Research article

# Food safety behavioural changes among the population in Sub-Saharan Africa during the COVID-19 first wave

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ABSTRACT

Sub-Saharan Africa (SSA) is known as a region that is highly affected by foodborne illnesses; and like the rest of the world, SSA is also deeply concerned about the COVID-19 pandemic. Despite the risk of infection by the SARS-CoV-2 coronavirus from food products and food packaging being thought to be very low, it does not exclude possibilities of cross-contamination. This study aimed at assessing that risk based on the population's key food safety Knowledge, Attitude, and Practices (KAP) that might be considered important to limit eventual virus propagation. A cross-sectional study consisting of an online survey was carried out between June and July 2020 (during the first wave of COVID-19 in the region). This study was targeted at Sub-Saharan Africans aged at least 18, and 817 participants from 5 developing countries (Cameroon, Ethiopia, Ghana, Kenya, and Nigeria) and South Africa (a middle-income country) were recorded. Most of the respondents appeared to be aware of COVID-19, its symptoms, and the protective measures. The awareness of the pandemic led to a reduction in street foods consumption, a rise in the preference for cooked foods, and a greater awareness of hygiene during food preparation and washing of fruits and vegetables before eating. Females appeared to be more knowledgeable on food safety KAP. Globally, higher KAP scores were revealed as the respondents were mature (age, employment, marital status, household, monthly income) and they were able to make responsible choices. Though the risk of the spread of COVID-19 through food contamination appears limited, efforts need to be made to sensitize the public (especially the most exposed communities) about the challenge behind food safety.

## 1. Introduction

COVID-19 is a respiratory illness caused by the SARS-CoV-2 coronavirus that firstly appeared in December 2019 in China and has been declared a world pandemic since March 2020. The virus was reported to have been originally transmitted from animals (bats) to humans but the main way of transmission is now from human to human via respiratory droplets released when people sneeze, cough, or exhale. Social distancing, as well as regular handwashing, are measures endorsed to control the spread of the disease. Besides, lockdown measures (partial or total) have been generally implemented from one wave to another across the world, thus implying the closure of many economic sectors, but the food supply chain is kept partially functional (Lone and Ahmad, 2020; Salyer et al., 2021) since food is a basic human need. However, food contamination has quite often been reported as the cause of many outbreaks, which is the reason why a certain number of hygienic recommendations and rules have been defined for populations and industries,

respectively. In Vietnam for example, a survey carried out from December 2019 to February 2020 suggested the necessity of a specific communication education strategy for society to improve the compliance with hygiene practices to prevent the spreading of COVID-19 (Nguyen et al., 2021). Indeed, the need for enhancing customers' protection systems, and the capability of inspecting and supervising the food processing progress by local authorities had previously been reported in a cross-sectional survey in 2015 (Nguyen et al., 2018). There is no evidence that food is a likely source or transmission route of COVID-19 (Lacombe et al., 2020; Rizou et al., 2020). However, different scenarios of the contamination may be hypothesized. Coronavirus may reach fresh food products or food packaging through a contaminated person who sneezes or coughs directly on them. The virus could therefore be transmitted shortly afterward via the hands or the food itself to the mucous membranes of the mouth, throat, or eyes (Lacombe et al., 2020; Rizou et al., 2020; Olaimat et al., 2020). As stated during the "International Union of Food Science and Technology/Canadian Institute of Food

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Science and Technology" (IUFoST/CIFST) Extraordinary Scientific Roundtable on COVID-19 and Food Safety in 2020, this COVID-19 crisis shows again the real importance of food safety—good hygiene practices must be respected by consumers as well as food industries. Food handlers (from industry to consumer) should follow the World Health Organization (WHO) Five Keys to Safer Food and especially, hand washing (Moy, 2020). Proper food handling and safety should be practiced before, during, and after preparation or even when eating food. Safely handling foods and cooking at the recommended temperatures are important to prevent foodborne illness (COD, 2019). Africa has been reported as the continent mostly concerned by foodborne diseases, with the highest associated death rates among all ages (Havelaar et al., 2015; World Health Organization, 2015). Foodborne disease outbreaks are quite often reported in Sub-Saharan Africa (Grace, 2015). Most risky foods (as per susceptibility to contamination) are aggregated across food categories, with firstly livestock products (responsible for 67% of the burden), and then fish, vegetables, and fruits (Hoffmann et al., 2017); most of which consumption is quite often recommended to address micronutrient deficiencies, and to boost immunity during the COVID-19 pandemic. Although the risk of infection by the SARS-CoV-2 coronavirus from food products, food packaging, or food carrier bags is thought to be very low (CDC, 2019), it is necessary to note that WHO reported in 2019 that 91 million people in Africa consumed contaminated food per year (i.e food containing harmful bacteria, viruses, parasites or chemical substances) that renders them ill, and around 137,000 people die (World Health Organization, 2019). The possibility of COVID-19 contamination through food can therefore not be completely ruled out. This study was therefore designed to assess populations' key food safety Knowledge, Attitude, and Practices (KAP) in Sub-Saharan Africa in the COVID-19 context and therefore appreciate the cross-contamination risk level.

## 2. Materials and methods

### 2.1. Study design and participants

A cross-sectional study consisting of an online survey based on a self-designed, structured questionnaire was carried out from June to July 2020, the period that marked the COVID-19 first wave in the selected countries. The findings were thereby reported on the 817 responses we received. Only Sub-Saharan Africans aged 18 and above were asked to complete the form. This online survey approach appeared as the most suitable to ensure respondents' safety during the pandemic and for us considering the COVID-19 lockdown measures. Participants were recruited using a snowball approach. The link was sent via emails and other social media platforms (such as WhatsApp and Facebook) to a network of families, friends, colleagues, and students who also shared it with their contacts. The African Nutrition Leadership Programme (ANLP) Alumni Network helped ensure data could be collected across different African countries.

### 2.2. Data collection

Data were collected on respondents' sociodemographic characteristics, their knowledge of COVID-19, and their practices and attitudes relevant to food safety based on a short questionnaire that was drafted to ascertain the risk of COVID-19 cross-contamination through food. Participants were asked to personally assess their home/street and raw/cooked food consumption level compared to before the COVID-19 pandemic, and also to rate their food hygiene practices. The survey was conducted in the main official languages of the selected African countries (French and/or English). The questionnaire was validated/piloted first by 25 people to make sure all the questions were understandable and precise.

### 2.3. Ethical statement

This study was carried out after having obtained an ethical approval from the University of Johannesburg Research and Ethics Committee. All respondents voluntarily completed the online survey form. They were asked to give their online consent before the start of the questionnaire. At that step, it was clearly explained that participation is anonymous, that the data will be used only for research purposes, and that they are free of leaving the questionnaire at any stage without submitting it.

### 2.4. Data analysis

The statistical software SPSS 25.0 (Statistical Package for Social Sciences) was used to analyse the data obtained. Descriptive statistics were first performed. For each respondent, the response given to each question was scored between 0 and 3 (depending on the number of answers/possibilities that were given); the minimum (0) and the maximum (1, 2, or 3) values representing the wrong and the right responses. The total score was therefore calculated from the set of questions that were asked and the value used to compare the food safety knowledge attitudes and practices (KAP) related to COVID-19 among participants. The maximum score that was possible was 15. An Analysis of variance (ANOVA) of this total KAP score with the socio-demographic parameters studied was therefore performed. A p-value $<0.05$ was considered statistically significant.

## 3. Results and discussion

### 3.1. Socio-demographic characteristics of the studied population

The socio-demographic characteristics of the 817 people who took part in the study are presented in Table 1. Among them, 246 were from Cameroon (representing Central Africa); 211 from Nigeria and 57 from Ghana (representing West Africa); 181 from South Africa (representing Southern Africa); 87 from Kenya and 35 from Ethiopia (representing Eastern Africa). This population was constituted of 60.8% of females; 5 races were represented, the highest being the black race. Participants from the Indian, White, Coloured, and Asian races were from South Africa which is a multiracial country. It is well known that young people usually participate more in social surveys compared to old people, the more they are educated the higher the number of responses (Poli et al., 2019; Wagner et al., 2018). This statement was true in this study where 47.9% of participants were aged between 30-49 years old while 41.6% and 10.5% were younger and older, respectively. Most of the participants had a tertiary education level (93.5%) and few had just a secondary education level (6.4%) or less (0.1%) and were either single (54%) or married (47.8%) for the majority. Just 21% were living in a household of 1–2 persons, the other in either 3–5 persons households (56.7%) or above (22.3%). They mostly had a public (32.6%) or private job (40.4%), a minority having informal work (8%) or being unemployed (27.1%). Their monthly income ranged from less than 100USD (23%) to those earning above 500 USD (16.4%).

### 3.2. COVID-19 & food safety KAP

Almost all the study participants were aware of COVID-19, its symptoms, and the recommended preventive measures (Table 2). In fact, between December 2019 when the first COVID-19 cases were reported in Chin et al., 2020 when this study was carried out, COVID-19 was already declared as a pandemic and many sensitization campaigns had been done at both national and international levels to inform populations about precautions to be taken that include hands washing, use of sanitizers, face masks wearing and social distancing. Most of the African countries were going through their first wave of the disease (Lone and Ahmad, 2020; Salyer et al., 2021).

Concerning the food safety aspects, 15.7% of the surveyed populations were not certain of the fact that foods could be vectors of the disease if contaminated. Up to 10.4% even declared this as totally false. As previously mentioned, there is no evidence that food is a likely source or transmission route of COVID-19. However, this hypothesis cannot be

**Table 1.** Socio-demographic characteristics of the surveyed population (N = 817).

| Variable | Frequency (%) | Variable | Frequency (%) | Variable | Frequency (%) |
|---|---|---|---|---|---|
| **Country of residence** | | **Age** | | **People living in the household** | |
| Cameroon | 246 (30.1) | 18–29 | 340 (41.6) | 1–2 | 223 (27.3) |
| Ethiopia | 35 (4.3) | 30–49 | 391 (47.9) | 3–5 | 386 (47.2) |
| Ghana | 57 (7) | 50 and more | 86 (10.5) | 6 or more | 208 (25.5) |
| Kenya | 87 (10.6) | | | | |
| Nigeria | 211 (25.8) | **Educational level** | | **Employment sector** | |
| South Africa | 181 (22.2) | Primary level | 1 (0.1) | Informal | 65 (8) |
| **Gender** | | Secondary school | 52 (6.4) | Private (working for a registered private company or organizations) | 309 (37.8) |
| Female | 497 60.8) | University/Tertiary institution | 764 (93.5) | Public (working for the government) | 222 (27.2) |
| Male | 320 (39.2) | | | Unemployed | 221 (27.1) |
| **Race** | | **Marital status** | | | |
| Asian | 2 (0.2) | Concubined | 8 (1) | **Economic status based on monthly income** | |
| Black | 715 (87.5) | Divorced | 23 (2.8) | Above average (301–500 USD) | 183 (22.4) |
| Coloured | 24 (2.9) | Married | 330 (40.4) | Affluent (>500 USD) | 134 (16.4) |
| Indian | 40 (4.9) | Single | 441 (54) | Average (100–300 USD) | 312 (38.2) |
| White | 36 (4.4) | Widow | 15 (1.8) | Poor (<100 USD) | 188 (23) |

excluded. Indeed, Pung et al. (2020) had already observed in Singapore that a cluster of COVID-19 patients resulted from physical contact and shared food during a conference. Considering this, the food safety attitudes and practices of the studied populations could be positively appreciated. Globally, they were in majority not consuming (31.9%) or less consuming (48.1%) street foods These foods are considered as an important public health concern as it has been identified as sources of many pathogenic microorganisms that pose food safety issues. The sector is not regulated due to its informal nature (Rane, 2011; Alimi, 2016). Cameroon appeared as the country with the highest consumption of these street foods (85.8% of its participants). Self-cooking of foods in hygienic conditions would certainly be recommended. A higher preference for cooked foods has been reported, the rise moving from 51.6% in Central

Africa to 78.7% in Eastern Africa. This suggests a high reduction of the risk in case of food contamination. Chin et al. (2020) described SARS-Cov-2 as being inactivated after a 5 min treatment at 70 °C. The respect of hygienic rules during food preparation and the systematic washing of fruits/vegetables reported by the participants tends to suggest a reduction of the risk of transmission through foods. Despite SARS-Cov-2 has been described as being able to remain infectious at freezing temperature (−20 °C) for even up to 2 years, transmission through frozen food may still be possible. Thorough washing of foods eaten raw as well as hands after is therefore imperative (Moy, 2020).

Table 3 presents the results obtained from the analysis of the correlation between the socio-demographic parameters COVID-19 and the food safety KAP score obtained by the studied population. Only

**Table 2.** COVID-19 & Food safety KAP of the studied population.

| Questions | Answer | Percentage | | | | Total (N = 817) |
|---|---|---|---|---|---|---|
| | | Central Africa (N = 246) | Eastern Africa (N = 122) | Southern Africa (N = 181) | West Africa (N = 268) | |
| Do you know about the coronavirus pandemic (COVID-19)? | No | 0.4% | 2.5% | | 0.7% | 0.7% |
| | Not really | 1.2% | 0.8% | 0.6% | | 0.6% |
| | Yes | 98.4% | 96.7% | 99.4% | 99.3% | 98.7% |
| The main clinical symptoms of COVID-19 are fever, fatigue, dry cough and breath problems | False | 0.8% | | 1.1% | 0.4% | 0.6% |
| | I do not know | 0.4% | | | 0.4% | 0.2% |
| | True | 98.8% | 100.0% | 98.9% | 99.3% | 99.1% |
| The spread of coronavirus can be prevented by proper washing of hands, using sanitizers, wearing face masks and social distancing. | False | | | | | |
| | True | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |
| Foods can be vectors of coronavirus if contaminated before consumption | False | 9.3% | 9.8% | 12.2% | 10.4% | 10.4% |
| | May be | 11.4% | 13.1% | 18.2% | 19.0% | 15.7% |
| | True | 79.3% | 77.0% | 69.6% | 70.5% | 73.9% |
| Consumption of outside/street foods and drinks | I do not consume | 14.2% | 46.7% | 37.6% | 37.7% | 31.9% |
| | Less important | 58.5% | 40.2% | 44.8% | 44.4% | 48.1% |
| | No change | 22.4% | 5.7% | 11.0% | 12.7% | 14.2% |
| | More important | 4.9% | 7.4% | 6.6% | 5.2% | 5.8% |
| Preference/Orientation to cooked foods | Lower | 10.2% | 7.4% | 7.7% | 8.6% | 8.7% |
| | No change | 38.2% | 13.9% | 23.2% | 19.0% | 25.0% |
| | Higher | 51.6% | 78.7% | 69.1% | 72.4% | 66.3% |
| How would you rate your hygiene in food preparation and washing of fruits/vegetables? | Poor | 0.8% | 0.8% | 0.6% | | 0.5% |
| | Average | 18.3% | 7.4% | 7.7% | 3.7% | 9.5% |
| | Very good | 66.7% | 55.7% | 45.9% | 45.1% | 53.4% |
| | Excellent | 14.2% | 36.1% | 45.9% | 51.1% | 36.6% |

Central Africa (Cameroon); Eastern Africa (Ethiopia + Kenya); West Africa (Nigeria + Ghana); Southern Africa (South Africa).

education level did not significantly impact this score. Almost the same score was obtained by subpopulations of people with a secondary education level and those with a university level. This is somehow understandable as hygiene is nowadays taught from childhood. A comparison of the score by region pointed Central Africa represented by Cameroon as having the lowest score. This is similar to the observation made by Odeyemi et al. (2019) who after an international survey observed that Cameroon had the least safety knowledge compared to Ghana and Nigeria. Zorba and Kaptan (2011) reported that men and younger individuals were significantly less interested in food safety issues than women and middle-aged respondents. This was also the case in this study where females had a higher score compared to males, and where the score was rising with the age group. This impact of maturity was confirmed as married, divorced, and widowed people, as well as people having public work or being affluent, had the highest KAP scores concerning marital status, employment sector, and total incomes, respectively. On the opposite, it was those who were single, those living in a household of 1–2 people, those who were unemployed, and those having the lowest monthly income who showed the lowest score. Besides the race also significantly determined the score. People of Indian and coloured races scored better than people of Black and White races.

Foodborne diseases generally go with poverty as it quite often results from the consumption of fresh, perishable foods sold in informal markets like popular unregulated markets (Grace, 2015). Developing countries are more concerned compared to middle-income countries. Recent analysis from WHO and the World Bank shows that food safety is still an African health challenge, the more as many Africans get their food in the informal and subsistence market sectors (Jaffee et al., 2019). The probability of foods also getting infected by the coronavirus and the possible spread of the infection when such foods are handled/consumed should not be undermined. A comparison of the source of foods consumed (Figure 1) tended to show that supermarkets are the main places where the population from South Africa (a middle-income country) gets their foods. In the other countries (developing countries), it was popular informal markets followed by supermarkets or by street resellers in the case of Cameroon. On the other hand, it is rather South Africa that showed the highest food contamination level of the population (Venter et al., 2021). As this country is known to have a regulated food supply chain food, this tends to confirm that the risk of cross-contamination through foods might be considered low. Le et al. (2020) reported that local organizations have a key role to play in epidemic preparedness and response, especially among the most vulnerable groups. As an example, in rural areas, village health workers could be seen as the most suitable persons to promote public health since they have an understanding of lifestyle, and are considered by local populations not just as health professionals but also as neighbours and friends (Tran et al., 2020).

**Table 3.** Change of COVID-19 & Food safety KAP Score with the sociodemographic variables.

| Variable | | Score | | | | ANOVA between groups | | |
|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Minimum | Maximum | Sum of Squares | F | p |
| Region | Central Africa | 11.85 | 1.418 | 8 | 15 | 160.552 | 23.500 | <0.001* |
| | Eastern Africa | 12.92 | 1.492 | 7 | 15 | | | |
| | Southern Africa | 12.67 | 1.657 | 7 | 15 | | | |
| | West Africa | 12.84 | 1.493 | 8 | 15 | | | |
| Gender | Female | 12.71 | 1.554 | 7 | 15 | 48.016 | 19.925 | <0.001* |
| | Male | 12.22 | 1.550 | 7 | 15 | | | |
| Race | Asian | 12.50 | 0.707 | 12 | 13 | 25.793 | 2.636 | 0.033* |
| | Black | 12.48 | 1.552 | 7 | 15 | | | |
| | Coloured | 13.17 | 1.685 | 8 | 15 | | | |
| | Indian | 13.08 | 1.474 | 11 | 15 | | | |
| | White | 12.28 | 1.814 | 8 | 15 | | | |
| Age | 18–29 | 12.26 | 1.507 | 7 | 15 | 57.731 | 12.023 | <0.001* |
| | 30–49 | 12.60 | 1.585 | 7 | 15 | | | |
| | 50 and more | 13.14 | 1.550 | 9 | 15 | | | |
| Education level | Primary level | 15.00 | | 15 | 15 | 6.170 | 1.252 | 0.286 |
| | Secondary school | 12.52 | 1.721 | 7 | 15 | | | |
| | University/Tertiary institution | 12.51 | 1.559 | 7 | 15 | | | |
| Marital status | Concubined | 12.00 | 1.309 | 10 | 14 | 49.579 | 5.129 | <0.001* |
| | Divorced | 13.17 | 1.193 | 10 | 15 | | | |
| | Married | 12.72 | 1.564 | 7 | 15 | | | |
| | Single | 12.32 | 1.568 | 7 | 15 | | | |
| | Widow | 13.20 | 1.521 | 10 | 15 | | | |
| Numbers of people in the household | 1–2 | 12.30 | 1.601 | 8 | 15 | 15.173 | 3.093 | 0.046* |
| | 3–5 | 12.62 | 1.543 | 7 | 15 | | | |
| | 6 or more | 12.55 | 1.572 | 7 | 15 | | | |
| Employment sector | Informal | 12.08 | 1.735 | 8 | 15 | 46.508 | 6.413 | <0.001* |
| | Private | 12.55 | 1.644 | 7 | 15 | | | |
| | Public | 12.83 | 1.406 | 9 | 15 | | | |
| | Unemployed | 12.29 | 1.513 | 7 | 15 | | | |
| Monthly income | Above average (301–500 USD) | 12.54 | 1.550 | 8 | 15 | 42.280 | 5.817 | <0.001* |
| | Affluent (>500 USD) | 12.90 | 1.623 | 7 | 15 | | | |
| | Average (100–300 USD) | 12.55 | 1.504 | 8 | 15 | | | |
| | Poor (<100 USD) | 12.17 | 1.600 | 7 | 15 | | | |

* Parameters with $p < 0.05$ are significant.
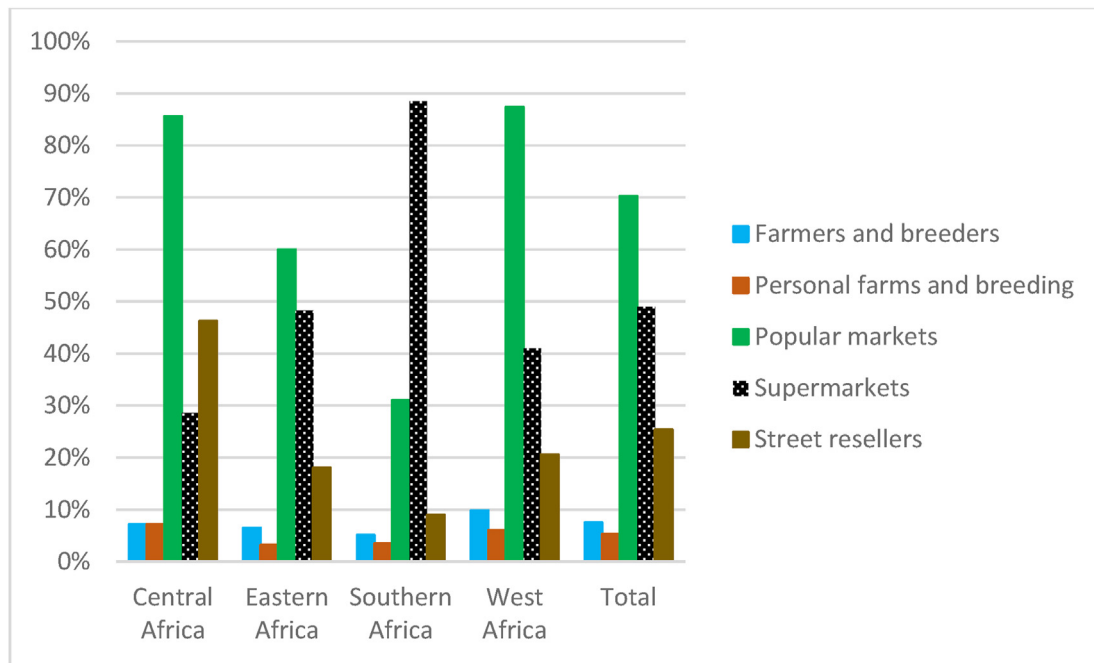
**Figure 1.** Sources of food consumed. *Central Africa (Cameroon); Eastern Africa (Ethiopia + Kenya); West Africa (Nigeria + Ghana); Southern Africa (South Africa)

### 3.3. Limitations of the study

Due to the COVID-19 lockdowns, just an online survey could be carried out which limited the sample size. It was not possible to go on the field and target populations from certain rural/semi-urban regions. Hence, only a particular socio-economic class of people who are educated was covered, and over 77% of them earn above 100USD per month. As known for online surveys, responses given by participants may be difficult to ascertain since they are based on their perceptions.

### 4. Conclusion

From our data, a positive food safety behavioural change among Sub-Saharan African populations was identified during the COVID-19 first wave. This suggests a reduced risk of contracting COVID-19 through better hygienic and food preparation measures. Efforts should still be made to educate and sensitize the most vulnerable populations about the importance and challenges behind food safety, especially in developing countries.

### Declarations

#### Author contribution statement

Alex D. Tchuenchieu Kamgain: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Hema Kesa & Eridiong O. Onyenweaku: Conceived and designed the experiments; Performed the experiments; Contributed reagents, materials, analysis tools or data; Wrote the paper.

#### Data availability statement

Data will be made available on request.

#### Declaration of interests statement

The authors declare no conflict of interest.

#### Additional information

No additional information is available for this paper.

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