

Agri-Food Fraud in a Geographic Area in Relation to Global Health: A Probe into the Perceptions, Knowledge, Attitudes, Practices, and Concerns of Cameroonian

Abstract

Objective: This study probes into the perceptions, knowledge, attitudes, practices, and concerns of Cameroonians on agri-food fraud intra-/inter-Cameroon trade borders about the local and global health of consumers.

Results: Two hundred and two Cameroonians (56% male and 44% female; including business people, entrepreneurs, farmers, students, etc) responded to the online questionnaire. Many participants (81%) were interested in the origin and authenticity of food they consume. Their perception on authentic agri-food product is mostly influenced by feedbacks from other consumers (59%), besides other factors (price/cost, labeling, packaging, and taste). Most participants (58%) sought information about the food products from other consumers (46.4%), in addition to the internet, self-intuition, product labels, and from retailers and suppliers. Participants (54%) considered canned food, fish, red palm oil, honey, spices, milk, meat, palm wine, cookies, wine, brewed, and powdered products to be vulnerable to fraud. Participants specified that intake of authentic food makes consumers healthier (73%) and nurtures confidence in the brand (36%), while dietary exposure to manipulated foods may result in sicknesses (80%), and a decrease in consumers' confidence in the food brand.

Participants think agri-food fraud across Cameroon trade borders is commonplace (91%), as such food products should be bought cautiously (88%). The majority of participants indicated that to ensure the authenticity and safety of food products across the Cameroon trade borders, there is a need for proper regulations and standards (81%), effective traceability systems (69%), technology such as blockchain (48%), and multi-stakeholder collaboration (48%) including international collaborations focusing on shared intelligence (76%), unified food standards

Research Article

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(53%), accompanied by joint inspections (59%) and data exchange (48%). Participants speculated that the global disease burden may be linked to the consumption of manipulated foods (91%). Conclusion: There is speculation on agri-food fraud in Cameroon and across its trade borders. Thus, there is a need for proper agri-food fraud information, education, and communication to improve consumers' awareness and health protection. There is a need for awareness raising on agri-food fraud from multi-stakeholder view-point (e.g. consumer advocacy groups) at national and international levels.

Keywords

Agri-food fraud • Consumer's health • Authenticity • Cameroon • Perception • Knowledge

Introduction

Agri-food fraud is a pressing global policy issue with far-reaching implications for global health, economic stability, food supply chain, and food security (Ehmke et al. 2019). It is situation of “Noncompliance concerning any suspected intentional action by businesses or individuals, to deceive purchasers and gain undue advantage therefrom, in violation of the rules referred to in Article 1(2) of Regulation (EU) 2017/625” (EC, 2017, 2019). Fraud in agri-food commodities is intentional or deliberate for economic gain [1-3]. The act can be described as, but not limited to, adulteration, substitution, counterfeiting, mixing with inferior or substandard products, and mislabelling [4]. Exposure to agri-food products that have been manipulated along its food supply chain may compromise food quality, pose a threat to consumers’ health, and result in a loss of customers’ trust/confidence in the brand, and to an extent on the border and market control systems [5,6]. Incidents of Agri-food fraud in Africa have revealed the intricate web of deceptive practices that span from the farm (production) to the market (processing and trade) making food susceptible to fraud at any stage.

Honey, a highly valued product that is consumed worldwide as a sweetener and medicine, has had a decreased rate of interest and trust because of its vulnerability to adulteration may be adulterated by illegally mixing it with syrups or sugars to increase volume and profitability [7]. The agri-food fraud suspicions report [6], revealed that a majority of suspicions occur at border controls and followed by market controls, with most of the suspicious commodities originating from Africa including shrimps from Senegal (classified as Additives not compliant with EU MLs); sole (fish product) from Gambia (classified as Adulteration (ingredient substitution)); and a series of fruits and vegetables originating from Africa specifically, Egypt (vine leaves, carrots, mandarins, oranges, and strawberries), Kenya (mangetout peas and peppers), Ghana (pineapples), Madagasca (cowpeas), Togo (spinach leaves), and or Uganda (peppers)) viewed as non-compliances (implicit claim violations) classified as residues of pesticides not compliant with EU maximum residue limits. These cases may speculate several unchecked and yet unnoticed agri-food fraud incidences, thus, the need for African nations to consider agri-food fraud detection and vulnerability assessment.

Agri-food fraud may result in both health and economic loss. For example, counterfeiting of dairy products, where fake versions of branded items are sold [8], not only jeopardizes consumer health but also tarnishes the reputation of reputable brands. As the world population continues to grow exponentially, the pressure to meet food demand often leads to the perpetuation of these fraudulent practices. For instance, mislabeling, a prevalent form of food fraud, has shown a concerning escalation, surging from 33% in 2015 to a staggering 47% in 2019 globally [9]. As predicted by the Consumers Brand Association, 2021, food fraud may cost between 10 - 15 billion USD loss to the global food industry hence affecting 10% of all global food products that are being commercially sold [10]. Global health is intricately linked to the authenticity and safety of food products. Agri-food fraud poses a direct threat to public health, as consumers may unknowingly consume sub-standard or adulterated products, exposing themselves to contaminants, allergens, and nutritional deficiencies [3,5,11]. Within the African context, where agriculture plays a central and principal role in many nations’ economies, the issue takes on heightened significance.

In Cameroon, situated at the crossroads of Central and West Africa, understanding the dynamics of agri-food fraud is paramount, not only for domestic concerns but also for its broader implications on global health. On the whole, this investigation on the perceptions, knowledge, attitudes, practices, and concerns of cameroonians on agri-food fraud intra- /inter-Cameroon trade borders (such as the Africa-EU trade border) in relation to the local and global health of consumers cannot be overemphasized. It has provided the first preliminary report connecting agri-food fraud in Cameroon to the health of consumers in Cameroon and consumers at global levels where the manipulated agri-food commodities may find themselves.

Materials and methods

Study area and approach

The survey was conducted in Cameroon both online and face-to-face between August 2023 to September 2023. A multi-stage random sampling method was followed for sampling respondents. At the first stage, respondents were randomly contacted face-to-face from diversified focussed groups such as “Njangi groups”, “food-related business

people”, farmers, etc. In the second stage, respondents were randomly contacted online from amongst the over 200 people and groups on our WhatsApp. At the third stage, those whom we contacted, randomly contacted (online) individuals and groups on their WhatsApp contact list.

Analytical framework

A research instrument consisting of a semi-structured interview/questionnaire was designed in English and translated into French, taking care not to lose any information for data collection. The semi-structured questionnaire is focused on Cameroonian's perceptions, knowledge, attitudes, practices, and concerns towards agri-food fraud intra-/and inter-cameroon trade borders e.g. with the European Union. This questionnaire was later uploaded to google forms. A Google form link to access the Google form and complete the questionnaire was generated. The data were collected face-to-face (in the form of interviews or questions and answers, with proposed answer choices) of the respondents in stage one. For stage two, the interview questions were placed online as a semi-structured questionnaire using google form, and the link was shared with over 200 people and groups on our WhatsApp. At the third stage, those who responded were encouraged to in turn share the questionnaires with those (individuals and groups) on their WhatsApp contact list.

To characterize the socioeconomic backgrounds of respondents, the following variables were assessed: age, education, occupation, and marital status. For perceptions, knowledge, attitudes, practices, and concerns, suitable statements were developed and validated by the field survey data. The respondents were asked to indicate (Yes, or No, or I don't know) the statement that better described them. Each dataset from the face-to-face (in the form of an interview) of the respondents in stage one was entered into the questionnaire through the Google Form link. Data from all the respondents across stages 1, 2, and 3 were directly merged and analyzed online by the Google Form tool. Descriptive statistics, such as frequencies and percentages were calculated directly by the Google Form tool and the results expressed in tables or bar charts.

Results and Discussion

This study was designed to gather information on Cameroonian's perceptions, knowledge, attitudes,

practices, and concerns surrounding agri-food fraud and its potential impacts on consumers' health in Cameroon and on global health scale, when considering that manipulated foods may cross the Cameroon trade borders with other countries/trade areas e.g. the European Union. A total of 202 Cameroonians responded to the online questionnaire between August and September 2023. In terms of participant demographics, the survey exhibited a diverse representation, with 55.5% male and 44.5% female respondents. The age distribution of participants was as follows: 18-25 years (26.3%), 26- 35 years (36.6%), 36-45 years (28.9%), and above 46 years (8.2%). Regarding educational background, 89.7% of participants held a university degree, while 9.3% possessed a high school certificate. The participants represented a range of professional backgrounds, with 33% identifying as students, 20.1% as researchers, 18% as private sector employees, 12.4% as government sector workers, 14% as entrepreneurs, and 9.3% as unemployed. Additionally, 10.3% of participants were involved in import and export activities, while the majority, 85.6%, were not engaged in such trade activities.

Perceptions, knowledge, attitude, and practices on food fraud, authenticity and trust

Global health is threatened by this fraudulent practice which needs to be talked about because of the unbarring consequences. Participant (81.4%) revealed that it is very important to know the origin and authenticity of the food product we consume. This is an appraisal of food authenticity. This aligns with other numerous studies such as [12] who define food authenticity as “the verification process that ensures foods match their label descriptions, including aspects such as geographic origin, production methods, processing technology, and composition.” and [13,14] who emphasized the origin and source of food as a major factor in food authenticity. (Figure 1) shows the percentage of the various factors that influence people to trust the authenticity of the food product they purchase. This data provides valuable insight, as it is essential to delve deeper into the underlying reasons behind these perceptions. While the price/cost, labeling, packaging, and taste influence consumers' perception of a food product being authentic or not, the majority (58.9%) of respondents conclude the food product is authentic or not depending on the results you get after consuming the product (Figure. 1).

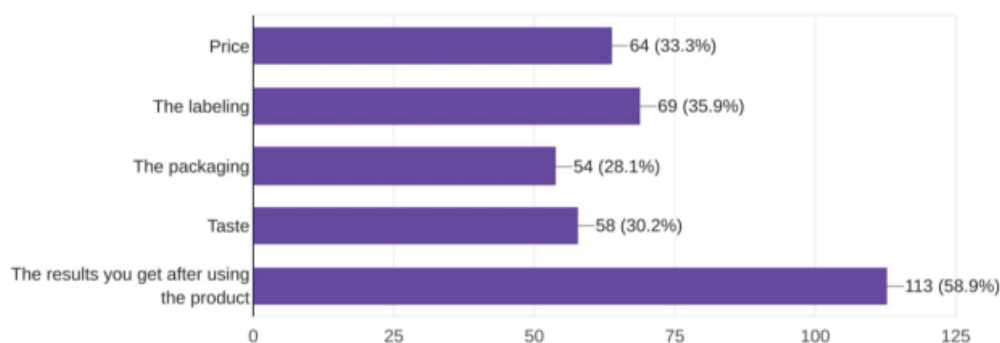


Figure 1. Factors influencing participant's trust in the authenticity of the food products they purchase.

Furthermore, 57.6% of the participants sought information about the authenticity and safety of food they purchase while 43.3% reported not doing so. Participants sought information about the food product from consumers of the product (46.4%), the internet (21.6%), self-intuition (16.5%), and sellers of the product (15.5%) as primary sources. Moreover, participants acknowledged supplementary sources such as suppliers and product labels. The participants specify diverse channels for sourcing information pertinent to the authenticity of food products, which still falls back in identifying the origin of food as an important factor [13,14]. This divergence in consumer behavior underscores the complexity of factors influencing perceptions of food authenticity and highlights the importance of understanding individual preferences and decision-making processes in the context of food purchases. Furthermore, the majority (54.1%) expressed concerns about the authenticity of specific food types, contrasting with 35.1% who did not harbour such concerns, while 10.8% remained uncertain (did not know).

The food types identified by the participants as commonly being manipulated include canned food, fish, red palm oil, honey, spices, milk, meat, palm wine, cookies, wine, brewery products, oils, and powdered products. This was not surprising as most of these food types have been highlighted by [4] as being vulnerable to fraud, e.g. milk being adulterated with melamine to increase the protein content. More to that, the recent EU agri-food suspicions report revealed fish products from Africa [6]. In the case of the vulnerability of red palm oil to fraud, the finding in this current study corroborates with the recent report of [3,15]. Additionally, honey, palm oil, and powder products have been cited by other scholars to be top food types that are prone to fraud [9,16]. This comprehensive list underscores

the diverse range of products that individuals perceive as potentially susceptible to fraud and thus suggests a need for concerns about their authenticity.

Within the context of their consumption habits most of the products in the above list of food types are being consumed on a regular basis by the participants. This then shows to be a major problem as the health of consumers are at stake due to the consumption of food which are likely to be manipulated with harmful products which are detrimental to health. In terms of the impacts of consuming food on health and wellbeing, participants revealed as on (Figure 2a) the advantages of consuming authentic food including it makes consumer healthier (73%) and nurture confidence on the brand (36%). Conversely, consuming inauthentic or manipulated foods may result in sicknesses (80%, Figure 2b) with decrease in confidence of the food brand and increase in frustration (Figure 2A and 2B).

Strategies to address and prevent food fraud risks across trade borders (management)

In response to growing worries about food fraud across international trade borders and its impacts on supply chain integrity, consumer health, industry reputation, and national credibility, recommendations have been proposed to reduce these deceptive practices. Notably, consumer awareness is an important aspect for consideration towards addressing food fraud [1]. In this study (Table 1), majority (>72%) of respondents had heard of something not being normal with some food products especially as the media e.g. from the News. However, there is a need for proper agri-food fraud information, education and communication (proper AFF-IEC), as well as the need for made-effective national legislation to improve consumers' awareness (Table 1).

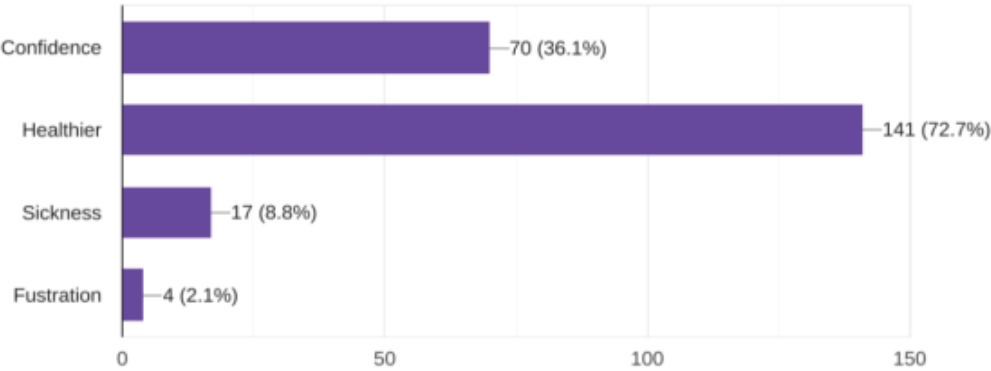


Figure 2A. Effects of authentic food consumption on health and well-being.

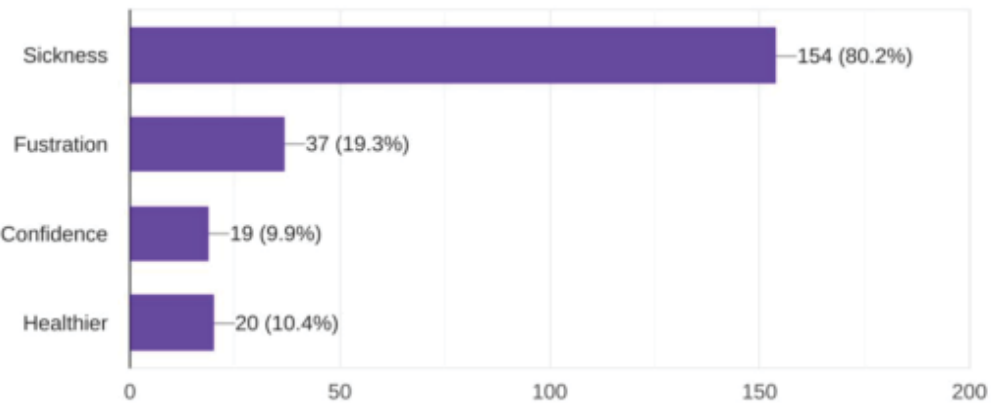


Figure 2B. Impacts of inauthentic food consumption on health and well-being.

	Responses in Percentage		
	Yes	No	I don't know
Have you heard about food fraud or agri-food fraud?	72.7	20.6	6.7
Have you ever encountered or heard about instances of food fraud in the news or media?	81.3	15.5	3.1
Do you know of any consequences or health risks associated with consuming products that have been involved in agri-food fraud?	88.1	9.8	2.1
Do you think there is enough awareness and education about agri-food fraud among consumers?	8.8	85.1	6.2
Do you believe that government regulations are effective in preventing and addressing agri-food fraud?	23.4	66.7	9.9

Table 1. Consumer's awareness of agri-food fraud.

Additionally, participants provided some food fraud practices which they are aware of such as mislabeling (61.1%), counterfeiting (47.2%), adulteration (addition of harmful substances (57%), addition of non-harmful substances to increase the quantity). All these cited malpractices fall in line with what other scholars have reported [4,9,16]. (Table 2) provides a detailed overview of food fraud occurrences

across Cameroon trade borders. This table highlights participants' perceptions of fraudulent practices observed in the Cameroon food trade. Majority of participants think food fraud across Cameroon trade borders either linked to food products crossing the borders as imported or exported food products are commonplace (91%), and 47% of them have at least heard of such malpractices across

	Responses in Percentage		
	Yes	No	I don't know
Do you think fraud can occur on food to be exported or imported?	90.6	3.1	12
Have you heard of any specific instances of food fraud occurring during the import or export of food products between Cameroon and other	47.1	41.9	11
Do you think that food fraud could have different implications when products cross Cameroon borders compared to another country?	59.5	18.9	21.6
Are you familiar with any international regulations or agreements aimed at preventing or addressing food fraud in cross-border trade?	27.1	66	13
Do you think consumers should be more cautious when purchasing food products that have crossed international borders?	88.4	5.3	6.3.

Table 2. Food fraud across trade borders.

the Cameroon trade borders. Participants (88%) advice that we should be more cautious when paying for the food products we buy to eat. There is a need for consumers, but more producers, to be familiarized with the Cameroon Food Safety Framework Law and relevant International Food Laws especially those from trade border countries, and global legislations. These further stresses the need for proper AFF-IEC.

In as much as there is need for proper AFF-IEC, the studied participants suggested some measures (or components of the proper AFF-IEC) that can be implemented to mitigate the risk of consuming adulterated or fraudulent food products in and beyond Cameroon. These measures include sensitization campaigns, enhanced quality control protocols, public awareness initiatives on food fraud, stringent government regulations, imposition of heavy sanctions on food adulterers, enforcement of food laws, rigorous verification processes for imported and exported food products, and the establishment of food detective agencies tasked with detecting and preventing fraudulent practices. According to the participants (Figure 3), in order to ensure the authenticity and safety of food products across the Cameroon borders, there is need for proper

regulations and standards (81%), effective traceability systems (69%), multi-stakeholder collaboration (48%), and technology such as blockchain (48%). This was not strange as blockchain is a driver for sustainability in global food supply chain (Friedman and Ormiston, 2022).

Furthermore, for proper and successful control of the criminal practice of food fraud broadly speaking, there is a need for international collaborations (Figure 4). Participants revealed that there is need for shared intelligence (76%), unified food standards (53%) perhaps within specific geographic sub-regions e.g. Central African sub-regional countries, accompanied by joint inspections (59%) and data exchange (48%). Proper design and implementation of a combination of the above aspects, if not all, may facilitate the interruption of activities of fraudsters across the agri-food network and lead to a common fraud alert system in geographical sub-regions. For example, a Rapid Alert System for Food and Feed to report suspected food fraud cases in and across the African sub-region may be established to raise consumers awareness and contribute towards the mitigation of the malpractice of agri-food fraud – borrowing from the European Commission’s the Rapid Alert System for Food and Feed (RASFF, <https://>

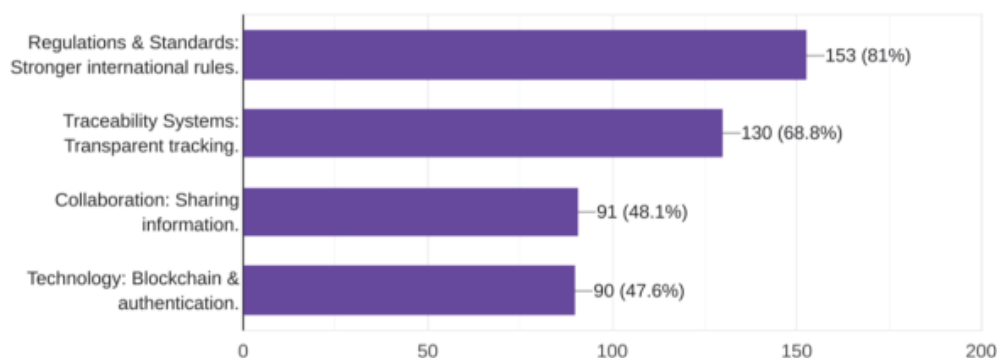


Figure 3. Measures that can ensure food authenticity and safety across Cameroon Tarde borders.

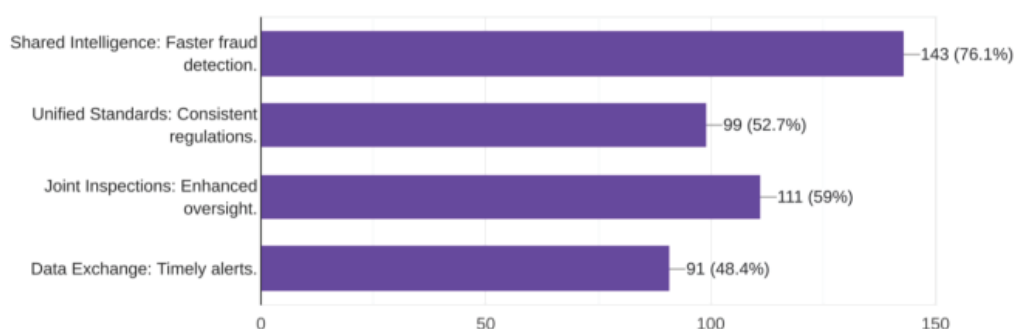


Figure 4. Active international collaboration as a way to mitigate Agri-food fraud.

food.ec.europa.eu/safety/rasff_en) which is used as part of the food safety tools. The first monthly agri-food fraud suspicions report of the European Commission released in January 2024 [6] revealed the majority of suspicions occurred at border controls and then by market controls, with several suspicious commodities originating from Africa (e.g. shrimps from Senegal to Spain) and mostly classified as Additives not compliant with EU maximum limits (MLs). This may only imply that there may be more agri-food fraud situations needing attention. This speculates that “one fraud anywhere may equate to several consumers in one world – the One Fraud to Consumers in One World concept – Abia 2024” (Figure 4).

Agri-food fraud relationship with global health disease and legislations

Participants (81.4%) speculate that the food products that they purchase and which has come from nearby and especially far away producers may be susceptible to some health risk partly due to fraud. This is not strange considering it has been highlighted that there is a need for vigilance when purchasing food products that have traversed international

borders due to the risks it might have on consumer health [17]. Their concerns encompass a range of factors, such as anxieties regarding potential fraud, the desire to ensure the authenticity of purchased foods, and the avoidance of fraudulent products. Furthermore, participants cited concerns about the possibility of adulteration, expiration of products, compromised quality leading to health and environmental risks, regulatory disparities, cultural and labeling differences, supply chain intricacies, limited oversight and traceability, and language barriers. These considerations underscore the multifaceted nature of the challenges posed by food fraud in cross-border trade and emphasize the importance of addressing these issues to safeguard consumer health and confidence.

(Table 3) presents the extent of participants' views on the links between agri-food fraud and global health. Many participants (61%) were familiar with global disease burden and speculated that the global disease burden may partly be linked to consumption of manipulated foods (91%). Therefore, participants assume that ensuring availability of authentic foods to consumers (67%) and providing proper IEC on agri-food fraud and associated

	Responses in Percentage		
	Yes	No	I don't know
Are you familiar with the concept of global disease burden, which refers to the impact of various diseases on populations worldwide?	61.7	27.7	10.6
Do you think that the consumption of adulterated or fraudulent food products could contribute to the prevalence of certain diseases?	91	5.3	3.7
Have you ever considered the potential connection between the authenticity of food products and the prevalence of certain diseases?	69.4	25.3	5.4
In your opinion, can ensuring food authenticity and preventing agri-food fraud contribute to reducing the global burden of diseases?	66.5	25.5	8
Are you aware of any specific instances where consumption of fraudulent or adulterated food products has been linked to the increased prevalence of certain diseases?	59.6	32.4	8
Do you think that raising awareness about the connection between agri-food fraud and disease burden is crucial for public health education	93.5	3.8	2.7

Table 3. Relationship between agri-food fraud and global health.

implications on global health, may in combination, contribute towards the reduction of the global disease burden. Some of the prominent diseases which develop as a result of agri-food fraud between Cameroon trade borders cited by the participants are cancer in particular (77.8%), which is the most prominent diseases to develop from agri-food trade across international trade bodies followed by cardiovascular disease in general (55.6%); diabetes (50.3%); gastrointestinal disease (1.1%); allergies (0.5%); and food poisoning (0.5%). Considering that participants suspected ill-health (or other the health risks) may result when one consumes manipulated (e.g. adulterated) foods, it is important to examine the literature if any such incidence has been reported. Agri-food fraud has been associated with breast cancer and testicular cancer [18]. Consumption of manipulated foods may lead to allergies [9,19]. Cameroon considers food safety issues as a public health concern and thus established a draft Law on food safety (Law No.2018/020 of 11 December 2018 - Framework Law on Food Safety, <https://prc.cm/en/multimedia/documents/6828-law-no-2018-020-of-11->

12-2018-food-safety) bearing 39 sections in 7 chapters. This is a major step and remains very promising from the perspective of ensuring foods and food products available to Cameroonians is in good quality and not manipulated in any way. (Table 4) shows legislation/ Law about agri-food fraud in Cameroon. According to the participants, there is need for more awareness raising on the food safety law, and this may need efforts of the government and also the consumer advocacy groups. Also, to fight food fraud across the food supply chain, there is a need for multi-national stakeholder collaborations along the trade border relations (Table 4).

Altogether, the demographic diversity of respondents, including individuals engaged in import and export activities, students, researchers, and professionals, enhances the representativeness of our findings, providing valuable insights into the interconnected dynamics of intra-/and inter-Cameroon agri-food fraud. Putting together the robust responses from the 202 participants in the multistage semi-structures face-to-face and online survey,

	Responses		
	Yes	No	I don't know
Are you aware of any regulations or laws in your country that address food safety and agri-food fraud prevention?	39.8	46.2	14
Do you believe that stronger international collaboration and harmonization of regulations are necessary to effectively combat agrifood fraud?	88.3	6.4	5.3
Do you think that consumer advocacy groups play a significant role in Advocating for stronger legislation again agri-food fraud?	45.7	34.6	19.7
Are you familiar with any international agreements or organizations that focus on harmonizing regulations and combating agri-food fraud on a global scale?	27.5	65.1	7.4
Would you support more strict regulations and penalties to prevent agri-food fraud, even if it could lead to higher costs for businesses?	92.1	5.2	2.6

Table 4: Legislations in regards to agri-food fraud.

spanning various demographic dimensions, enriched our exploration of perceptions, knowledge, attitudes, practices, and concerns of cameroonians related to agri-food fraud in the specific context of Cameroon and its trade borders. Notably, the survey participants demonstrated a commendable level of awareness and concern about agri-food fraud in Cameroon, as well as on the risks associated with consumption of manipulated foods or food products. This showcases a growing recognition of the importance of food fraud and authenticity in line with food safety.

Conclusion

There is a speculation on agri-food fraud in Cameroon and across its trade borders. This study has showcased a growing recognition of the importance of food fraud and authenticity in line with food safety. There is a need for proper agri-food fraud information, education and communication (proper AFF-IEC), as well as effective national legislations to improved consumers' awareness, and thus protect consumers' health. There is need for more awareness raising on the food safety law, and this may need efforts of the government and also the consumer advocacy groups. Also, to fight food fraud across the food supply chain, there is a need for multi-national stakeholder collaborations along the trade border relations. Proper

design and implementation of a combination of international trade border collaborations (such as shared intelligence, unified food standards perhaps within specific geographic sub-regions e.g. Central African sub-regional countries, accompanied by joint inspections and data exchange), if not all, may facilitate the interruption of activities of fraudsters across the agri-food network and lead to a common fraud alert system in geographical sub-regions. For example, a Rapid Alert System for Food and Feed to report suspected food fraud cases in and across the African sub-region (RASFF-Africa) may be established as part of the food safety tools to raise consumers awareness and contribute towards the mitigation of the malpractice of agri-food fraud. Altogether, ensuring availability of authentic foods to consumers and providing proper IEC on agri-food fraud and associated implications on global health, may in combination, contribute towards the reduction of the global disease burden.

Declaration

- Ethics approval and consent to participate: "Not applicable"
- Consent for publication: "Not applicable"
- Availability of data and materials: "Not applicable"

- Competing interests: “The authors declare that they have no competing interests”
- Funding: “Not applicable”
- Authors’ contributions: “WAA brought the idea and coined and designed the study. WAA and TBP carried out the studies and performed data analysis.
- TBP prepared the draft manuscript and WAA Proofread it. Both TBP and WAA read and approved the final manuscript.”
- Acknowledgements: “All participants of the online survey are highly acknowledged. Thank you”
- Authors’ information (optional).

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