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Awareness and Use of Food Adulterants among Food Vendors and Market Women in the Northern Part of Ghana

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Authors' contributions

The sole author designed, analyzed, interpreted and prepared the manuscript.

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ABSTRACT

Ingestion of unsafe/adulterated foods is on record to have caused devastating health conditions and deaths around the world. Accordingly, an investigation to unearth this revelation is crucial in saving lives. This study, within the context of the Theory of Planned Behaviour investigated the awareness level, affordances and effects of food adulterants from the perspectives of market women and food vendors in the Bolgatanga Municipality. The study employed a sequential explanatory mixed-method design including both questionnaire and semi-structured interview guide in data collection. Using purposive, convenience and simple random sampling techniques, 106 respondents comprising 46 food vendors and 60 market women were sampled for the study. Quantitative data were analyzed using both descriptive and inferential statistics while the qualitative data followed the thematic approach. The study discovered that respondents were moderately aware (3.34±0.82) of the use of food adulterants. Again, factors such as, improve food colour, desire to increase profits, quest to improve food appearance, adding to weight and improvement of taste predominantly trigger food adulteration. Furthermore, the study revealed that food adulterants pose various health threats to consumers as perceived by respondents. Finally, the study established that there was no statistically significant difference between food vendors and market women on their level of awareness on the use of food adulterants

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[t(104)=0.670,p=0.504]. Hence, the study recommends that, the Bolgatanga Municipal Assembly and health directorate should embark on intensive public education campaigns to educate the entire populace to increase awareness levels and improve food safety knowledge to curtail the predominant use of food adulterants.

Keywords: Food, adulterants; adulteration; awareness; improve; use; market; women and vendors.

1. INTRODUCTION

The role of food and its implications for healthy growth and development of an individual has brought to the forefront the need to scrutinize systematically in its quality and consumption. Indeed, over the years, researchers in food and nutrition and public health officials have strongly emphasized the influence of food in ensuring the quality of life, especially in the prevention and management of many chronic conditions [1,2]. Intuitively, it could be said that food could either bolster healthy living by providing all the essential nutrients required by the human body or throttle healthy living by becoming a very dangerous vehicle for transmitting risk factors that trigger foodborne diseases. Hence, the need for careful and very thoughtful consideration in the purchase, selection and consumption of food and food items and products.

The concern and attention given to food safety in Ghana and around the world arises due to the upward trend of foodborne illness incidence rates over the past 20 years both locally [3,4] and internationally [5,6]. Scallan et al., [7] paint a very frightening statistics from the United States of America when they reported that out of the 9.4 million incidences of foodborne illness caused by 31 major pathogens, there were 55, 961 hospitalizations and 1,351 deaths. Hassan and Dimassi [8] unveil that the addition of unsafe food adulterants and poor food safety practices results in diarrheal diseases accounting for 1.8 million deaths annually. The Center for Disease Control and Prevention of the United States of America (USA) indicated that an estimated 48 million foodborne illnesses are recorded annually, out of which 128,000 results in hospitalizations and 3,000 results in the death of victims [6]. According to [9], foodborne illnesses recorded 1.3 million cases with 21,000 hospitalizations and 5000 deaths yearly in the United States. Khuluse [10] reported that 22% and 54% of foodborne outbreaks in Europe paints another astounding indication that there is the cause to worry in terms of food safety and consumption. Hence, food which is eaten with all intents and purposes of nourishing the body with the requisite nutrients is also on record to have caused devastating consequences leading to many deaths around the world.

In Bangladesh, it is reported that nearly 30 million people are affected by food-borne diseases annually [11]. Likewise, [12] have disclosed that food-borne epidemics which relates to the incidence where two or more cases of a similar illness resulting from the ingestion of common food are common in South Africa but the recording of information is limited. In Ghana, [13] revealed that the adulteration of branded prepackaged palm oil products with Sudan IV dye was determined to be 60%. This available evidence suggests that food adulterants can have serious consequences on public health and safety, and therefore, an affront to individual wellbeing. Accordingly, [14] opined that food safety is a worry and should be given the needed attention as it poses risks to the population, especially to vulnerable groups such as infants and young children, elderly individuals and those with immunodeficiency disorder.

The preceding discussion has demonstrated that food adulteration is a worldwide problem that can have significant public health and safety implications. It is an incongruous practice with a spectrum of adulterated food products including all but not limited to milk products, fruit juices, confectionery, oils, flour and meat products. It should be noted that adulteration of food may occur at any point along the food production chain before it reaches the end consumer. Unadulterated food may be considered safe for consumption because it could be free from chemical, biological or physical hazards that may result in ailments or even death to the consumers. In essence, it is crucial for stakeholders to outline conditions and measures that are necessary along the food production chain to ensure that it is safe, sound and fit for human consumption.

Food adulterants refer to those additives and substances that are not only unwanted by consumers but also makes food unsafe or sub-standard and may cause adverse health

consequences ranging from acute symptoms such as abdominal pain, vomiting, asthma, headache, mental retardation, cardiac arrest and chronic effects such as cancers [15]. Food adulteration, therefore, relates to the act of degrading the quality of food offered for sale either by the admixture or substitution by inferior substances or by the removal of some valuable ingredient [16]. Research has shown that food adulteration is a contentious matter in public discourse that has unintentional and/or intentional connotations. This view is held by [17] that unintentional adulteration includes naturally occurring substandard foods, due to lack of rainfall, drought, poor storage condition, etc. Intentional adulteration, on the other hand, is done with the intent to defraud or cheat the consumers. Generally, food adulteration is an unacceptable practice that could be best observed as unlawful in food safety guidelines worldwide. Though the food products that could be adulterated vary from country to country, it ranges from food products such as dairy, fruit juices, confectionery products, oils, and flour and meat products [13]. Though adulteration can be spontaneous, it is elective adulteration that induces major ethical and health debates [16]. Therefore, this paper operationalizes food adulteration as the one that is voluntary and induced.

Literature highlights several push factors behind the practice of food adulteration. One of the factors is the quest to improve profits. [1] noted that adulterants may be deliberately added to food products to increase profit margins. These authors further disclosed that the additions of food adulterants are among other things to increase visible quantities and reduce manufacturing costs. In a study on the laws of food adulteration, Nielsen [18] observed that apart from dishonesty on the part of traders to make quick and easy money, there was also evidence of loopholes in the implementation and strict adherence food adulteration act in many part of the world. The laxity and delay in prosecuting offenders is the reason behind the upsurge of food adulteration. In investigating consumer attitudes towards nutritional labelling, [19] uncovered that ignorance on the part of the consumers regarding their right and responsibilities towards food adulteration results in faulty buying practices, as only 59% of consumers can understand food labelling. According to [20], apart from improving the taste and increase in weight leading to profits, food adulteration is done by unscrupulous persons to improve food appearance. [21] found factors such as financial gains, enhancement of food colour, preservative and as a substitute as a cheaper food component to be the motivation factors driving food adulteration. Food is adulterated primarily in order to make it appealing, to disguise the effects of the use of non-wholesome ingredients, to enhance organoleptic properties and to safeguard nutritional properties; thus, food adulteration gives economic benefits to those who participate in it [13]. With these findings in mind, researchers and food and nutrition practitioners can begin to identify what promotes food adulteration in specific settings. This study intends to investigate the extent of the truth of the factors outlined in the literature review in the study area.

Having understood the affordances behind the practice of food adulteration, researchers have investigated the level of awareness of the practice of food adulteration among the general population around the world so as to mitigate the impact of food adulteration. A study conducted by [22] established that rural and urban households consumers in Ogun State, Nigeria exhibited a low level of awareness and knowledge on food safety practices and foodborne illnesses. The study exhibited significant relationships between the level of awareness of foodborne illnesses and associated complications between rural and urban household consumers. Besides, there was an association between respondent's marital status and knowledge of food safety and practices. It is inferred from these studies that the residency of consumers and marital status matter in determining consumers' level of awareness of food safety practices. Contrary to this finding, the result by [23] study which examined awareness regarding food safety and consumer protection, and reported a moderate level of awareness of food safety in which about 60% of women had knowledge about common food adulterants and around 45% were aware that food adulteration is harmful to health. Additionally, the study also disclosed that around 62.5% of women accepted that they very often have experienced food adulteration. Besides, the study also revealed that literate women were more aware in comparison with illiterate women awareness level of food adulteration.

In another study, it was revealed that most women had a high level of awareness on food adulteration and safety practices at Rae Bareli District of Northern India [24]. On their part, [25]

discovered that most families in the Udupi Taluk, Karnataka, District of India, had moderate knowledge on food adulteration with a significant association of knowledge score on food adulteration with age and educational status of the respondents. Therefore, these scholars concluded that age and educational status of women can be viewed as being highly crucial in knowing the level of awareness of women towards food adulteration. The availability of contradictory findings suggests that further studies are required to investigate the level of awareness among consumers especially market women and food vendors in different settings to provide targeted support to those who might be at risk.

Besides, while some studies have been conducted on food adulteration and food safety practices of consumers and foo vendors in some parts of the world, such study is rare in the Bolgatanga Municipality of Ghana. Additionally, findings from different studies of the world have indicated that certain background factors could be crucial in determining the level of awareness of food adulteration. It is interesting to note that irrespective of the background characteristics, the general populations are still at risk of experiencing food adulteration either intentional or unintentional. This study, therefore, adds to literature on market women and food vendors perceptions on the level of awareness of food adulteration.

Researchers have continually explored the health risks of food adulteration as it is linked to many diseases ranging from mild to life threatening conditions such as vision and liver problems, skin and stomach disorders like diarrhoea, dysentery and vomiting [26]. Additionally, it has also been observed that the use of adulterants like seed powder or tamarind can cause diarrhoea as a close substitute for coffee powder causes serious diarrhoea [27]. Life frightening effects such as pepticulcers, colon, liver diseases like cirrhosis and liver failure, heart diseases, a blood disorder, bone marrow abnormality and kidney damage as well as fertility-related challenges have been observed due to adulterants like colouring dyes, calcium carbide, urea, burnt engine oil and sometimes even due to excess amount of permitted preservatives [26]. Accordingly, researchers are urged to conduct studies to expose some food adulteration practices which have dire consequences on consumers.

Having realized the health risk and consequences of food adulterants, it has become necessary to question the level of awareness especially among food vendors and market women on food adulteration by exploring their perception on its use. Researchers are convinced that being aware and the ability to detect food adulterants is the first and crucial step to go in reducing and falling prey to the health risk of food adulteration. To this end, [28] believes that the majority of the foodborne illnesses could be averted if food handlers such as food vendors and market women were knowledgeable in safe food handling, and customers are informed appropriately in the choices of food and food handling. Singh et al. [29] support this claim when they observed that lack of awareness leads to spread of adulterants and various communicable diseases through the food system. Vasanthakalaam [30] maintain that awareness of consumers is crucial in preventing food adulteration as unawareness and unfair market behaviour might endanger consumer health.

Consequently, countries including Ghana seem to be battle-ready in combating food adulteration by investing a large amount of resources in ensuring food safety practices to engender less food adulteration. For instance, state agencies such as the Food and Drugs Authority (FDA), Public Health Units or Environmental Health Department of various Metropolitan, Municipal and District Assemblies (MMDAs) have all instituted rules and regulation to control and regulate the activities of food vendors in all food system in order to safeguard the provision of safe food to consumers. These they do by regulations such as food vendors having medical report annually, using protective clothing such as hair restraints, hand gloves etc., showing and actually displaying general cleanliness and ensuring adequate insects control in food preparation areas in order to protect food contamination among others [31,32]. However, the increasing reports of instances of food adulteration is more than enough indication of inadequate surveillance and testing protocols by the Ghanaian regulatory institutions. [13] exposé of palm oil being adulterated with Sudan IV dye of about 60% in Accra coupled with 420,000 cases reported per year of food adulteration which is linked to an annual death rate estimated at 65,000 costing some US$ 69 million to the Ghanaian economy [33] are all justifications for the need to investigate accordingly the level of awareness of food

vendors and market women on food adulteration in specific settings in Ghana. Although the general population of Ghana seems to have some information on food adulterants, it appears there is still insufficient understanding of the general awareness of market women and food vendors on food adulterants, affordances and the effects of adulterants on the human population in Ghana. This study, therefore, attempts to fill this gap by investigating the level of awareness among market women and food vendors on the use of food adulterants in the Bolgatanga Municipality of Ghana.

Large-scale comparative international and national surveys continue to show that there is a surge in the ingestion of adulterated food and food products contaminated with microorganisms or chemicals. According to the [34], an average of 10,000-20,000 persons per 1,000,000 of the world's population suffer yearly from foodborne diseases from ingesting adulterated food items in developing countries. Even though Ghana is yet to have sentinel sites or any documented surveillance system for foodborne diseases [4], statistics from the [35] indicated that 420,000 cases of foodborne diseases are recorded in the outpatient departments of Ghana annually with death estimate of about 65,000 at a total cost of US$69 million to the Ghanaian economy. In arguing for the push factors behind the surge in foodborne diseases emanating from the ingestion of adulterated food items, [4] recount poor personal hygiene, poor sanitation, attitudes toward food hygiene and overcrowding. These push factors resonate with most market environment situations in the Bolgatanga municipality where this study was carried out.

Besides, in Ghana, it has been observed that many citizens fear that with no empirical data on the range of food products adulterated, the rising cases of food adulteration where food products adulterated comprise but not limited to powdered pepper, groundnut paste, fruits and milled melon seeds otherwise known as 'Agushie' [13,33] could not actually safeguard public health and safety. Apart from the dearth of literature concerning the awareness and use of food adulterants from the perspectives of market women and food vendors in the Bolgatanga municipality, the choice of Bolgatanga municipality for this study was informed by the fact that the municipality is a major hub for the sale of food commodities such as beans, millets, maize, yam, meat, gari, groundnut paste and other spices and herbs in the Northern enclave of Ghana. Considering the potential impact this could have on food safety and potential adulteration, it seemed crucial that the use of food adulterants as experienced by food handlers particularly food vendors and market women are continuously researched.

The following research questions guided the study:

1. What is the level of awareness on the use of food adulterants among food vendors and market women in the Bolgatanga Municipality?
2. What factors influence the use of food adulterants among food vendors and market women in the Bolgantanga Municipality?
3. What are the perception of food vendors and market women in the Bolgantanga Municipality on the effects of food adulterants on consumers?
4. To what extent do the factors (adding to weight, improving taste, cheaper substitute, increased profit, serving as preservative, improving food appearance, and improving food colour) predict food adulteration in the Bolgatanga Municipality?

The study also tested this hypothesis:

H_0: There is no statistically significant difference between food vendors and market women on their level of awareness on the use of food adulterants in the Bolgatanga Municipality.

H_1: There is a statistically significant difference between food vendors and market women on their level of awareness on the use of food adulterants in the Bolgatanga Municipality.

The researcher hopes that the findings of the study would have theoretical, methodological, and practical significance. In respect to the theoretical significance, the findings of this study would provide a more scientific perspective on the affordances behind the practice of food adulteration. It is hoped that the findings of the study when published would inform the general population on the awareness and use of food adulteration. Practically, it is envisaged that the findings of the study when published would create awareness and bring to light the effects of the practice of food adulteration so that measures are implemented to discourage the practice of food adulteration. This would lead to

promoting food safety practices among the general population so that foodborne diseases among the general population are reduced. Methodologically, the findings of the study would provide insights in employing the clinical research approaches in studying the link between foodborne diseases and ingestion of certain food products.

1.1 Theoretical Framework

This study utilized the Theory of Planned Behaviour (TPB) postulated by Icek Ajzen [36]. TPB remains one of the finest blueprints in understanding human behaviour which is an array of subjective probabilities such as beliefs and attitudes. The main thrust of the Theory of Planned Behaviour is that human actions and preferences are rooted in three kinds of beliefs: behavioral, normative and control beliefs. A behavioral belief, a person's belief about the outcomes of a behavior, generates the individual's attitude toward the behavior. Normative belief, which relates to a person's perception of how a behavior will be adjudicated by significant others, produces a subjective norm. Control belief refers to a person's perception of the control he/she has over the behavior, which is linked to perceived behavioral control [36]. TPB operates on the assumption that there are strong interconnections and interrelationships between attitudes, beliefs and behaviour regarding consumer preferences. The theory maintains that consumer's behavioural intention is occasioned by his/her attitudes and beliefs. Thus, behaviour of market women and food vendors towards food adulterants would determine their attitudes and beliefs towards identifying food adulteration practices. TPB in spite of its popularity as a theory in understanding consumer preferences has not been largely linked to food vendors and market women awareness level relative to food adulterants. Hence, TPB was deemed as an appropriate theoretical lens for the study since the study sought to measure the awareness level of market women and food vendors. Besides, their view on the factors and effects of the use of food adulteration is contingent on their level of awareness which is the main thrust of the theory that the nexus between attitudes, beliefs and behaviour.

2. METHODOLOGY

This study adopted the pragmatist paradigm by employing the sequential explanatory mixed-method design in which both quantitative and qualitative data were collected and analyzed. The pragmatist's stance is informed by the fact that neither quantitative nor the qualitative approach only is adequate to give a complete picture of the phenomenon. Hence, the combination of both the qualitative and quantitative approach avoids the shortcomings of using a single approach by augmenting survey questionnaire with an interview component to enhance the validity of the findings [37]. Using the purposive, simple random and convenience sampling techniques, 106 participants comprising 46 food vendors and 60 market women were sampled and participated in the study. A self-designed questionnaire and semi-structured interview guide were the main instruments used for the study.

The food adulteration questionnaire which consisted of four (4) sections, A, B, C, D had 23-items 9 items measuring awareness level, 7 items measuring factors influencing the use and 7 items measuring the effect of food adulteration based on a 5-point Likert scale such that 1= Strongly Disagree, 2= Disagree, 3= Undecided, 4= Agree, and 5= Strongly Agree. Using Cronbach alpha coefficient, the food adulteration questionnaire had reliability coefficient of 0.86, 0.84 and 0.88 for awareness, factors and effects respectively. Six respondents were involved in the qualitative phase of the study (3 market women and 3 food vendors) based on the recommendation by [38]. According to [38] for qualitative studies, samples are typically small and based on the information needed. The semi-structured interview was one-on-one and allowed the researcher to focus on the research questions, yet open up new avenues for further probing to unearth important issues as proposed by Ary et al. [39]. With permission from the participants, the conversations were audiotaped to ensure a more accurate data representation during transcription and analysis. The appropriateness of an interview in this study is put forward by [37] when he maintained that it allows exploration of variables under investigation in greater detail, and so complements a survey. The quantitative data were entered into the SPSS and explored to identify missing data and outliers. Descriptive statistics (mean, standard deviations) and inferential statistics (independent samples t-test, multiple regression) were employed to answer the research questions and formulated hypothesis at 0.05 alpha level while the qualitative data was analyzed thematically.

3. RESULTS AND DISCUSSION

3.1 What is the Level of Awareness on the Use of Food Adulterants among Food Vendors and Market Women in the Bolgatanga Municipality?

This research question investigated the respondents' level of awareness on the use of food adulterants. In analyzing this research question, mean and standard deviation were calculated to determine the perceived level of awareness of food adulterants such that mean<2.50 indicated low awareness, 2.50≥mean<3.50 showed moderate awareness, and mean≥3.50 indicated high awareness. The results of the analysis are presented in Table 1.

Table 1. Respondents level of awareness on the use of food adulterants

	Statements	Mean ±SD	Awareness level
1.	Food adulterants are those substances which are used in food products making the food unsafe for human consumption.	4.13±0.66	High Awareness
2.	Food products are said to be adulterated if their quality is adversely affected by adding any substance which is injurious to health or by abstracting a nutritious substance.	4.10±0.70	High Awareness
3.	I am aware of these adulterants intentionally added to food; colouring agents, starch, Pepper oil, injectable dyes etc.	3.93±0.72	High Awareness
4.	Food adulterants do not add any nutritional value to food	3.86±0.68	High Awareness
5.	I can identify adulterated food	3.44±0.55	Moderate Awareness
6.	I am aware of these adulterants incidentally added to food; like pesticide residues, larvae in foods, droppings of rodents.	3.32±1.00	Moderate Awareness
7.	Despite the health hazards of food adulterants, it is still used to maximize profit.	2.51±1.11	Moderate Awareness
8.	Food-stuffs sold are mainly adulterated by the producers before being handed over to retailers	2.44±0.84	Low Awareness
9.	Adulterated foods are not healthy but are very common on the market	2.36±1.16	Low Awareness
	Overall awareness level	3.34±0.82	Moderate awareness

The information in Table 1 disclosed that respondents had varying levels of awareness concerning the various statements aimed at knowing their awareness level on food adulteration. Particularly, the findings showed that respondents exhibited high awareness (4.13±0.66) when they agreed that food adulterants are those substances which are used in food products making the food unsafe for human consumption. Similarly, the respondents recorded a high awareness level (4.10±0.70) when they agreed that food products are said to be adulterated if their quality is adversely affected by adding any substance which is injurious to health or by abstracting a nutritious substance. Again, respondents had a high awareness level (3.93±0.72) to the fact that adulterants such as coloring agents, starch, pepper oil, injectable dyes, etc are intentionally added to food. Besides, respondents had moderate awareness level as they agreed to they being able to identify adulterated foods (4.47±0.67), being aware of the fact that adulterants are incidentally added to food like pesticide residues, larvae in foods, droppings of rodents (3.32±1.00) and the fact that despite the health hazards of food adulterants, it is still used to maximize profit (2.51±1.11). However, the findings in Table 1 again disclosed that respondents had low awareness and actually disagreed to the fact that food stuff they use and sell are already adulterated by the producers before they either buy or sell them (2.44±0.84) and finally, the respondents also had low awareness and disagreed to the fact that food adulterants are not healthy (2.36±1.16).

Review of results in Table 1 has revealed that the overall level of awareness of food adulterants (3.34±0.82) indicated that generally, the respondents had a moderate level of awareness on the use of food adulterants. Based on the 5-point Likert scale used for the data where the mean/average is 3.0, it could be noticed that the responses to the statement were above average indicating that they strongly agreed to most of the statements which disclosed that they generally have a moderate level of awareness on food adulterants.

The qualitative data explored the views of the respondents on their level of awareness on the use of food adulterants. In uncovering their awareness level a market woman remarked:

''I know about the use of food adulterants but I know that it doesn't cause any harm so I use it often. 'Hmmm' am saying this because what I add to what I sell is so common to us and we eat it in our homes so it is not bad at all. I sell groundnut paste and after milling, it gets too thickened so I mostly add vegetable oil to it to make it thinner a bit or else I will run at a loss because the groundnut is sometimes expensive especially when there is poor harvest.''

Another market woman said;

''I am very much aware of the use of food adulterants and of course, we are all in for money so for me I will not wait to run at a loss while I can buy something small just to make a profit. So for me, I add adulterant 'paa'(often) to what I sell. I have added just a little and please mind my word ' I said just a little' dried grounded cola nut to my powdered pepper for the past 9 years selling at the market and my customers keep coming no one is dead so why should I worry.''

Views from a food vendor's perspective also revealed similar thoughts;

''I am extremely careful when it comes to preparing food for people to eat. I have been a food vendor for a very long time and when it comes to adding of adulterant, that I don't use because I know and I have heard that it is not healthful at all. The only thing I add to my dishes prepared is spices (maggie, badia complete season, remie spice). I once heard that these sold spices contain monosodium glutamate but I don't know how true that is.''

It could be inferred from the above views that respondents were aware of the use of food adulterants but while some maintain being aware and admitting that the practice could be harmful, some did not have any evidential proof of any harmful effect on consumer's health.

The finding from research question one agrees with the study of [23] study in India where market women reported a moderate level of awareness of food safety in which about 60% of women had knowledge about common food adulterants and around 45.00% were aware that food adulteration is harmful to health. The finding of the study also concurs with [25] where they discovered that most families in the Udupi Taluk, Karnataka, District of India, had moderate knowledge of food adulteration. However, the findings of research question one disagrees with the findings from the study by [22] who discovered that rural and urban households consumers in Ogun State, Nigeria exhibited a low level of awareness and knowledge on food safety practices and foodborne illnesses. The findings emanating from this study imply that both market women and food vendors have knowledge about the practice and the affordances leading to food adulteration as well as the potential dangers associated with the phenomenon of food adulteration in the Bolgatanga Municipality.

3.2 What Factors Influence the use of Food Adulterants among Food Vendors and Market Women in the Bolgantanga Municipality?

This research question sought to solicit the views of the participants on the factors that influence the use of food adulterants. Based on the review of literature, factors such as improvement in food colour, increased profit, improved appearance, increased weight and taste, serving as a preservative and a substitute for a cheaper component were outlined and investigated. The results are presented in Table 2.

Table 2. Factors influencing the use of food adulterants (N=106)

Factors	Mean ±SD
1. Improve Food Colour	3.29±0.95
2. Increased Profit	3.26±0.97
3. Improve Food Appearance	3.13±1.08
4. Add to Weight	3.12±1.22
5. Improve taste	3.06±1.11
6. Serve as Preservative	2.99±1.07
7. Substitute as a cheaper component	2.65±1.22

The information in Table 2 reveal that the respondents perceived all the factors highlighted in this study to be influencing the use of food adulterants. However, the participants rated highest on improving food colour (3.29±0.95), followed by the quest to increase profits (3.26±0.97), improve food appearance (3.13±1.08), adding to weight (3.12±1.22), improved taste (3.06±1.11), serving as preservative (2.99±1.07) while serves as a substitute for a cheaper component (2.65±1.22) was the least preferred measure. From these results, it could be observed that improving food colour, increased profits, improving food appearance, adding to the weight and improving the taste were the major factors influencing food adulteration in the study area.

From the analysis of the interview data, it was discovered that market women and food vendors were influenced by a number of factors on the use of food adulterants as revealed in the quantitative data. In unveiling some of the factors, a food vendor disclosed that:

''When I use saltpetre powder in preparing the 'waakye' I sell, it gives it a good texture and colour, aside reducing the cooking time of the beans and makes it so attractive for people to think that there are enough beans making it look entirely different from that of my competitors. Customers always prefer my 'waakye' and they queue for it because they claim it has an exclusive taste from the others''

Another food vendor shared a similar view;

''I add just a little yellow food colour to the braised rice I sell just to make it attractive, when customers see it they mostly presume it is turmeric powder being added and since most people are very aware of the health benefits of turmeric so they tend to buy from me because I prepare it so well that, aside its attractiveness it tastes good too.''

A market woman expressed her sentiment;
''Any time I go to the mill to mill my maize, I witness some pepper sellers adding dried cola nut and sometimes some red colour to their pepper for bulk and colour but my sister it is not my job to expose them. I do what is best for me so do they, just that I am very cautious I don't buy from them and don't allow my close relations to do same.''

While some market women and food vendors accentuate that colour appeal, increase in weight and great appearance highly trigger the use of food adulterants others were influenced by some other factors which are outlined below;

''It had been a norm over the years thus adding wheat flour to milk powder in preparing ice cream to make it creamier and thicker making customer convinced there is enough milk. This is just an alternative to adding more milk knowing very well that milk is expensive, then, I gain a substitute for money. I learnt this skill from my sister who sells ice-cream at Accra and I decided to practice and use as a trade here. The taste is enhanced as well because I also add coconut extract to it.''

Another vendor expressed a similar view;

''For me, I don't add anything to my honey. It is pure and those who buy from me testify to that. I am very much aware of honey being adulterated. I know some honey producers add caramel and I am able to test the originality on my own so I don't buy from them because I don't want to loose customers. Again, to gain profit some honey sellers buy the original and add caramel or even melted foam to them but still sell them very expensive to gain profit because customers cannot really figure out the differences, it looks very similar unless subjected to honey testing.

So those who sell that type really gain than us. I tried selling some years back and it almost collapsed my business so I stopped.''

The results from research question 2 clearly buttresses the findings of previous studies [21,13,20], apart from improving the taste and increase in weight leading to profits, food adulteration is usually practised to improve food appearance, a means for financial gains, enhance food colour, serving as a preservative and also as a substitute as a cheaper food component. However, the finding of this study seems to suggest that both market women and food vendors are not oblivious of the push factors behind the phenomenon of food adulteration as it is the case by [19] study in Nigeria who revealed that ignorance on the part of the consumers regarding their right and responsibilities towards food adulteration accounts for the increasing instances of food adulteration.

3.3 What are the Perception of Food Vendors and Market Women in the Bolgantanga Municipality on the Effects of Food Adulterants Usage?

The third research question investigated the perception of food vendors and market women in the Bolgatanga Municipality on the effects of food adulterants on consumers. The result of this research question is shown in Table 3.

Table 3. Perceived effects of food adulterants on consumers

Statements	mean ±SD
1. Food adulterants are said to shorten the life span of consumers	4.18±0.45
2. Food adulterants pose threat to the health of consumers when eaten on a regular basis	4.08±0.65
3. Food adulterants, when used in larger quantities, may cause liver damage, cancer or respiratory tract infection	3.50±1.11
4. Food adulterants may cause allergies to consumers when used in excess	3.40±0.99
5. In men, the constant use of some chemical food adulterants may interfere with the ability of males to impregnate their wives	3.30±0.62
6. Food adulterants interfere with the normal developmental stages of consumers	3.25±1.06
7. The constant use of some food adulterants may delay conception and childbirth in women	3.13±0.73

Accordingly, the information in Table 3 revealed that the participants perceived all the effects highlighted in this study to be the consequences of food adulteration. Nonetheless, the participants rated highest on shortening the lifespan of consumers (4.18±0.45), followed by health threat of consumers when taken regularly (4.08±0.65), then causing liver damage, cancer and respiratory tract infections (3.50±1.11), followed by causing allergies to consumers (3.40±0.99), and again fertility challenges for men (3.30±0.62), developmental challenges on consumers (3.25±1.06) while fertility challenges for women (3.13±0.73) was the least rated among the outlined effects. From these results, it could be observed that dire consequences such as liver damage, cancer or respiratory tract infections, shortening lifespan and food allergies are some of the effects of food adulteration.

The qualitative analysis also revealed the perception of some market women and food vendors on the effects of food adulterants' usage on consumers' health and their views are captured in the opinion below:

''In fact, some of the food adulterants are very harmful to health like the addition of chalk powder to sugar or the addition of Sudan dye to palm oil so me as for that ''de3'' I wouldn't add but for adding cornflour to groundnut paste I don't think is bad so that is what I do. I will say some people are aware even though we do not do it in the open but they still buy.''

Another market woman had this view;

''For me, I sell palm oil, I buy and sell I do not produce it myself. I have heard producers add Sudan dye or sometimes red food colour to palm oil which is harmful to health but because I cannot test it to be sure, I buy it like that to sell but those who produce always assure us that theirs is original and I believe them for their word because I have done business with them for a very long time and I am not ready to destroy that relationship.''

A food vendor also had this to say;

''I sell 'waakye' and I use saltpetre powder in preparing it to get good texture and colour. I heard it some time ago that saltpetre shouldn't be consumed in large quantity because it can cause headaches so I just use a very little quantity for my food and I do not think it is causing any harm to any consumer of mine because I still have more customers.''

Another view alludes to the fact that knowing what is safest and the right quantity of food adulterant to use is the key and this is observed in the statement below:

''For adulterants is all about knowing the safest to use and the right quantity to add to your product. If you get to know this then there is no problem adding it to your product if it wouldn't harm anyone and after all, I also eat what I sell so if it will harm then I will have been a victim too.''

The finding of this study concurs with the revelation that the effect of the practice of food adulteration lies in life terrifying diseases such as peptic ulcers, colon disease, liver diseases like cirrhosis and liver failure, heart diseases, blood disorder, bone marrow abnormality and kidney damage as well as fertility-related challenges emanating from the use of adulterants such as colouring dyes, calcium carbide, urea, and burnt engine oil [26]. These findings implied both market women and food vendors are conscious of the negative consequences emanating from the practice of food adulteration and that they can identify some illnesses and diseases to the ingestion of certain adulterants.

3.4 To What Extent Does the Factors (Adding to Weight, Improving Taste, Cheaper Substitute, Increased Profit, Serving as Preservative, Improving Food Appearance, and Improving Food Colour) Predict Food Adulteration in the Bolgatanga Municipality?

This research question sort to find out to what extent do the factors such as adding to weight, improving taste, cheaper substitute, increased profit, serving as preservative, improving food appearance, and improving food colour predict the adulteration of food items in the Bolgatanga Municipality. Multiple regression was employed in analysing this research question and the results are presented in Table 4 and 5.

Table 4. Model summary of multiple regression results for factors influencing food adulteration

Model	R	R square	Ajusted R square	Std.error of the estimate	Change Statistics				
					R square CHANGE	F change	df1	df2	Sig. F Change
1	0.849[a]	0.720	0.700	0.252	0.720	36.021	7	98	0.000

a. Predictors: (Constant), Adding to weight, improving taste, cheaper substitute, increased profit, serving as preservative, improving food appearance, improving food colour
b. Dependent Variable: Food Adulteration

The multiple regression results in Table 4 revealed that factors such as adding to weight, improving taste, cheaper substitute, increased profit, serving as preservative, improved food appearance, improvement in food colour collectively accounted for 72% to adulteration which was considered to be statistically significant [$F(7, 98) = 36.021$, $p<0.05$].

This result implied that other factors which were not included in this study were responsible for 28% influence on food adulteration.

Table 5. ANOVA results for factors influencing food adulteration

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	16.072	7	2.296	36.021	0.000[b]
	Residual	6.247	98	0.064		
	Total	22.319	105			

a. Dependent Variable: Food Adulteration
b. Predictors: (Constant), Adding to weight, Improving taste, cheaper substitute, Increased profit, Serve as preservative, Improving food appearance, Improving food colour

Based on these results, it was evident that together, these factors were good predictors of food adulteration among market women and food vendor in the Bolgatanga Municipality. The study further examined the influence of each predictor to food adulteration, and the results are presented in Table 6.

Table 6. Standardized and unstandardized coefficients for factors influencing the use of food adulteration

Model		Unstandardized coefficients		Standardized coefficients			Collinearity statistics	
		B	Std. error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	2.065	0.102		20.233	0.000		
	Improve food colour	0.120	0.072	0.247	1.661	0.100	0.129	7.731
	Improve food appearance	0.179	0.044	0.419	4.042	0.000	0.266	3.758
	Serve as preservative	0.048	0.039	0.112	1.248	0.215	0.353	2.833
	Cheaper substitute	0.076	0.025	0.201	3.080	0.003	0.673	1.487
	Improve taste	-0.055	0.028	-0.134	-1.983	0.040	0.628	1.591
	Add to weight	-0.046	0.039	-0.120	-1.182	0.038	0.276	3.621

A dependent variable: Food adulteration

The results in Table 6 show that out of the seven factors, increased profit (β=0.187, t=1.738, p<0.05), improve food appearance (β=0.419, t=4.042, p<0.05), cheaper substitute (β=0.201, t=0.003, p<0.05), improve taste (β=-0.134, t=-1.983, p<0.05), and adding to weight (β=-1.182, t=0.038, p<0.05) individually contributed significantly to food adulteration while the contribution of improve food colour (β=0.247, t=1.661, p>0.05), whereas serving as a preservative (β=0.112, t=1.248, p>0.05) were not significant. Based on these findings, it is concluded that increased profit, improve food appearance, cheaper substitute, improve taste, and adding to weight were the major factors that influenced the use of food adulteration among food vendors and market women in the Bolgatanga Municipality. These findings confirmed the results of previous studies like [25] and [6] who cited similar factors as determinants and precursors behind the practice of food adulteration. The point is made from these findings that attempts at improving the food safety practices need to take into consideration all these factors so that a holistic approach is adopted to address the human induce and deliberate practice of the phenomenon of food adulteration. It is interesting to note that the market women and food vendors themselves are required to demonstrate key commitment in ensuring safe practices.

3.5 Test of the Study's Hypothesis

H_0: There is no statistically significant difference between food vendors and market women on their level of awareness of food adulterants in the Bolgatanga Municipality.

H_1: There is a statistically significant difference between food vendors and market women on their level of awareness on the use of food adulterants in the Bolgatanga Municipality.

To answer this hypothesis, the independent samples t-test was employed, and the results are presented in Table 7.

Table 7. Independent samples t-test results for nature of participants and awareness of food adulterants

	Nature of participants	Mean ±SD	t	df	Sig. (2-tailed)
Awareness of Food Adulterants	Food Vendors	3.38±0.41	0.670	104	0.504
	Market Women	3.32±0.50			

It could be seen from the results in Table 7 that food vendors had a higher mean score (3.38±0.41) than market women (3.32±0.50). However, the t-test results indicated that there was no statistically significant difference in the awareness level on the use of food adulterants among food vendors and market women [t (104) = 0.670, p=0.504, 2-tailed] at 0.05 alpha level. Therefore, the null hypothesis that there is no statistically significant difference between food vendors and market women on their level of awareness on the use of food adulterants in the Bolgatanga Municipality was supported whereas the alternative hypothesis was not supported.

4. CONCLUSION

Generally, the study showed that food adulteration is a common phenomenon which is perpetuated with several intents and purposes triggering several effects on human health. Even though market women and food vendors demonstrated having moderate/fair awareness on the use of adulterants being added to food items, they are not oblivious of the affordances of the phenomenon of adulterants being added to food items. Admittedly, both market women and food vendors indicated the quest to increase profit margins, improving food colour, taste and appearance and adding to weight were the common reasons advanced to be the push factors behind adding adulterants to food items.

Hence, the study concludes that, when the awareness level of market women and food vendors on the use of food adulterants are enhanced, it will result in better food safety practices.

5. RECOMMENDATION

The study, therefore recommended that besides stringent supervision in the various market, the Bolgatanga Municipal Assembly and health directorate should embark on serious health education to increase awareness level of market women and food vendors to improve food safety knowledge for healthy food consumption among the general population in the Bolgatanga Municipality. Again, the Regional Division of Food and Drugs Authority and Ghana Standards Authority should organize random checks by way of clinical trials of food items particularly known to be often adulterated and administer very serious punitive measures to deter the perpetrators of this unsafe food practices.

The study again recommends that, the public health department of the municipality together with the radio stations should embark on intensive public education campaigns to educate the entire dwellers of Bolgatanga Municipality on the negative consequences of consuming adulterated food items to curtail this unhealthy practice. Market women and food vendors should be made aware by the Municipal Health Directorate of the gains they are likely to derive from their commitment towards ensuring food safety and the dangers associated with the ingestion of adulterated foods and food items to help stop the deliberate practice of food adulteration.

DISCLAIMER

The products used for this research are commonly and predominantly use products in my area of research and country. There is absolutely

no conflict of interest between the author and producers of the products because I do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the author.

CONSENT AND ETHICAL APPROVAL

All ethical consideration underlying research such as confidentiality, anonymity, informed consent, respect for persons and trustworthiness criteria were addressed in the study.

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COMPETING INTERESTS

Author has declared that no competing interests exist.

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