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Original Research Article

Consumer Awareness on Food Adulteration Practices on the Market and its Challenges

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Abstract: Food adulteration has been a problem since the dawn of civilization because it not only lowers the quality of food but also has various negative health impacts. Value evaluation and ensuring consumer protection from fraudulent activities both involve authentic testing of food and adulteration detection of various food products. This study examined consumer's awareness of food adulteration practices on the market and its challenges. The study sampled 240 shoppers at the Takoradi main in Ghana. The study revealed that though food adulteration has received a lot of media attention, most consumers still lacked a lot of knowledge on what constitutes an adulterant and how to detect it at the household level. Various adulteration practices such as poor handling and packaging of fresh products, excessive use of artificial flavouring and colouring substances, misuse of food additives among others were found to be very common on the market. Challenges of food adulteration such as the lack of adequate technology to detect adulterants in food as well as consumers awareness of procedures to lodge complaints pertaining adulteration were also found. Consumers and food regulatory agencies were hence admonished to ensure that the necessary protocols are followed whenever issues concerning food adulteration occurs.

Keywords: Food adulteration, food adulterants, consumer awareness, food regulatory agencies, Ghana.

INTRODUCTION

One of the most basic needs for every living being is food. Food is mainly composed of liquid and solid substances for the provision of materials such as heat, and energy for performing different functions in the body (Foskett *et al*., 2021). Food is one of the most complicated sets of chemicals and plays an important role in the promotion of health and disease prevention. These items are mostly adulterated putting consumers health at risk.

Food adulterants are chemical substances added to foods either intentionally or unintentionally which decreases the value of the food and renders it unwholesome for human consumption (Rees, 2020). These items are added to foods to increase volume, gain profit, increase shelf life (El-Loly, Mansour and Ahmed, 2013) , improve appearance (Ayza and Yilma, 2014) among others. The usage of adulterants has been common in societies with few legal controls on food quality and hence poor or even nonexistent monitoring by authorities.

Food adulteration can cause serious effects on human health without the knowledge of the person (Choudrhary *et al*., 2020). Food adulteration is defined as a dishonest act or omission related to the sale or preparation of food which is intended to generate personal economic benefit or damage to a third party (Fassam and Dani, 2017). This term is normally used to define the failure of a food product to follow the hygiene rules legally. Food adulteration can take several forms such as the addition, substitution, or removal of certain items to/in/from foods (Banti, 2020). This practice decreases food quality and lowers the dietary ingredient of food that presents a significant or unreasonable risk of illness or disease to the consumer. It also ultimately deceives the consumer. The severity of food adulteration is that the composition of the adulterants, and the mode of its addition to food items are known by only the perpetrators putting the consumer at a risk.

Most consumers according to findings by Anita & Neetu (2013); Faraz *et al*, (2013); Hossain (2018) are aware of the incidence of food adulteration

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on the market and its potential effects but lack knowledge on how to detect it at the household level. On the other hand, other studies (Gautam & Singh, 2016; Harsha *et al*., 2013; Nasreen & Ahmed, 2014) found that though food adulteration has received a lot of media attention, most consumers are still deficient on what constitutes an adulterant and the types of food commonly adulterated. Literature on food adulteration and its detection methods (Attrey, 2017; Banerjee *et al*., 2017; Schieber, 2018; Spink, 2014), highlights new measures and approaches to efficiently and effectively counter the ever growing menace. These measures according to Al-Mamun *et al*., (2018), are necessary since it not only exposes these fraudulent activities on the part of food producers and sellers but also equip consumers with knowledge on its detection.

Food fraud in Ghana has become a growing public concern with increasing instances of different adulterants found in foods (Sulley & Amankwah, 2020). These practices according to research findings (Abayase *et al*., 2022; Mohammed *et al*., 2019; Gonu *et al*., 2015) highlights the need for food control officers to put in more efforts in the fight against this menace. The Food and Drugs Authority established under the Food and Drugs Law, 1992 (PNDCL 305B) to regulate and control the circulation of safe food and the Ghana Standard Authority (GSA) exist to ensure food products found on the market conform to quality and safety standards required of foods before it gets to the consumer. Section 16 of Ghana's criminal code Act 29/1960 states that; 'An intent to defraud means an intent to cause, by means of such forgery, falsification or other unlawful act, any gain capable of being measured in money, or the possibility of any such gain, to any person at the expense of any other person'. This statute means that any activity carried out with the intention of deceiving another is a crime. This means that when food is fraudulently marketed to deceive the consumer, typically for financial benefit, it is illegal. Food adulteration in Ghana is increasing at an alarming rate but the challenge is that most of these cases are not reported (Sulley *et al*., 2023). This has led to inaccurate statistics on food adulteration in the country. Every Ghanaian citizen has the right to know what is involved in the production, processing, packaging, labelling and sale of food found on the market. Unfortunately, this knowledge is very limited leaving consumers at the mercy of these fraudulent individuals (Essuman *et al*, 2022). This paper seeks to highlight consumers awareness of food adulteration practices on the Takoradi main market. It also addresses the common food items adulterated, the reasons for adulteration and the challenges of food adulteration.

MATERIAL AND METHODS

Questionnaire Development and Measurement

A questionnaire comprising both open and close ended type questions was designed and pretested by the researchers. The questionnaire centered on respondents' demographics, knowledge on food adulteration, the different food adulteration practices occurring on the market and the challenges of food adulteration. Measurement items used in this research were adopted from previous studies.

Items for measuring respondents' knowledge on food adulteration contained eight questions and was derived from Essuman *et al*., (2022) and Oti, (2021). Items on the different food adulteration practices occurring on the market were derived from Kpodo, (1989). The authors assessed the challenges of food adulteration using five items adopted from Sulley *et al*., (2023)

Sample and Data Collection

A cross-sectional survey was conducted on consumers based on the study's purpose at Takoradi main market. The target populations were consumers found buying food items at the Takoradi main market. A total of 240 respondents (18 years and above) were conveniently sampled out of an estimated 300 leaving the response rate at 90%. Respondents were informed of the voluntary nature of the study hence only willing participants were used in the study. The questionnaire was administered personally to consumers and collected by the researchers. The items in the question were translated into the local language (Fante) for those respondents who could not read, and their responses collated by the researchers. The data collection took place in May 2023.

Data Analysis

The data collected was analyzed with the use of SPSS. A summary of the processed data into percentages and frequency tables was conducted by descriptive statistics. Most of the respondents (63.3%) were females and 45% were between the ages 21 to 29 years.

RESULTS

Awareness of Food Adulteration Practices on the Market

Consumers used in the study (80%) had knowledge about food adulteration practices on the market. 65% mentioned they were fully informed of the different food adulterants used by traders. Their responses on how they received this information yielded varying responses from Table 1. Results from the study however showed that, most of them (75.8%) had no knowledge on how to detect an adulterated food from an unadulterated one. 95.4% had also experienced food adulteration before with 67% admitting they knew the impact of food adulteration on the individual. Most (63%) mentioned they were not aware food items sold without government certification might be adulterated with 68% stressing their lack of knowledge on the fact that some of the adulterants used in food can be harmful to human health.

Table 1: Awareness of Consumers Regarding Food Adulteration Practices on the Market

Awareness	Response	Frequency	Percentage
Do you have any knowledge about food adulteration?	Yes	48	20
	No	192	80
Do you have information about any common food adulterants on the market?	Yes	84	35
	No	156	65
How did you come by this knowledge?	Personal	28	11.7
	Observations	52	21.6
	Through the media	96	40.0
	Relatives	64	26.7
Do you have knowledge on how to detect an adulterated food from an unadulterated one?	Yes	58	24.2
	No	182	75.8
Have you ever experienced food adulteration before?	Yes	229	95.4
	No	11	4.6
Are you aware of the impact of food adulteration on the individual?	Yes	80	33
	No	160	67
Did you know that food items sold without government certification might be adulterated?	Yes	88	37
	No	152	63
Are you aware some of these adulterants used in food can be harmful to our health?	Yes	76	32
	No	164	68

Different Food Adulteration Practices, Food Item Adulterated and Reason for Adulteration.

Various adulterants are commonly used in food with the aim of obtaining different attributes of food quality. These substances which are mostly vegetable proteins (soybean, cassava, potato, yucca, or wheat), are also major sources of allergens (Manning & Soon, 2016). Respondents used in the study were tasked to provide some common food products commonly adulterated and the reasons/incidence for/of adulteration. These responses were compiled under major headings by the researchers and are provided in Table 2. The headings include poor food safety systems which generated such practices as the sale of rotten fruits and vegetables, stale pastries, bread, cakes, poor preparation and service of street foods, poor storage of canned and tinned foods for varying reasons.

Other adulteration practices such as poor harvesting and drying system occurs in most foods at the farm level. This the respondents mentioned food items such as beans, maize, millet, cowpeas, local rice, groundnuts, and fresh vegetables (cabbage, lettuce, carrot, spinach, broccoli, parsley, cucumber). Polishing of fruits such as apples and grapes with artificial nail polish, spraying of lettuce and other green leafy vegetables all account for poor handling and packaging of fresh products as mentioned by respondents. The excessive use of artificial flavouring substances such as the addition of syrup and colour to fresh fruit juice, molasses to honey, starch, wheat/rice powder to ice cream among others were found to be very rampant on the market of late.

Table 2: Food adulteration practices

Food Adulteration Practice	Common Food Item(S)/ Category Adulterated	Incidence of or Reason for Adulteration
Poor food safety systems	1. Fresh vegetables and fruits, bread, pastry products. 2. Canned products 3. Vegetable salads, cooked foods for sale 4. Smoked fish and meat	1. Stale or rotten products 2. Expired/low standard items 3. Poor hygienic means of preparation and service
Poor harvesting and drying systems	1. Beans, maize, millet, cowpeas, groundnuts, local rice. 2. Fresh vegetables such as carrots, cabbage, lettuce, parsley, celery, cucumber, cauliflower.	1. Presence of rodent's droppings, larvae, weevils, and or addition/presence of stones and twigs to make bulky 2. Presence/addition of pesticide residue as part of the cultivation process to protect it from pests/prolong its lifespan
Poor handling and packaging of fresh products	1. Apples, grapes, guava, kiwi, dragon fruit, passion fruit. 2. Lettuce, parsley, celery, cabbage, cucumber. 3. Mango, pineapple, banana,	1. Coating with wax/ dipping in copper sulphate to make it glossy and fresh looking. 2. Spraying with chemicals to make it look fresh and glossy 3. Addition of calcium carbide for artificial ripening

	fresh tomatoes, ripe plantain	
Excessive use of artificial flavoring substances	1. Honey 2. Fresh fruit juice 3. Ice cream 4. Cakes/bread	1. Addition of molasses, burnt foam, starch to increase volume 2. Addition of syrup and fruit concentrate to make it bulky and sweet. 3. Addition of starch, rice powder, corn flour to thicken it 4. Addition of saturine to enhance taste
Excessive use of coloring substances	1. Red fish/meat 2. Turmeric powder/ curry powder 3. Cayenne pepper 4. White eggs of farm hens 5. Palm oil	1. Soaking in nitrates and nitrites to enhance the color 2. Addition of metanil yellow to enhance the yellow color 3. Addition of milled cola nuts/ pear seed/ prekese, food colour to increase volume 4. Colored with textile dye to look like local hen eggs 5. Addition of Sudan dyes
Misuse of food additives	1. Hot pepper sauce for kenkey/banku 2. Soups, stews 3. Bread 4. Cheese, soy sauce, salty snacks 5. Soups, salad dressings, sauces, and syrups 6. Fruit juice and carbonated drinks 7. Palm wine, alcohol.	1. Addition of monosodium glutamate to enhance taste 2. Yam/cassava stock, corn flour to increase volume 3. Addition of citrine and trans-fat to enhance taste, increase shelf life and improve consistence of product 4. Yeast extract to boost flavor 5. Addition of xanthan gum to enhance thickening 6. Addition of sodium benzoate as a preservative
Addition of extraneous matter to foods	1. Salt 2. Sugar 3. Corn dough 4. Groundnut paste 5. Tomato powder 6. Fufu 7. Powdered shrimp 8. Milled agushi	1. White powdered stone to increase volume 2. Chalk powder to increase volume 3. Addition of yeast to aid in fermentation and as a raising agent for the dough 4. Dried cassava flour (Kokonte), corn flour, vegetable oil to increase volume 5. Food colour, wheat flour to increase volume 6. Palm oil, guava leaves instead of plantain or cocoyam 7. Dried fish head 8. Flour
Misuse of preservatives	1. Koobi (salted fish), dried fish 2. Fresh fruit juices	1. Addition of formalin to increase shelf life 2. Addition of fruit preservatives to increase shelf life
Substandard foods and liquids	1. Sachet water 2. Bottled water 3. Mineral water 4. Imported juice 5. Imported tombrown 6. Milk powder 7. Imported rice	1. Packaging of untreated water instead of treated ones 2. Arsenic contaminated/ contaminated with bacteria 3. No mineral added 4. Substandard/expired products 5. Low quality 6. Non diary creamer, pastry flour. Low quality 7. Local rice, artificial (rubber) rice

Red meat, fish, turmeric powder, curry powder, cayenne pepper among others were all listed to be adulterated with artificial colours. The misuse of food additives and the addition of extraneous matter to food items are also food adulteration practice on the market. Others such as the misuse of preservatives and the sale of sub-standard food items and water were also mentioned by respondents. Such practices as the over usage of monosodium glutamate in cooked foods for sale, yeast to corn dough, saturine to bread among others were brought up in this study.

Challenges of Food Adulteration

Respondents' views on the challenges of food adulteration yielded varying responses. 72% said they were not aware of any institutions for consumer complaints regarding food adulteration. The remaining 28% were however aware of such institutions and mentioned the Food and Drugs Authority (FDA) and the Ghana Standards Authority (GSA) as shown in Table 3. Again, respondents were further asked to name the places they normally buy their food items from. The local market (43.8%), hawkers (40.8%) and supermarkets (15.4%) were mentioned in the study.

60% went further to explain they had no confidence in these areas from which they buy their food items from.

Table 4: Challenges of food adulteration

Question	Responses	Frequency	Percentage
Are you aware of any institutions for consumer complaints pertaining food adulteration in Ghana?	Yes	68	28
	No	172	72
List some of the institutions you know of.	FDA	45	18.8
	GSA	23	9.6
	None	172	71.6
Where do you normally buy your food items?	Hawkers	98	40.8
	Local markets	105	43.8
	Super Markets	37	15.4
Do you have confidence in the food items that are sold in these places?	Yes	96	40
	No	144	60
In your opinion what are some of the challenges of food adulteration in Ghana	Lack of stringent laws	22	9.2
	Lack of supervision	14	5.8
	Limited awareness	25	10.4
	Inadequate technology	23	9.6
	All the above	156	65

DISCUSSIONS AND IMPLICATIONS

People's attitudes toward health and food safety are significantly influenced by the level of public fear or concern and their responses to information as such. The complicated and fragmented nature of Ghana's food supply chain with the involvement of numerous parties in food production, distribution, and sales leaves room for various food fraud activities to take place. Many food products such as fresh vegetables, grains, fruits, spices, cooking oils, meat, fish and beverages have received recorded cases of food adulteration (Sulley & Amankwah, 2020). The presence of adulterants in food may go unnoticed and masked easily due to the physicochemical changes in foods during the manufacturing process (Cawthorn *et al*., 2013). In effect these adulterants can be anything ranging from chemicals to materials that are of the same properties such as colour, texture, consistency among others as the main product. A research by *Essuman et al*., (2022) explains consumers lack of information concerning common food adulterants and its effect on human health. Surprisingly, though food adulteration has a lot of impact on consumers and has gained media attention in recent times, findings from this study shows that most people are still lacking considerable knowledge on what it is and its impact on human. An individual's knowledge on what food adulteration is should go hand in hand with the ability to detect adulterants in food even at the household level (Attrey, 2017). The findings from this study however showed that this is lacking. In line with Abayase *et al*., (2022) and Gautam & Singh's (2016) findings, consumers who are aware of food adulteration practices on the market face the challenge of how to detect this practice at the household level. Nasreen & Ahmed's, (2014) study also revealed that only 28% of the respondents used in a study on food adulteration practices in Dhaka city knew how to detect adulterated food from unadulterated ones.

Individual concerns about issues relating to food safety are varying. This has given rise to an increasing attention to the different practices and processes food items go through before they reach the final consumer. Poor food safety systems are responsible for food borne diseases, which are a major cause of morbidity and mortality, as well as an important hindrance to socioeconomic development worldwide (WHO, 2022). This study found such practices (refer to Table 2) that comes with the production, handling, passing, processing, storage, transportation, and marketing of foods as a means of adulteration. These practices according to Yeasmin *et al*., (2023), are mostly incidental because handlers/sellers may be ignorant or lack the facilities to maintain the quality of these foods. Others are also intentionally done for varying reasons. Olu *et al*., (2021) argued that harvested leaves find their way to the market at a cheap rate. Pesticide residues, droppings of rodents, larvae in foods are due to lack of proper hygienic conditions of food products and drinks throughout production site to consumption table. According to Kusum (2018), the producers or traders may not be able to add different adulterants but the processes these foods go through, may be the source of contamination or adulteration since any substance without its original state is extraneous to the product.

Other adulteration practices such as poor harvesting and drying system occurs in most foods at the farm level. Results from the study shows that food items such as beans, maize, millet, cowpeas, local rice, groundnuts are mostly exposed to rodents/pests during the drying stage which mostly gets adulterated by the dropping from these pests. Twigs/leaves/branches of plants also come into contact with these food items during harvesting and drying. Fresh vegetables such as cabbage, lettuce, carrot, spinach, broccoli, parsley, cucumber among others also get adulterated with residual pesticides used to keep them fresh and protect

them from pests. An important concern is that food sellers mostly commit these practices for financial gains (addition of stones, twigs/leaves to legumes to make them bulky). Polishing of fruits such as apples and grapes with artificial nail polish to enhance its appearance, spraying of lettuce and other green leafy vegetables to enhance its green colour and freshness all account for poor handling and packaging of fresh products. These practices according to Oti (2021) are intentionally done for financial gains.

The excessive use of artificial flavouring substances such as the addition of syrup and colour to fresh fruit juice, molasses to honey, starch, wheat/rice powder to ice cream to thicken it among others were found in this study to be very rampant on the market of late. Findings from Yeasmin *et al*., (2023) , showed colour adulteration to be the most frequent type of adulteration in this category. Another study by Sulley *et al*., (2023) concluded that all these scenarios that falls under this practice are done by sellers to earn unfair profit. The addition of extraneous matter to certain foods items and the sale of substandard foods and liquids for various reasons were also reported in the current study according to Table 2. These reasons such as fetching higher income and increasing shelf life (Omari *et al*., 2018), dishonesty and lack of accidental quality assessment on products suspected *(Abayase et al*., 2022) are all a public concern because of the danger they pose to human health.

The vital food safety incidents in recent years have led to increased media exposure, public health impact and a lack of client confidence leading to a rise in growing concerns by the public. Research shows that 25 percent of global food safety incidents is because of food fraud (Visciano, P. & Schirone, 2021). Inadequate laws, funding, and staffing seem to be common challenges to the management of substandard and counterfeited merchandise and services in most developing countries (Visciano, P. & Schirone, 2021). Findings from this study affirmed this assertion from previous studies. Though respondents were aware of some of the challenges of food adulteration, most of them lacked knowledge concerning food safety regulatory bodies in Ghana. Again, most respondents also did not know that sellers who adulterate their merchandise could be prosecuted by the law if only they are reported to the right authorities. Enterprises/businesses that falls into the hands of the law as a result of perpetrating food adulteration are affected by a loss of consumer confidence in their products, recalls and destruction of contaminated products, complaint expenses and increases of insurance premiums and costs related to equipment replacement or cleaning (Ayza & Belete 2015). Accordingly, a supplier's fault is inevitably reported in the mass media, casting doubt on that company's reputation. This affects not only the sales of that product, but also the sales of many other products supplied by the company's warehouse or retailers and even the products can be banned/discarded automatically. However, the lack of adequate supervision by food control bodies as well as strict adherence to these punishments stipulated by the laws of Ghana leave perpetrators to go free. These challenges leave even those consumers who are aware of these regulations in doubt of the proper management of food adulteration cases in Ghana. Again, there is lack of adequate awareness of food adulteration practices. There is also inadequate technology to check on the authenticity of most of the food products sold to consumers on the market. Therefore, there ought to be a strict enforcement of the laid down food control codes and statutes by the regulatory bodies to ensure consumer confidence in the laws as well as the products they buy. The availability of adequate technology for selecting, preparing, and testing food samples is required to enhance fast screening of adulterants in food.

CONCLUSION

Food adulteration is an age-old problem that affects people at all societal levels. These practices are mostly employed by offenders to gain profit and deceive the consumer. Consumer's knowledge, attitudes and practices relating to food adulteration on the market seems inadequate making it difficult to appropriately handle its occurrence. Such practices as poor food safety systems, poor harvesting and drying system, poor handling and packaging of fresh products, excessive use of artificial flavouring and colouring substances, misuse of food additives, among others are very prone on the markets of late. Inadequate public awareness programs on what constitutes an adulterant and how to report such cases to authorities, the lack of adequate technologies to spot adulterants in foods, lack of stringent measures put in place to ensure offenders are brought to book and the lack of adequate supervision on the part of food control regulatory bodies like the FDA and GSA are challenges emanating from food adulteration in Ghana. To help protect the lives of consumers from these harmful adulterants, individuals should develop sensory and textural means of detecting adulterants in food even at the household level. Consumers can also develop the habit of reporting offenders to the appropriate bodies for the needed action to be taken. As a recommendation, regulatory agencies should also ensure that the needed action is taken when offenders are reported.

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