

CONSUMERS' AVERSION TO FOOD SAFETY RISK ASSOCIATED WITH COWPEA STORAGE IN UYO, AKWA IBOM STATE, NIGERIA

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ABSTRACT

When consumers are averse to food risk, they take proactive steps that will eliminate or reduce their exposure to such risks, which in turn can contribute to reducing the global burden of disease. This study assessed consumers' aversion to food safety risk associated with cowpea storage. The analysis used survey data from 120 consumers collected through interviews with the use of questionnaire. Consumers' response to the food hazard information under consideration was analyzed descriptively and the predisposing factors for receiving information and being averse to food risks were analyzed using probit regression. About 22.50% of respondents were implicitly excluded from making informed decisions given that they did not receive the food hazard information. Most respondents (55.91%) who received the information are averse to the associated risks, but majority of those who are averse (92.31%) focused on reducing their risk exposure and the severity of possible health effects rather than eliminating the risk. Also, up to 86% of those who initially exhibited extreme risk avoidance behaviours switched to tolerant ones. These findings highlight the extent to which behaviours are sustained while food hazards at issue may still exist, the importance of ensuring non-exclusivity in disseminating food safety alerts and information, and the need to design consumer focused interventions to ensure safe food consumption pending the strengthening of relevant food safety institutions in developing regions.

Key words: food hazard information, consumer behavior, food risk aversion, cowpea, Nigeria

INTRODUCTION

Cowpea (*Vigna unguiculata* L. Walp), also known as bean, is a lower-cost vital source of protein and other needed nutrients in Nigeria, and therefore an essential part of a nutritious diet for households (Adomi *et al.*, 2023). A major challenge, however, encountered in the cowpea chain is loss in storage due to damage caused by weevil (Bruchid) called *Callosobruchus maculatus* (Ahuchaogu and Ojiako, 2020). In the bid to reduce weevil induced post-harvest loss, cowpea marketers in Nigeria employ various strategies, including the use of aluminum phosphide, organochlorine, organophosphate pesticides, and unconventional pesticides which are not classified or accepted as food preservatives. Residues of these pesticides have been observed in cowpea samples from food markets in the country at various times and, for the accepted ones, at levels exceeding the safe maximum residue limit (MLR) (Ogah *et al.*, 2012; Olufade *et al.*, 2014; Yusuf *et al.*, 2017; Zira *et al.*, 2018; Olutona and Aderemi, 2019; Saheed *et al.*, 2020; Okoye *et al.*, 2021). In the last quarter of 2018, the Consumer Protection Council (CPC) in the country released a memo alerting consumers on the use of unsafe pesticides by marketers to reduce weevil infestation in cowpea (FCCPC, 2018a, b; Premium Times - Nigeria, 2018). The CPC warned of the potential health related hazard of ingesting unsafe pesticides. Such use of

unsafe pesticides or the unsafe use of accepted pesticides and continuous ingestion of foods and drinking of water contaminated with them can have serious health consequences (Thompson *et al.*, 2017; Hongsoibsong *et al.*, 2019; Okoye *et al.*, 2021).

Relevant institutional infrastructures are required to monitor and guard the food supply chain against the introduction of hazardous agents. However, the existing structures are weak, especially as relates to effective regulations in local open markets. Hence, consumers of foods from such markets, which are widespread in the country, are left with no other option than to take the best precautionary action(s) known to them to minimize possible food hazard issues and ensure healthy consumption. Precautionary action(s) taken may either be sustained by consumers who are averse to the risk associated with the storage practice in question until the food hazard issue is fully addressed, or not sustained by other consumers who are more likely to revert to prior consumption patterns while the food hazard still exists. With the existing weak institutional infrastructures, consumers' aversion (which is the basis for sustained precautionary action) and not just immediate responses to food hazards, becomes crucial in safeguarding against public health issues and reducing the global burden of disease, pending the strengthening of such institutions.

Varying responses to food hazard information and food integrity issues are documented in literature. Purchase intentions and consumption have been observed to decrease significantly over an extended period (Peng *et al.*, 2015; Taylor *et al.*, 2016; Law and Cornelsen, 2022) and also short term (Schlenker and Villas-Boas, 2009; Tonsor *et al.*, 2010; Bai and Gong, 2017; Shang and Tonsor, 2017; Carrieri and Principe, 2022) after receiving food safety information or hearing of scandals. This significant decrease may be more pronounced for consumers who the information is targeted at and may also momentarily extend to other commodities which are close substitutes within the same food group (Shimshack *et al.*, 2007; Arnade *et al.*, 2009). Conversely, it has also been observed that consumers exhibit a significant low use of food quality information (Zhang *et al.*, 2019) and are less responsive to public information on food hazard due to perceptions and consumption habits (Verbeke *et al.*, 2007; Cao *et al.*, 2015; Rieger *et al.*, 2016, 2017). Although such information may raise food safety concerns among consumers, the proportion of those concerned may not necessarily match the proportion of those who actually take precautionary actions (Rimal *et al.*, 2008), and sometimes those who respond revert to prior consumption patterns quickly (Dahlgran and Fairchild, 2002; Carrieri and Principe, 2022). Basically, the response of consumers to specific food hazard information or food integrity issues can be to either discontinue consumption (permanently or temporarily) and switch to alternatives, reduce purchase and consumption, use risk relieving strategies, or accept the risk and continue purchase and consumption of the affected food (Roselius, 1971; Yeung and Morris, 2001; Kendall *et al.*, 2019; Law and Cornelsen, 2022). Consumers who choose to take precautionary action(s) will adopt any of the first three responses. Permanently discontinuing consumption and switching to alternative foods can totally eliminate the risk from consuming the affected food, while reducing purchase/ consumption and using risk relieving strategies help reduce the risk, exposure to it, or severity of the possible effect.

Different responses from consumers may stem from varying circumstances. It is possible that poor responses to information on food hazards may improve once a consumer's exposure to such a hazard is known by the consumer (Kariuki and Hoffmann, 2021). It is also possible that more preventive responses may be triggered by the knowledge of immediate adverse health effects (Dahlgran and Fairchild, 2002; Rieger *et al.*, 2016) and other factors. However, this is sparsely known for Nigerian consumers; there is limited research on how consumers respond to specific food safety risks. Nordhagen (2022) also observed the paucity in studies examining specific food safety hazards to be more pronounced, especially when compared to those

addressing general food safety issues. The objective of this study is to provide evidence from Uyo, on consumers' behavioral response and aversion to a specific food hazard, and the factors that predispose consumers to being averse to food hazards as an important step in addressing possible public health issues. The study provides an idea of how consumers interact with food safety information, especially how sustained their behavioral responses to such information are, given the weak regulations in open markets. Findings from this can aid in the design of interventions that address safe food choices and effective food safety alert systems in the country, while taking into consideration her unique food environment.

MATERIALS AND METHODS

Conceptual Approach

Information shared to the public (which includes those shared by consumer protection agencies about marketers' use of unsafe pesticides in cowpea storage) is non-exclusive and non-rival because once disseminated, the suppliers of such information cannot exclude anyone from benefiting from its availability, and it is also easy for the information to be used by others at no extra cost to the additional user (Nicholson and Snyder, 2012, 2016). Despite these characteristics, not all individuals may have heard the information, particularly if the primary mode of disseminating such information may not be accessed or used by all consumers. Hence, three categories of individuals are likely to exist –those who had read/heard the information first-hand either through the agency or media, those to whom the information was relayed by close allies through interpersonal communication, and individuals who have not heard/read the information.

Food hazard information is assumed to be a valuable food safety resource for cowpea consumers and can enable them to make better purchase and consumption decisions in the bid to reduce their exposure to the hazard. Based on the theory of risk aversion and the principle of expected utility maximization, concepts from Goldberg and Roosen (2007) and Bassey *et al.* (2018) are adapted and modified to derive a framework for assessing consumers' aversion to risks associated with cowpea storage after receiving hazard information. Consumers response to the hazard information were considered for two types of risks –that of buying cowpea stored with unsafe pesticide (purchase risk) and the health risk associated with consuming cowpea stored with unsafe pesticides (consumption risk). For both types of risk, a framework is inferred for only consumers who heard/read about the food hazard information either first-hand or relayed, because avoiding risky situations is only possible when individuals are aware such risks exist, but for the second type of risk – consumption risk, the framework is inferred for only those who chose to purchase cowpea after receiving the information.

Aversion to purchase risk associated with the use of unsafe pesticides in cowpea storage

The weak institutional infrastructure for food supply chains and the fact that the use of safe or unsafe weevil loss reduction methods is a credence attribute makes the decision by cowpea marketers to use unsafe pesticides a hidden-action, which cannot be traceable to any particular marketer if there is a public health issue given the large number of smallholder cowpea marketers. Hence, a similar risk probability (r) of purchasing cowpea stored with unsafe pesticide is assumed for all cowpea consumers. The expected outcome for purchasing cowpea is O_{UP} and the expected utility for the consumer is given as:

$$EU [PC_1] = r U(O_{UP}) + (1 - r) U(O_{SP}) \quad (1);$$

where O_{SP} is the expected outcome for purchasing cowpea not stored with unsafe pesticide.

By taking and sustaining precautionary action(s), which incurs some form of cost c (explicit or implicit) and which the consumer expects to be effective, he/she shows his/her unwillingness to accept the risk r . Such action(s) are expected to reduce r to r_o , such that r_o can be zero (0) if action(s) taken totally eliminate r (otherwise, $r > r_o > 0$). Given the precautionary action(s) taken, the consumers expected utility then becomes of the form:

$$EU [PC_2] = r_o U(O_{UP} - c) + (1 - r_o) U(O_{SP} - c) \quad (2).$$

The amount of c is such that in the worst case, the consumer is indifferent between when his expected utility is as given in equation 1 and when it is as given in equation 2. A payment for risk reduction or elimination, such as c , is a function of the extent of risk reduction expected (Bassey *et al.*, 2018). Goldberg and Roosen (2007) showed that such a cost c is increasing in the risk reduction ($r - r_o$). This implies that what the consumer is paying (i.e., the implicit or explicit cost to the consumer) is an indication of the extent to which he/she expects to reduce the risk faced. Hence, when r_o equals zero (0) – indicating the total elimination of r , then c is expected to be greater than it will be when r is merely reduced and $r > r_o > 0$. In turn, the cost of merely reducing r is expected to be greater than it will be when r is accepted and $r = r_o$. That is, $c_{r0} = 0 > c_r > r_o > 0 > c_r$, where $c_{r0} = 0$, $c_r > r_o > 0$ and c_r are the implicit and/or explicit cost of totally eliminating r , reducing r , and accepting r , respectively. Therefore, taking and sustaining precautionary action(s) that totally eliminate the *purchase risk* to zero (0) implies a higher risk reduction cost (c) incurred and an extremely averse consumer.

Aversion to risk associated with consuming cowpea stored with unsafe pesticides

The inability of consumers to determine post-purchase if cowpea purchased was stored by marketers using unsafe pesticides implies that those who purchased cowpea all face a similar risk probability (n) of consuming unsafe cowpea. The framework for this *consumption risk* is similar to the purchase risk scenario discussed previously. The expected outcome for consuming such cowpea is O_{UC} (otherwise, the expected outcome from consuming cowpea free from unsafe storage pesticides is O_{UC}) and the expected utility for the consumer is given as:

$$EU [CC_1] = n U(O_{UC}) + (1 - n) U(O_{SC}) \quad (3)$$

A consumer who is averse¹ to n can try to reduce it to n_o by taking and sustaining precautionary action(s) –i.e., risk relieving measure(s), which incurs some form of cost x . With the precautionary action(s), the expected utility becomes:

$$EU [CC_2] = n U(O_{UC} - x) + (1 - n_o) U(O_{SC} - x) \quad (4)$$

Again, x is an indication of the extent to which consumption risk is expected to be reduced. Therefore, taking and sustaining precautionary action(s) that reduce the consumption risk to n_o implies an averse consumer. Hence, sustained precautionary action(s) at both stages of risk are observables which reveal the unobservable risk aversion of consumers.

Methodology

Survey of consumers and data description

The data for this study are from a 2021 survey of consumers conducted from May to June in Uyo, an urban city and the capital of Akwa Ibom State in the South-South region of Nigeria. To select respondents, a two-stage sampling technique was used. In the first stage, the city was stratified by its major roads and five of the nine major roads were randomly selected. In the second stage, consumers were selected randomly from chosen roads. A total of 120 consumers from the selected roads were interviewed using a questionnaire – 15 in each of two roads selected, 20 in 1, and 35 in each of the remaining two. Respondents were provided information about the study, including voluntary participation, i.e., the freedom to refuse answering any question or opt out at any time. Data obtained from all interviewed consumers were used to assess aversion; however, due to incomplete responses for some explanatory variables, data from 112 of these consumers were eventually used for the probit regression analysis. The questionnaire focused on ascertaining if information on the food hazard in question was received,

¹The assumption of aversion here is hinged on the use of precautionary measure(s) which consumers expect to be effective in reducing risk; it in no way validates the effectiveness of such risk reduction measures, as that is beyond the scope of this study.

determining consumers' awareness of possible health related issues, ascertaining consumers' response and if precautionary action(s) are being taken, and examining consumers' socio-economic characteristics and other contextual details. Post-survey, precautionary actions were classified as purchase based and post-purchase based; purchase based actions were those aimed at reducing the risk of purchasing cowpea stored with unsafe pesticides, while post-purchase based actions were those aimed at reducing the risk associated with consuming such cowpea. Also, consumers who received the food hazard information were classified as averse only if they were still taking precautionary action(s), as extremely averse if the precautionary action employed was to stop consuming cowpea, and as quite averse if they took other precautionary actions apart from stopping consumption. Three set of respondents were observed in the sample – those who had not received the food hazard information in question, those who received the information but are not taking any precautionary action to reduce or eliminate either the purchase or consumption risks (i.e., those not averse), and consumers who are averse (i.e., they are taking precautionary action(s) to either reduce or eliminate the purchase and/or consumption risks).

Estimation method

The structure of the data shows that being averse is only identified for consumers who received the food-hazard information. This necessitates the assessment of the predisposing factors for receiving the food-hazard information in addition to assessing the factors that predispose consumers to being averse. Separate probit models are used for both assessments.

The specification of the equation that assesses factors predisposing consumers to receiving the food hazard information is given as:

$$l_i = x'_{li}\beta_l + \varepsilon_{li} \text{-----} (5)$$

where $l_i = 1$ if the consumer received the food hazard information, otherwise $l_i = 0$. β_l is a (9×1) vector of unknown parameters including an intercept term, x'_{li} is an 8-dimensional row vector of explanatory variables that are expected to predispose consumers to receiving the food hazard information (see Table 1 for variables description), and ε_{li} is the error term of the information equation. This equation is estimated for all respondents.

For the factors predisposing respondents to being averse, the following equation is estimated for only respondents who received the information:

$$v_i^* = x'_{vi}\beta_v + \varepsilon_{vi} \text{-----} (6)$$

where v_i^* is a consumer's aversion and is unobserved.

Given the assumption of observing sustained precautionary action(s) only if a consumer is averse, we observe $v_i = 1$ (precautionary action taken and sustained) if and only if $v_i^* > 0$, and $v_i = 0$ otherwise. With this assumption, it follows that:

$$P\{v_i = 1\} = P\{v_i^* > 0\} = P\{x'_{vi}\beta_v + \varepsilon_{vi} > 0\} (7).$$

For a standard normal distribution of ε_{vi} we have the probit model fully given as:

$$\begin{aligned} v_i^* &= x'_{vi}\beta_v + \varepsilon_{vi}, \varepsilon_{vi} \sim NID(0, 1) \\ v_i &= 1 \text{ if } v_i^* > 0, \text{ and} \\ v_i &= 0 \text{ if } v_i^* = 0 \text{-----} (8); \end{aligned}$$

P is probability, β_v is a (13×1) vector of unknown parameters including an intercept term, x_{vi} is a 12-dimensional row vector of explanatory variables that are expected to predispose consumers to being averse (variables description also provided in Table 1), and ε_{vi} is the error term of the aversion equation.

RESULTS AND DISCUSSION

Consumers' Receipt of Food Hazard Information

The results presented in Table 2 show that about 23% of respondents did not receive the food hazard information on cowpea –either first-hand or as relayed. This implies that food safety alert information does not necessarily reach all consumers. The non-receipt of the information being discussed is of particular concern because the hazard information under discussion was first shared by the CPC over two years prior to this study; yet, until the time of data collection some consumers were implicitly excluded from making informed consumption decisions. Over time, there are usually obvious distributional consequences when certain groups of consumers are unreached with relevant food safety information (Shimshack *et al.*, 2007). The results in Table 3 indicate that the likely consumer groups reached with the food hazard information are those with higher monthly income ($p < 0.10, \beta = 2.07 \times 10^{-6}$), females ($p < 0.05, \beta = -0.87$) and those who allot a low proportion of their monthly food expenditure to cowpea ($p < 0.10, \beta = -1.28$). Low proportion of food expenditure on cowpea implies consumers' access to more food options. Thus, our study shows that consumers with more food options are more predisposed to receiving food hazard information. This seems ironical and worrisome because consumers who need more food hazard information on cowpea (or any particular food) are those who allocate more of their food expenditure to it. More food options may align with more economically endowed consumers, which is also seen (in income) as a significant predisposing factor to receiving the food hazard information in question. The findings suggests that a well-developed food safety alert system should be designed to guard against food-safety-inequalities arising from gender, income or consumption biases; such a design may require strategies for also reaching the male folks and low-income consumers, who may not be predisposed to receiving information via certain mediums.

Table 1: Description and summary statistic of explanatory variables in regression analysis

Variables	Description	Sample mean ^c / (%) ^f (all respondents)	Mean ^e / % ^f (respondents with information)	Mean ^e / (%) ^f (respondents without information)	Mean ^e / (%) ^f (averse respondents)	Mean ^e / (%) ^f (non-averse respondents)
Sex	1 if consumer is male, 0 if female	30.00	27.96	37.04	25.00	31.71
Age	Age of consumer (years)	30.44	30.23	31.19	32.77	27.00
Household size	Number of people in household	4.03	3.98	4.19	4.17	3.76
Marital status	1 if consumer has been married, 0 if never married	39.17	39.78	37.04	28.85	53.66
Monthly income	Consumer's monthly income (₦)	249415.40	286366.70	126244.40	367714.30	189146.30
Cowpea consumption	Proportion of monthly food expenditure spent on cowpea	0.21	0.19	0.26	0.17	0.21
Formal education	Number of years in formal education	13.97	14.25	13.00	14.83	13.51
Market frequency	Number of times grocery shopping is done per month	7.42	7.69	6.48	6.60	9.07
Source of information	1 if consumer received food-hazard information from formal institutions and media, 0 if received from friends, colleagues and others. (only for consumers who received information)	-	43.01	-	42.31	43.90
Information timing	1 if consumer recently received food-hazard information, i.e., less than a year, 0 otherwise (only for consumers who received information)	-	46.24	-	53.85	36.59
Adverse health content	1 if consumer is also aware of adverse health effect(s) associated with unsafe pesticide, 0 otherwise. (only for consumers who received information)	-	66.67	-	69.23	63.41
Information frequency	Number of times consumer has heard/read the food-hazard information. (only for consumers who received information)	-	4.70	-	4.61	4.80

Field Survey (2021); ₦ - Nigerian naira, ^c - continuous and count variables, ^f - categorical variables

Table 2: Information on food hazard and aversion to food risk

Food hazard information	Aversion (based on precautionary action)	Frequency	(%)	Frequency of all those averse	% of all those averse	Frequency of all who received information	% of all who received information
Received	Quite averse (i.e., averts consumption risk)	48.00	92.31 ^b	52.00	55.91 ^a	93.00	77.50 ^c
	Extremely averse (i.e., averts purchase risk)	4.00	7.69 ^b				
	Not averse	41.00	44.09 ^a				
Not received		27.00	22.50 ^c			27.00	22.50 ^c
Total						120.00	100.00

Field Survey (2021); ^a - respondents who received the food hazard information, ^b - averse respondents, ^c - all respondents

Table 3: Probit regression of predisposing factors for receiving food hazard information and being averse to food risk

Explanatory variables	Result for information	Result for aversion
Sex	-0.8738** (0.3407)	-0.4254 (0.3725)
Age	0.0030 (0.0167)	0.0266 (0.0205)
Household size	-0.0968 (0.0789)	-0.0688 (0.0892)
Marital status	0.3765 (0.3974)	-0.0389 (0.4183)
Monthly income	2.07e-06* (1.12e-06)	6.01e-07* (3.64e-07)
Proportion of cowpea consumption	-1.2804* (0.7736)	-0.6998 (1.0611)
Formal education	0.0299 (0.0350)	0.0439 (0.0448)
Market frequency	0.0027 (0.0243)	-0.0293 (0.0239)
Source of information ^g	-	-0.2615 (0.3180)
Information timing ^g	-	0.6886* (0.3615)
Adverse health content ^g	-	0.2462 (0.3289)
Information frequency ^g	-	-0.0699 (0.0521)
Constant ^h	0.7037 (0.7783)	-0.7448 (1.0111)
Number of observations used	112.0000	86.0000
Log likelihood	-51.7048	-50.1388
Probability > χ^2	0.0498	0.1098

** and * indicate the levels of significance at $p < 0.05$ and 0.10 , respectively. Values in parenthesis are standard errors.

^g - only observed if consumer received food hazard information, and relevant only for *aversion* analysis. ^h - intercept

Behavioral Responses to Food Hazard Information

On receiving the information, the response of about 31% of consumers indicates their initial unwillingness to tolerate the risk; these consumers choose to totally eliminate the risk by discontinuing consumption. Conversely, about 25% focused on reducing their exposure to the risk by decreasing consumption while 24% focused on reducing the severity of its possible effect through the use of risk relieving strategies (Table 4). A good proportion (56%) of consumers report that they are still using one or more precautionary actions since receiving the information and are therefore considered averse to the possible food risk (Table 2). This differs from findings of significant low use and low response to food quality and hazard information in other parts of the world (Verbeke *et al.*, 2007; Cao *et al.*, 2015; Rieger *et al.*, 2016, 2017; Zhang *et al.*, 2019). Precautionary actions taken are classified as *purchase based*, which refers to decisions about purchasing cowpea, and *post-purchase based*, which include home storage and meal preparation options

(Table 5). The post-purchase based precautionary actions described by consumers serve as risk relievers and are aimed at reducing consumption risk. Although the effectiveness of the risk relievers identified in this study is not known to be justified by any scientific or technical knowledge, their use by most consumers implies a likelihood of using other science-based relievers once they are known to them.

Consumers' Aversion to Food Risk

Some behavioral responses were sustained while others were discontinued by a number of consumers (Table 4). Of the 31% consumers who responded by initially discontinuing the consumption of cowpea, only about 14% sustained their non-consumption decision. This finding is similar to Carrieri and Principe (2022) and Dahlgran and Fairchild (2002), however, majority (92%) of the consumers who resumed consumption of cowpea did so while taking post-purchase based precautionary actions. The most sustained response by consumers is the use of post-purchase risk relieving measures (Table 5) and

Table 4: Behavioral responses to food hazard information [$n = 93$]

Response	Frequency	(%)
Stopped consuming cowpea without resuming consumption	4.00	4.30
Initially stopped consuming cowpea but resumed consumption while taking post-purchase risk relieving measures	23.00	24.73
Initially stopped consuming cowpea but resumed consumption without taking post-purchase risk relieving measures	2.00	2.15
Reduced quantity of cowpea purchased for consumption while taking post-purchase risk relieving measures	20.00	21.51
Reduced quantity of cowpea purchased for consumption without taking post-purchase risk relieving measures	3.00	3.23
Did not change the pattern of cowpea consumption but started taking post-purchase risk relieving measures	2.00	2.15
Did not change the pattern of cowpea consumption and does not take post-purchase risk relieving measures	39.00	41.94

Field Survey (2021); n - respondents who received the food hazard information

Table 5: Precautionary actions [$n = 52$]

Type of action	Action(s) taken	Frequency*	(%)
Purchase-based	Reduced quantity of cowpea purchased for consumption	23.00	44.23
	Stopped consuming cowpea	4.00	7.69
Post-purchase based (risk relieving measures)	Sun drying	3.00	5.77
	Proper cooking	3.00	5.77
	Washing before cooking	3.00	5.77
	Immersing in hot water before cooking	1.00	1.92
	Parboiling and sieving	29.00	55.77

Field Survey (2021); * - multiple counts reflecting respondents' use of more than one precautionary action, n - averse respondents

the reduction in the quantity of cowpea consumed. Few respondents (7.84%) portrayed extreme aversion by permanently discontinuing the consumption of cowpea as a means of eliminating the food risk. The low number of extremely averse respondents and the high number of those who did not sustain their initial non-consumption decision may highlight the importance of cowpea to consumers and the possible difficulty in completely switching to alternative foods. Meal preparation options are the most used post-purchase risk relieving measures –69.23% (Table 5), of which the burden is borne solely by consumers. The possible difficulty in completely switching foods and the loop-sided burden of the post-purchase based actions can incentivize marketers to continue unsafe practices.

The results in Table 3 show that consumers who received the information recently were more predisposed to being averse than those who received it much earlier ($p < 0.10$, $\beta = 0.69$). This indicates that the consumers who affirmed continuing with precautionary action(s) were those who recently became aware of the information. The finding suggests that in designing food safety alert systems, it is important to ensure that information about potential food hazards remains fore in consumers' minds. Also, higher monthly income is seen to predispose consumers ($p < 0.10$, $\beta = 6.01 \times 10^{-7}$) to being averse; implying that more economically endowed consumers are likely to be health conscious and take precautionary actions against food risks than their respective counterparts. This is expected, given the loop-sided burden and implicit corresponding cost(s) of the key precautionary action(s) taken by consumers.

Other reasons stated by consumers for not taking or sustaining precautionary action are shown in Table 6. The most important are the preference for and nutrition of cowpea. Habits and preferences associated with specific foods have been highlighted in the literature as reasons for being less responsive to public information on food hazard (Verbeke *et al.*, 2007; Cao *et al.*, 2015; Rieger *et al.*, 2016, 2017). It is possible that consumers are unaware of alternative lower-cost sources of essential nutrients proved by cowpea. It is also possible that there are other underlying factors which influence the process of changing food habits despite possible adverse health effects. Further research is needed to fully understand safe food choices, particularly ambivalent behavioral responses despite food hazard information.

Table 6: Reason for not taking precautionary action(s) [$n = 41$]

Reason	Frequency	(%)
Prefers cowpea-based meals	19.00	46.34
Cowpea-based meals are nutritious	7.00	17.07
Doubtful of hazard information	1.00	2.44
Never experienced any adverse effect	3.00	7.32
Affordability	1.00	2.44
Limited food options	1.00	2.44
Religious belief	1.00	2.44
No definite reason	8.00	19.51

Field Survey (2021); n - respondents that are not averse

CONCLUSION

This study looked at how consumers responded to a food hazard information about cowpea storage. The result shows that despite the importance of consumers' receipt of food-hazard information in their decision to take precautionary action, not all consumers received the information in question. Majority of consumers, who received the food hazard information were averse to the related food safety risks, and chose actions that indicated an attempt to either eliminate such risks, reduce exposure to it, or reduce the exposure to possible health effects. Consumers with higher income and those who heard/read about the food hazard information recently (mostly as a repeat) were more predisposed to being averse to the food risks associated with cowpea storage. Income was also an important factor that predisposed consumers to receiving the food hazard information in question. Most consumers, who responded to the hazard information by initially discontinuing consumption, did not sustain their decision.

The results highlight the need for timely and properly disseminated food safety alerts and information to guarantee that consumers are not implicitly excluded from making informed choices about their consumption. Further research may be needed to understand the underlying factors that predispose females and higher income individuals to access food hazard information than their counterparts. Also, the likelihood of consumers discontinuing their risk avoidance decisions or reverting to more tolerating behaviors while the food hazard issue may not have been resolved can impede whatever efforts are being made towards consumer protection. Therefore, in addition to a more robust food safety alert system, consumers need to respond appropriately in order to curb certain practices that violate food integrity which some suppliers engage in. The combination of a thriving food safety alert system and appropriate response by consumers will contribute to providing a more sustainable solution for food safety. Finally, further qualitative based research may be needed to highlight other important factors that explain the decision of consumers who choose not to take precautionary actions, even pro tem.

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