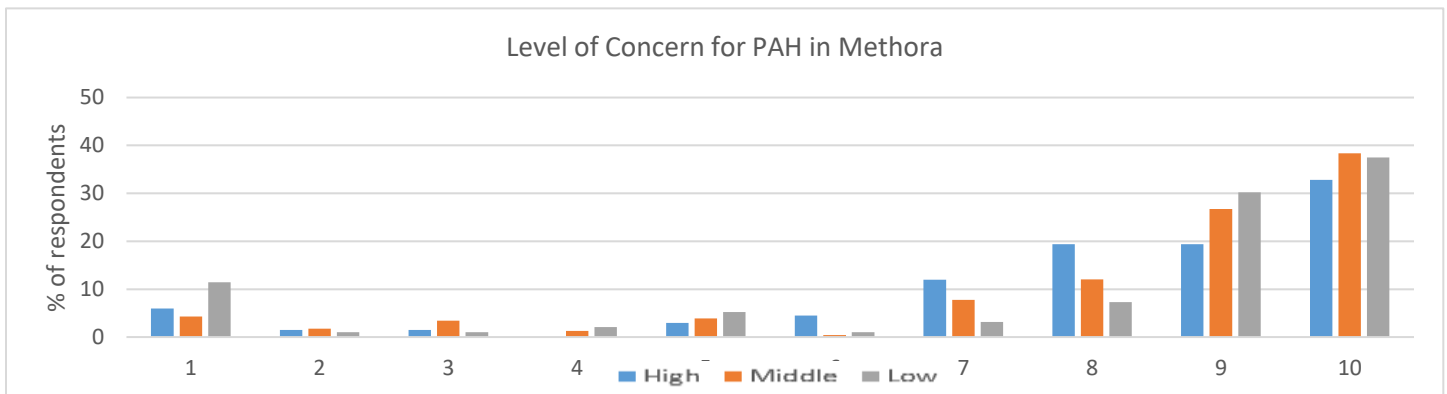


Figure 13: Respondent's level of concern for PAH in Methora by SES.

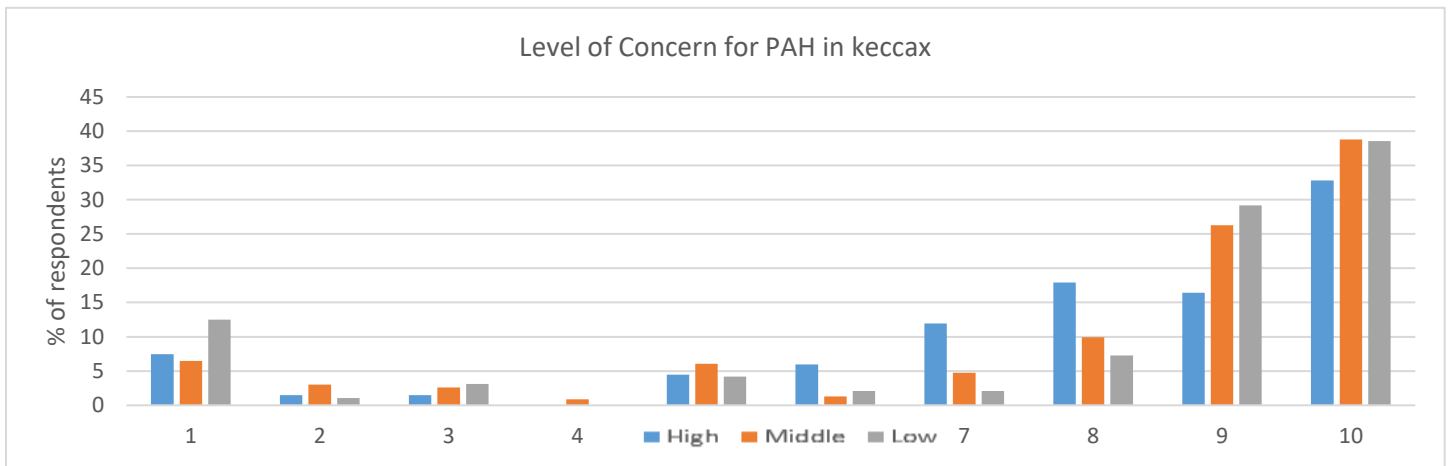


Figure 14: Respondent's level of concern for PAH in keccax by SES.

Importance of and Willingness to Pay for Lower-PAH Products

Importance of Low PAH-Producing Ovens

Respondents were then asked how important they think it is that fish processors have ovens that can produce *methora* or *keccax* with low PAH levels (1 = not important and 10 = very important). The majority of respondents reported that they think it is very important (ratings of 9 and 10) for processors to have low PAH producing ovens (Figures 15 and 16). There was little variability in responses among SES groups.

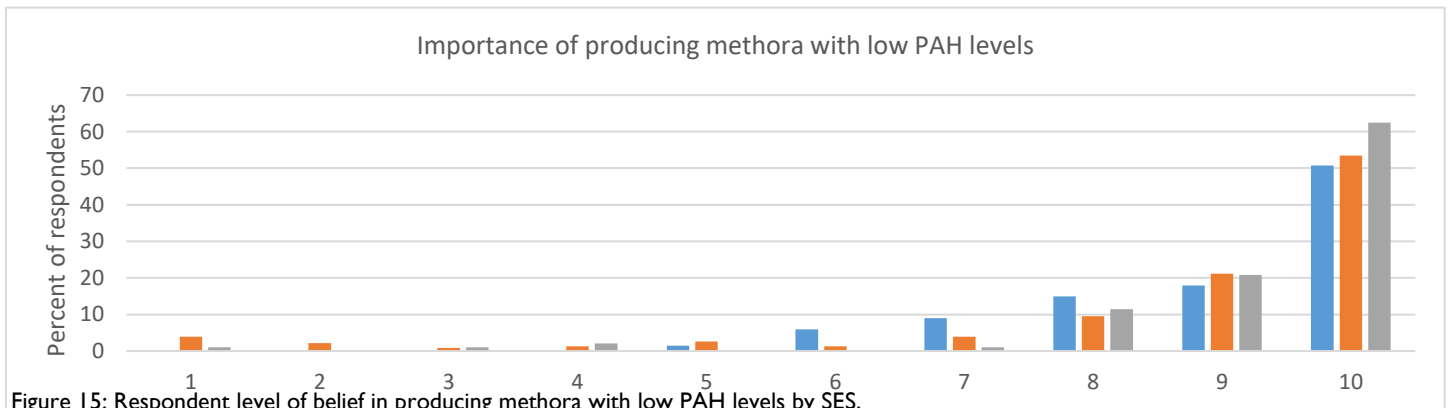


Figure 15: Respondent level of belief in producing methora with low PAH levels by SES.

Figure 15: Importance of fish processors having ovens that can produce lower PAH levels for *methora*, reported by SES.

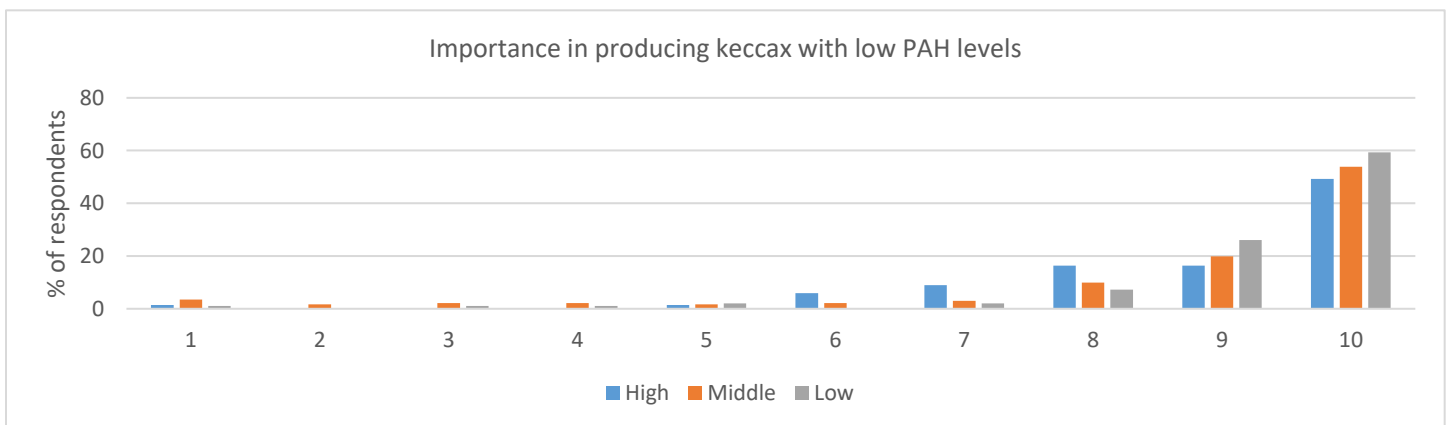


Figure 16: Importance of fish processors having ovens that can produce lower PAH levels for *keccax*, reported by SES.

Willingness to Pay More

Respondents were read the statement, “If fish processors have newer ovens that can produce *methora* and *keccax* with low PAH levels, the price will increase to help pay for this new technology.” Following this statement, when asked if they would be willing to pay more for this product that contains less PAHs, over 80% responded “yes” for both *methora* and *keccax* across all SES groups.

CONCLUSIONS AND DISCUSSION

This study provides preliminary insight on the primary purchasers of household foods, purchasing preferences for *methora* and *keccax*, awareness and concerns regarding PAHs in these products, and willingness to pay more for products with lower PAH levels. While results are only attributable to the 396 individuals sampled and cannot be generalized to all Senegalese consumers of smoked and braised fish products, they are nonetheless indicative of important trends and provide information to guide future research.

In terms of socioeconomic representation of survey respondents, the largest portion of respondents were classified in the Middle SES, with less respondents representing each the Low and High SES groups. Participant ages ranged from 18-65, with the largest portion falling in the 35-39-year-old age range. Perhaps to be expected given traditional gender roles in Senegal, the overwhelming majority of respondents was female (97%), indicating that women are the primary purchasers of food on behalf of the household. This held true across all SES groups. These demographic and socioeconomic data are important for understanding the survey audience, and they also provide direction for targeted outreach campaigns.

The majority of respondents (80%) purchase both *methora* and *keccax*, with no clear preference for one product. There do not appear to be critical differences among consumers in the three SES groups, with the exception that no consumers in the Low SES group reported that they purchase *methora* exclusively where a small portion of High SES respondents only purchase *methora*. Most consumers in Senegal, regardless of SES, purchase *methora* and *keccax* 1-3 times per month on average, with a higher percentage of respondents who purchase *methora* from the same vendor on a regular basis than *keccax*.

This survey found overall awareness of PAHs to be very low, with less than 5% of all respondents knowing what PAHs were. Further, the majority of respondents was not originally concerned about this food safety aspect related to these products. However, their perceptions shifted substantially after hearing the statement regarding PAHs and their associated risks from the enumerators. Upon learning that information and asked again about their level of concern, the majority of respondents stated that they had a high level of concern for PAH in *methora* or *keccax* and also reported that they believe it is very important for fish processors to have ovens that produce lower levels of PAHs. Further, most respondents (over 80%) said that they would be willing to pay more for products with lower PAH levels.

Overall, these results indicate that consumers can in fact be important drivers for the production of safer smoked and braised fish products. Due to the low awareness of PAHs, targeted outreach campaigns are essential to educate and motivate consumers. Based on survey data, education should include information on both *methora* and *keccax* equally, should aim to reach consumers that span all SES groups, and should strive to reach and educate women in particular since they are the primary purchasers of household food. It should be noted, however, that reported willingness to pay often does not translate to action. It would be worth further investigating how much more consumers are willing to pay for safer products, and ideally, to conduct field tests where consumers at markets are presented options with different safety labels and different prices, and observers record which products are most frequently purchased.

In a complementary and parallel effort, BD4FS has continued to engage women fish processors in Senegal so that their production of smoked fish products can meet increased consumer demand and willingness to pay more for safer products. Through focus group discussions, BD4FS learned that a major barrier to adopting modern ovens that produce lower levels of PAHs is that they were not designed with input from fish processors. Most modern ovens are more expensive than traditional ovens and they do not adequately account for the volume of fish regularly processed. With this, BD4FS is working with the fish processor associations to promote size-appropriate and affordable smoker ovens.

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APPENDIX A: SURVEY

QUESTIONNAIRE INSTRUCTIONS

- **INT: Interviewer Instructions (green)**
- **PROG: Programmer Instructions (blue)**
- **OE: Open Ended Question (purple)**

INTRODUCTION

PROG: SINGLE CODE / INT: CHECK QUOTAS

ID Interviewer..... (OE)

Location..... (OE)

Good morning \ afternoon. My name is from Dadch&co Market Research, an independent market research company. We are currently conducting a study on behalf of **Food Enterprise Solution (FES) as part of its Feed the Future Business Drivers for Food Safety project (BD4FS) funded by USAID** to understand the consumer behavior of smoke fish. All information collected will be treated with utmost confidentiality and will only be used by the FES to identify consumer preferences regarding two type of processed fish (Keccax, and Methora), as well as identify consumption levels of these two types of processed fish. In addition, this survey looks to identify consumer knowledge regarding PAH (Polycyclic Aromatic Hydrocarbons),

Definition of PAH

The PAH are a group of naturally occurring organic compounds. These compounds are created during the burning of materials and are often linked with processed food, specifically foods cooked utilizing smoke. This interview will take between 20-25 mins.

May I proceed with the survey?

PROG: SINGLE MENTION

| Response | Code | Actions |
|----------|------|-----------|
| Yes | 1 | Continue |
| No | 2 | Terminate |

S1. Do you or any member of your family work for any of the following organizations?

PROG: SINGLE MENTION / INT: READ OUT LIST

| | | |
|---|----|------------------|
| Marketing or market research company / department within a company | 1 | TERMINATE |
| Advertising agency or department within a company | 2 | |
| Public relations agency or department within a company | 3 | |
| Media house e | 4 | |
| Producer / Distributor of Methora / Keccak ; / company e.g transforming smoke fish. | 5 | |
| Don't know [PROG: MUTUALLY-EXCLUSIVE] | 6 | |
| None of the above [PROG: MUTUALLY-EXCLUSIVE] | 99 | CONTINUE |

S2. Have you participated in any market research survey in the last 6 months?

PROG: / INT: SINGLE MENTION

| Response | Code | Actions |
|----------|------|-----------|
| Yes | 1 | Terminate |
| No | 2 | Continue |

S3. Are you a member of this household? i.e. you are not employed here or just staying temporarily with the family

PROG: / INT: SINGLE MENTION

| Response | Code | Actions |
|----------|------|-----------|
| Yes | 1 | Continue |
| No | 2 | Terminate |

S4. Are you the primary person responsible for purchasing food for the household?

PROG: / INT: SINGLE MENTION

| Response | Code | Actions |
|----------|------|-----------|
| Yes | 1 | Continue |
| No | 2 | Terminate |

S5. How many people live in your household? _____

PROG: / INT: MENTION IN COL. NUMBER THE FIGURE

| Response | Number | Actions |
|------------------|--------|----------|
| How many Males | | Continue |
| How many females | | |

S6. Do you purchase:

PROG: / INT: MULTI MENTION

| Response | Yes | NO | Actions |
|----------|-----|----|------------------|
| Methora? | 1 | 2 | If Yes Continue, |
| Keccax? | 1 | 2 | If No Go to S8 |

S7. Is

xxxxxxxxxxxxxxxx a part of your diet:

PROG: / INT: MULTI MENTION

| Response | Yes | No | Actions |
|----------|-----|----|-----------------|
| Methora | 1 | 2 | If YES Go to S9 |
| Keccax | 1 | 2 | If NO Go to S8 |

PROG: / INT:

IF METHORA ONLY PURCHASE AND BE PART OF DIET ANSWER QUESTIONS IN SECTION METHORA

IF KECCAX ONLY PURCHASE AND BE PART OF DIET, ANSWER QUESTIONS IN SECTION KECCAX

IF BOTH METHORA AND KECCAX ARE PURCHASED, BE PART OF DIET ALSO, ANSWER TO ALL SECTION

S8. If NO to either purchasing or eating Methora/ Keccax, why not:

PROG: / INT: SINGLE MENTION

| Response | Methora | Keccax |
|---|---------|--------|
| It is not available (availability)____ | 1 | 1 |
| Me or household members do not like the taste (taste)____ | 2 | 2 |
| I am concerned with the safety of eating methora (food safety) ____ | 3 | 3 |
| My household does not eat fish (food preference) ____ | 4 | 4 |
| Other (please specify): _____ | 99 | 99 |

S9. Gender.

INT: DO NOT ASK

| Response | Code |
|----------|------|
| Male | 1 |
| Female | 2 |

S10. Please tell me what age bracket you fall in?

PROG: IF GIVEN ABOVE, PRECODE

PROG: / INT: SINGLE MENTION

| | | |
|-------------------|----|------------------|
| Below 18 years | 1 | TERMINATE |
| 18 – 24 years | 2 | CONTINUE |
| 25 – 29 years | 3 | |
| 30 – 34 years | 4 | |
| 35 – 39 years | 5 | |
| 40 – 44 years | 6 | |
| 45 – 49 years | 7 | |
| 50 – 55 years | 8 | TERMINATE |
| 56+ years | 9 | |
| Refused to answer | 99 | |

SII. LSM CASSIFICATION: I am now going to ask you several questions related to your way of living. Some of these questions might sound strange to you but I need to ask them to understand your Household Lifestyle. Please tell me which, if any, are presently in your household.

| | Yes | No | SEC/ LSMI_YES (for punching) | |
|--|-------------|----|---------------------------------|----|
| Do you have a color TV? | 18 | 0 | 1 | |
| Did you access the internet during the past 4 weeks? | 49 | 0 | 2 | |
| Do you have a satellite dish/ DSTV/cable TV subscription? | 34 | 0 | 3 | |
| Do you have a built-in kitchen sink in your kitchen? | 31 | 0 | 4 | |
| Do you have a microwave oven? | 32 | 0 | 5 | |
| Did you read a newspaper in the last 7 days? | 17 | 0 | 6 | |
| Do you have a video recorder? | 18 | 0 | 7 | |
| Do you have a cell phone/mobile phone with a working line? | 16 | 0 | 8 | |
| Do you have an electric iron? | 17 | 0 | 9 | |
| Do you have a personal computer for your own personal use at home? | 34 | 0 | 10 | |
| Do you have a fixed telephone line at home or an outstanding application for one | 14 | 0 | 11 | |
| Did you watch TV in the last 7 days? | 17 | 0 | 12 | |
| Do you have access to e-mail? | 41 | 0 | 13 | |
| Do you have an automatic washing machine? | 32 | 0 | 14 | |
| Do you have refrigerator? | 20 | 0 | 15 | |
| Do you have a hi-fi or music center? | 17 | 0 | 16 | |
| Do you have a free-standing deep freezer? | 19 | 0 | 17 | |
| Do you have a video camera/camcorder? | 35 | 0 | 18 | |
| Do you have an account with a commercial bank? | 15 | 0 | 19 | |
| Do you live in a house, cluster house or condominium / | 11 | 0 | 20 | |
| How many cars do you have in your household? One answer only / | None | 0 | 0 | 21 |
| | One | 12 | 0 | 22 |
| | Two or more | 24 | 0 | 23 |
| Did you buy adult clothing in the past six months? | 10 | 0 | 24 | |
| Add this every time (Constant) | 32 | 0 | | |
| Total | | | | |

Category classification:

| LSM | Points | SEC/LSM POINTS | SEC |
|--------|---------|----------------|-----|
| LSM 1 | 0-37 | 1 | E |
| LSM 2 | 38-54 | 2 | |
| LSM 3 | 55-70 | 3 | |
| LSM 4 | 71-87 | 4 | D |
| LSM 5 | 88-103 | 5 | |
| LSM 6 | 104-120 | 6 | C2 |
| LSM 7 | 121-153 | 7 | |
| LSM 8 | 154-186 | 8 | |
| LSM 9 | 187-219 | 9 | CI |
| LSM 10 | 220-252 | 10 | CI |
| LSM 11 | 253-285 | 11 | CI |
| LSM 12 | 286-318 | 12 | B |
| LSM 13 | 319-352 | 13 | B |

| | | | |
|--------|---------|----|---|
| LSM 14 | 353-385 | 14 | B |
| LSM 15 | 386-418 | 15 | A |
| LSM 16 | 419-451 | 16 | A |
| LSM 17 | 452-999 | 17 | A |

Thank you for answering those questions. The following questions are strictly related to Methora.

SECTION: PURCHASING METHORA IN THE HOUSEHOLD

ALL: HOUSEHOLD

We are now going to talk about your consumption of Methora. Please give me your honest feedback, **this data is going to be used** to calculate the risk of exposure to PAH in Senegal.

Q1. Please tell me, on average how many times do you purchase Methora in a month?

PROG: / INT: SINGLE MENTION

INT: READ OUT RESPONSES

| | | |
|-------------------|------------|------------------|
| 1-3 | 1 | CONTINUE |
| 4-7 | 2 | |
| 8-11 | 3 | |
| 12 or more | 4 | |
| Other (Specify) | 99 | |
| Refused to answer | 100 | TERMINATE |

Q2. When purchasing Methora, in what quantity do you buy (**How Many**)?

PROG: / INT: SINGLE MENTION

INT: READ OUT RESPONSES THEN AFTER MENTIONNED THE QUANTITY AT COL. HOW MANY

| Responses | Code | How many | CONTINUE |
|---------------|------|-----------------|-----------------|
| By whole fish | 1 | | |
| By piece | 2 | | |
| by grams | 3 | | |

| | | | |
|------------------------|----|--|--|
| by kilo | 4 | | |
| Other (Specify) | 99 | | |

Q3. On average how long does your purchase last before you or your family consume it all?

PROG: / INT: SINGLE MENTION

INT: READ OUT

| Responses | Code | CONTINUE |
|------------------------|------|-----------------|
| Less than 2 days | 1 | |
| Less than 4 days | 2 | |
| Less than a week | 3 | |
| Other (Specify) | 99 | |

Q4. When purchasing Methora, where do you prefer to buy your fish?

PROG: / INT : If more than one location please rank with 1 being the most preferred

INT: READ OUT

| Responses | Rank | CONTINUE |
|--------------------------------|------|-----------------|
| Fish Processing site | | |
| Street Vendor | | |
| Large Market with many vendors | | |
| Supermarket | | |
| Minimarket | | |
| Restaurant | | |
| Other (Specify) | | |

Q5. Do you purchase Methora from the same person/location on a regular basis?

PROG: / INT : SINGLE MENTION

| Response | Code | Actions |
|----------|------|-----------------|
| Yes | 1 | Continue |
| No | 2 | Go to Q7 |

Q6. If yes, can you explain why your purchase from that same person or location?

PROG: / INT: Verbatims

SECTION: Methora Characteristics

Q7. Do you know which species of Methora you often buy?

PROG: / INT : SINGLE MENTION

| Response | Code | Actions |
|----------|------|-----------|
| Yes | 1 | Continue |
| No | 2 | Go to Q10 |

Q8. If yes please list all of the species of Methora you buy (*This is a freelist question. The idea here is the one that comes to mind first has the highest saliency and also gives opportunity to list species that we may not have pictures of.*)

PROG: / INT: MULTI MENTION: Mentioned the responses which come spontaneously at the col. Spontaneous.

| Name of Species | Code |
|-----------------|------|
| | 1 |
| | 2 |
| | 3 |
| | 4 |
| | 5 |
| | 6 |
| Don't Know | 98 |
| Other Specify | 99 |

Q9. Can you tell us why you purchase the species you selected as number 1 **PROG: / INT: VERBATIM**

Q10. If there is a species of fish you do not purchase, please explain why you do not purchase that species (**If more than one fish is not purchased, enumerator should label respondents response to which labeled fish.**)

Q11. When purchasing Methora, please rank in order the factors you deem important with 1 being most important and 11 being the least important. If it is not an important factor you may leave it empty. **PROG: / INT: RANK FIRST, GIVE THE LEVEL OF IMPORTANCE AFTER**

| | RANK | being most important | EVALUATION LEVEL OF IMPORTANCE | | | | | | | | | | being the least important | Other reasons please specify |
|----------------|------|----------------------|--------------------------------|---|---|---|---|---|---|---|----|----|---------------------------|------------------------------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| ___ Color | | | | | | | | | | | | | | |
| ___ Length | | | | | | | | | | | | | | |
| ___ Species | | | | | | | | | | | | | | |
| ___ Price | | | | | | | | | | | | | | |
| ___ Fatness | | | | | | | | | | | | | | |
| ___ Smell | | | | | | | | | | | | | | |
| ___ Oily | | | | | | | | | | | | | | |
| ___ Cut | | | | | | | | | | | | | | |
| ___ Taste | | | | | | | | | | | | | | |
| good quality | | | | | | | | | | | | | | |
| well-preserved | | | | | | | | | | | | | | |
| not spoiled | | | | | | | | | | | | | | |
| Other Specify | | | | | | | | | | | | | | |

Thank you, the following questions are regarding the purchase of Keccax.

SECTION: Purchasing Keccax

Q12. Do you know which species of Keccax you often buy? Yes or No

PROG: / INT: SINGLE MENTION

| Response | Code | Actions |
|----------|------|-----------|
| Yes | 1 | Continue |
| No | 2 | Go to Q15 |

Q13. If yes please list all of the species of Keccax you buy (This is a freelist question. The idea here is the one that comes to mind first has the highest saliency and also gives opportunity to list species that we may not have pictures of.)

| Name piece of Keccax | Code |
|----------------------|------|
| | 1 |
| | 2 |
| | 3 |
| | 4 |
| | 5 |
| | 6 |
| Don't Know | 98 |
| Other Specify | 99 |

Q14. On average how many times do you purchase Keccax in a month?

PROG: / INT: SINGLE MENTION

INT: READ OUT RESPONSES

| | | |
|-----------------|----|-----------------|
| 1-3 | 1 | CONTINUE |
| 4-7 | 2 | |
| 8-11 | 3 | |
| 12 or more | 4 | |
| Other (Specify) | 99 | |

Q15. When purchasing Keccax, in what quantity do you buy?

PROG: / INT: SINGLE MENTION

INT: READ OUT RESPONSES

| Responses | Code | |
|-----------------|------|-----------------|
| By whole fish | 1 | CONTINUE |
| By piece | 2 | |
| by grams | 3 | |
| by kilo | 4 | |
| Other (Specify) | 99 | |

Q16. On average how long does your purchase last before you or your family consume it all?

PROG: / INT: SINGLE MENTION

INT: READ OUT

| Responses | Code | CONTINUE |
|------------------------|------|-----------------|
| Less than 2 days | 1 | |
| Less than 4 days | 2 | |
| Less than a week | 3 | |
| Other (Specify) | 99 | |

Q17. When purchasing Keccax, where do you prefer to buy your fish? If more than one, please Rank

PROG: / INT : If more than one location please rank with 1 being the most preferred

INT: READ OUT

| Responses | Rank | CONTINUE |
|--------------------------------|------|-----------------|
| Fish Processing site | | |
| Street Vendor | | |
| Large Market with many vendors | | |
| Supermarket | | |
| Minimarket | | |
| Restaurant | | |
| Other (Specify) | | |

Q18. Do you purchase Keccax from the same person/location on a regular basis?

PROG: / INT : SINGLE MENTION

| Response | Code | Actions |
|----------|------|------------------|
| Yes | 1 | Continue |
| No | 2 | Go to Q22 |

Q19. If yes, can you explain why you purchase from that same person or location?

PROG: / INT: Verbatims

Q20. Can you tell us why you purchase this species of Keccax

PROG: / INT: VERBATIM

Q21. If there is a species of fish you do not purchase, please explain why you do not purchase that species (*If more than one fish is not purchased, enumerator should label respondents response to which labeled fish*).

| |
|--|
| |
|--|

Q22. When purchasing Keccax, please rank in order the factors you deem important with 1 being most important and 11 being the least important. If it is not an important factor you may leave it empty. . **PROG: / INT: RANK FIRST, GIVE THE LEVEL OF IMPORTANCE AFTER / Spontaneous first then after read out the other**

| | RANK | being most important | EVALUATION LEVEL OF IMPORTANCE | | | | | | | | | | being the least important | Other reasons please specify | |
|-----------------|------|----------------------|--------------------------------|---|---|---|---|---|---|---|----|----|---------------------------|------------------------------|--|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | | |
| ___ Color | | | | | | | | | | | | | | | |
| ___ Length | | | | | | | | | | | | | | | |
| ___ Species | | | | | | | | | | | | | | | |
| ___ Price | | | | | | | | | | | | | | | |
| ___ Fatness | | | | | | | | | | | | | | | |
| ___ Smell | | | | | | | | | | | | | | | |
| ___ Oily | | | | | | | | | | | | | | | |
| ___ Cut | | | | | | | | | | | | | | | |
| ___ Taste | | | | | | | | | | | | | | | |
| good quality | | | | | | | | | | | | | | | |
| well-preserved" | | | | | | | | | | | | | | | |
| not spoiled | | | | | | | | | | | | | | | |
| Other Specify | | | | | | | | | | | | | | | |

Q23. Do you have any concerns regarding food safety related to Keccax or Methora that you could tell us about? (please indicate Keccax, Methora, or both).

PROG: / INT : Verbatim

| | |
|--|------------------|
| Food Processing and Food Safety | Responses |
|--|------------------|

| | |
|---|--|
| Have any concerns regarding food safety related to Methora | |
| Have any concerns regarding food safety related to Keccax | |

The following section is regarding food processing and food safety.

READ STATEMENT TO RESPONDENT

Polycyclic aromatic hydrocarbons (PAH) are a group of chemicals that occur whenever a substance is burned. The effects of PAHs on the body are known, some PAHs may cause cancer and may affect the eyes, kidneys, and liver. Humans are most likely to come into contact with PAHs through consumption of food that has been processed by smoking, grilling, braising and other cooking methods. The higher the consumption, more the consumer are exposed.

Q24. Are you aware of PAHs?

PROG: / INT : SINGLE MENTION

| Response | Code | Actions |
|------------|------|-----------|
| Yes | 1 | Go to Q25 |
| No | 2 | Go to Q26 |
| Don't Know | 98 | |

Q25. If yes, where did you hear it from?

PROG: / INT: SINGLE MENTION

INT: READ OUT RESPONSES

| Responses | Code | |
|------------------------|------|-----------------|
| Friend | 1 | CONTINUE |
| Family | 2 | |
| Doctor | 3 | |
| Researcher | 4 | |
| Internet | 5 | |
| TV | 6 | |
| Radio | 7 | |
| Other (Specify) | 99 | |

Q26. After hearing this statement, on a scale of 1 to 10 with one being the least and 10 being the most, how concerned are you with PAH's in your Methora or Keccax?

PROG: / INT: TICK A NOTE ON THE LEVEL OF CONCERN

| | Least Concerned | | | | Some Concerned | | | | | Very Concerned |
|----------------|-----------------|---|---|---|----------------|---|---|---|---|----------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Methora | | | | | | | | | | |
| Keccax | | | | | | | | | | |

Q27. On a scale of 1 to 10 with one being not important and 10 being very important, how important do you think it is that fish processors have ovens that can produce Methora or Keccax with low PAH?

PROG: / INT: TICK A NOTE ON THE LEVEL OF CONCERN

| | Not Important | | | | Important | | | | | Very Important |
|----------------|---------------|---|---|---|-----------|---|---|---|---|----------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Methora | | | | | | | | | | |
| Keccax | | | | | | | | | | |

Q28. If fish processors have newer ovens that can produce Methora or Keccax with low PAH levels, the price will increase to help pay for this new technology. Would you be willing to pay more for a product that contains less PAHs?

PROG: / INT: SINGLE MENTION

| Response | Code | Actions |
|------------|------|----------------------------------|
| Yes | 1 | Go to Q29 |
| No | 2 | Go to section demographic |
| Don't Know | 98 | |

Q29. How much more would you be to pay for a product that has less PAH?

PROG: Ask this question if at S6 ; S7 code = 1 / INT: Specify price they willing want to pay for each product

| Response | Price willing to pay CFA | Actions |
|----------|--------------------------|----------------------------------|
| Methora | | Go to section demographic |
| Keccax | | |

DEMOGRAPHICS

Finally, I am going to ask you a few questions. These are purely for our analytical purposes.

PROG: ASK ALL

Q30. Which of the following best describes your current stage in life? **SINGLE ANSWER**

| | |
|--------------------------|---|
| Single with children | 1 |
| Single without children | 2 |
| Living with a partner | 3 |
| Married without children | 4 |
| Married with children | 5 |
| Divorced / separated | 6 |
| Widowed | 7 |
| Refused | 8 |

Q31. What is your current main work status? **SINGLE ANSWER**

| | |
|---|---|
| You work for someone else only/ employed full time only | 1 |
| Employed full time but with a side hustle / business | 2 |
| Self- employed only / I run my own business / I don't work for anyone | 3 |
| You are studying / student | 4 |
| You are retired | 5 |
| You are unemployed/ do not work | 6 |
| Refused | 8 |

Q32. What would your average net income in a month be? **SINGLE ANSWER**

| | |
|---------------------------------|---|
| Less than 58 000 XOF | 1 |
| From 58580 XOF to 232000 XOF | 2 |
| From 232 580 XOF to 348 000 XOF | 3 |
| From 348 580 XOF to 464 000 XOF | 4 |
| From 464 580 XOF to 579 420 XOF | 5 |
| More than 580 000 XOF | 6 |
| Refused | 8 |

Q33. What is your current level of education? **SINGLE ANSWER**

| | |
|----------------------|---|
| No formal education | 1 |
| Primary education | 2 |
| Secondary education | 3 |
| Diploma/ Certificate | 4 |
| Undergraduate degree | 5 |
| Post-graduate degree | 6 |
| Doctorate | 7 |
| Refused | 8 |

We have come to the end of the interview, thank you for your time