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Study on knowledge and perception of food adulteration among consumers in Kumasi metropolis

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Abstract
The study assessed the knowledge and perception of customers on food adulteration within the Kumasi Metropolis. The study population constituted consumers who purchase their foods from local and continental restaurants. The study employed a cross-sectional design and hence, distributed a total of 245 questionnaires to the randomly selected participants. The study targeted 100 customers from restaurant operators, 50 consumers from food vendors, 150 consumers from chopbar operators and lastly 100 customers from one corner shop food joints. In total, 400 customers and food service providers constituted the study population size. The data were keyed into The IBM Statistical Package for Social Sciences (SPSS) version 20.0 and the results were analysed on the basis of descriptive statistics. A Cronbach Alpha value of 0.70 or more was used as a criterion to ascertain the reliability of each measuring scale. Findings from the study suggest that respondents' knowledge and awareness on food adulteration were above average with most of the respondents having a fair knowledge with regard to how food adulteration occurred and the foods that are often susceptible to food adulteration. It was recommended that the Public Health Directorate of the Ghana Health Service at the various district should team up with the district information service department to educate the local people in their native language to increase information adoption by the local community.

Keywords: Food adulterant, food adulteration, consumer awareness, local and continental restaurants, Kumasi metropolis

Introduction

Food remains one of the most important things in human life as it serves as the number one source of nutrient to human beings (Antwi-Boasiako & Gyimah, 2018) [3]. According to Antwi-Boasiako and Gyimah (2018) [3], even though food becomes a key source of nutrients to humans nonetheless, its consumption when adulterated can lead to varied forms of diseases and infections. Generally, a highly nutritious meal can become unwholesome when its preparation, transportation and selling becomes adulterated (Alauddin, 2012) [2]. Adulterants in food may have adverse health ramification on the consumer with some resulting in stomach torment, asthma, spewing, headache, mental hindrance, cardiac arrest, inveterate ailments such as cancers and even in some cases lead to death (Alauddin, 2012) [2]. Moreover, even in instances where the adulteration does not cause any substantial. Negative effect to the user, it can have a damaging effect in the food supply chain (Esteki, Regueiro, & Simal-G´andara, 2019) [8]. For instance, adulteration could cause consumers, regulators, industry, and trading partners to distrust the food supply chain which in effect could result in some form of market and trade distractions (Spink, *et al.*, 2016) [22]. A clear case of such occurrence is when the contamination of a Chinese milk by a melamine substance resulted in a severe boycott of the country's dairy products by its local users and its foreign consumers (Cartín-Rojas, 2017) [7].

Food adulteration may arise from the need to compete with other more powerful businesses, manufacturers, food service establishments, and major food retailers (Manning, 2016). Hence, adulteration is used by a producer to either make its product appear more attractive or less costly than that of the other competitor product offering (Esteki *et al.*, 2019) [8]. Seldomly, the driving force for food adulteration could emanate from the scarcity of a given food component. A clear case of this phenomenon is the happening of the horsemeat scandal which in part was driven by a reduced European supply of beef and other meat products (Esteki *et al.*, 2019) [8]. Another reason that could account for the increasing trend in food adulteration could be the growing complexity of the current global food supply system, the expansion of world trade across novel markets, and the steady rise in food prices (Huck, Pezzei, & Huck-Pezzei, 2016) [11].

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According to Cartín-Rojas (2017) [7], food adulteration undermines food safety by disregarding its composition, origin or side effects of adulterants on consumers' health. Generally, food adulteration constitutes the practice of mixing, substituting or hiding the quality of a food by either mislabeling the food product or adding unknown substances to the food to increase its quantity or give it a new identity (Nasreen & Ahmed, 2014) [17]. Arguably, food adulteration is an ancient and an anti-competitive criminal practice yet evidence in the food space suggests that its occurrence is still prevalent (Shears, 2010; Schell, Gallo, & Cook, 2012) [20]. Examples of recent happenings of food adulteration cases are the melamine substance found in milk products in the Republic of China (Lakshmi, Labs, & Pradesh, 2012) [15] the horsemeat scandal in European Economic Community (Khan, 2013) [13] the Halal meat scandal (Smith, 2004), the Eurovet scandal (Smith, 2013) [21], and the black fish scandal (Smith, 2015). One of the fundamental driver for adulteration is unawareness of consumers with respect to rights and obligations towards safe food practices bringing about faulty purchasing practices. Customers are significant partners in anticipation of debasement and their mindfulness will assist in curbing this danger and work on the well-being. Thus, the current investigation was done to survey the information and mindfulness about adulteration among consumers living in the Kumasi Metropolis.

Consumer knowledge and Awareness on Food Adulteration

Frederick Accum is credited as the first man to draw the public attention to food adulteration. Accum' exposé was published in a seminal paper titled '*Adulteration of Food and Culinary' Poisons* (Wilson, 2008) [23]. By devising methods to detect chemical additives, he proved their common existence in a large variety of foods (Wilson, 2008) [23]. Among the problems he observed were the frequent use of metals to colour or modify food, candies and sweets being marketed in bright colours, some of which were achieved using red lead or copper, pickles and many green vegetables being made greener with copper washes. Complaints of stomach ailments were often heard and fatalities were noted in newspaper accounts of the day. Although the free use of chemical additives was stared with repulsion in the 19th century by food consumers and modifiers of public opinion yet Accum's exposé seems to have not prevented the increasing rate of food adulteration in modern times (Schell, Gallo, & Cook, 2012) [20]. Examples of recent happenings of food adulteration cases are the melamine substance found in milk products in the Republic of China (Lakshmi *et al.*, 2012) [15], the horsemeat scandal in European Economic Community (Khan, 2013) [13] [13], the Halal meat scandal (Smith, 2004), the Eurovet scandal (Smith, 2013) [21], and the black fish scandal (Smith, 2015). Accordingly, this section of the work seeks to explore consumer level of awareness towards food adulteration.

The study of Ishwar *et al.* (2018) assessed urban slum consumer's awareness and knowledge about adulteration in India. The study used a cross-sectional approach where questionnaire were distributed to 100 consumers who were responsible for their household purchasing decisions. The mean age of the study subjects was 40.2-11.7 years and also when it came to the educational status of the respondents, only 7% of the respondents were identified as illiterate.

Results from the study suggest that good practices such as the checking of Food Safety and Standards Authority of India (FSSAI) logo (90%), Agmark logo (76%) and nutrition label (65%) are lacking among the respondents. The most prominent source of knowledge about adulteration was mass media especially television (65%). Also, it was observed that almost half (43%) of the respondents had ever purchased an adulterated food at least once in the past six months. The study concluded that majority of slum consumers targeted in the study were unaware about the most common forms on food adulteration in their frequently purchased foods.

Findings reported in the study of Ishwar *et al.* (2018) tend to be consistent with the results found in the study of Baruah (2010) [6] as the author's assessment about women awareness about food adulteration observed that even though women in Jorhat happen to be aware that certain foods can be easily adulterated but they had little knowledge about the common adulterants often used to adulterate these category of foods. Similarly, within the same country specifically, Karnataka state in India, a work done by Abidfaheem, Nayak and Andrade (2013) [1] found out that Taluka dwellers within that state had lower level of awareness about food adulteration. Analogous results were found in the study of Gautam and Singh (2016) [10] as their study results reported lower consumer awareness score on food adulteration assessments. Aside the respondent's lower awareness about food adulteration, it was also observed that most of the respondents had limited knowledge on the harmful effect food adulteration tend to have on their health and well-being.

A study by Nasreen and Ahmed (2014) [17] assessed the extent of food adulteration by using the period of 1995–2011 as their data points as well as explore consumers awareness about its occurrence in the Dhaka city of Bangladesh. Their study reviewed results of food sample testing by Public Health Food Laboratory of Dhaka City Corporation, Bangladesh Standards and Testing Institution, Consumers Association of Bangladesh publications as well as reports from lay press, including those on mobile magistrate court operations. With regards to the consumer level of awareness, the study surveyed a total of 96 residents of Dhaka city, using a structured questionnaire. Results from the review suggest that the overall proportion of food samples adulterated within the period of 2001-2005 decreased nonetheless, between the periods of 1995-2011, assessment of the food review showed that 40-54% of daily-consumed foods in the country were adulterated. The foods found to be mostly adulterated in Bangladesh were milk products such as, dried milk powder, curd, ice cream, cheese, butter and edible oil and oil products such as, butter oil, soybean oil, mustard oil, palm oil, coconut oil and food grains and cereals products such as, rice, wheat, lentil (flour made of peas or chickpeas), Ata (course wheat flour) and Suzi (semolina).

However, only a small section of the respondents that is, 11 (12%) looked at the approval of regulatory authority before buying packaged food items. Shockingly, only 26(28%) of the respondents correctly knew how to test salt by adding it to rice and observing change in colour to purple after adding lemon juice to it. The study concluded that most of the consumers had limited knowledge and awareness on how to detect adulterants in foods they frequently purchased or used.

Research approach and methods
Research Design

The study used a cross sectional research design to collect a large pool of information from customers within the Kumasi Metropolis to understand their level of awareness about food adulteration, cross sectional design gave the best approach to achieve this objective. Also, since the study was interested in understanding the factors that accounted for the respondents' level of awareness and knowledge about food adulteration, cross sectional design gave the best logistical means to achieve this specific objective. For instance, Saunders *et al.* (2009) [18] assert that data gathered through cross sectional design can be used to propose the probable reasons that accounted for the connection between two given variables.

Study Population

The study population came from consumers who patronize any of the catering facilities within the Kumasi Metropolis. Per the Ghana Tourism Authority categorization, the food service sector can be grouped into local and continental restaurants, food vendors, chop bars and one corner shop (Ghana Statistical Service, 2017) [9]. Guided by a weekly recall of the various food services, 100 customers were targeted from restaurant operators, 50 consumers were targeted from food vendors, 150 consumers were targeted from chopbar operators and lastly 100 customers were targeted from one corner shop food joints. In total, 400 customers and food service providers constituted the study population size. The breakdown of the study population in reference to each food cluster has been presented in Table 1.

Table 1: Population Size

Cluster of food service providers	Population Size
Chop Bar operators	150
Restaurant	100
One corner eating Places	100
Food vendors	50
Total	400

Sampling Strategy and Sample Size

A multi-cluster sampling method was used in this study. According to Babbie (2007) [4], multi-cluster sampling becomes ideal when it is impossible or unfeasible to gather information or data from all the list of the units forming the population. Guided by the multi-cluster sampling method, the population was first divided along the identified customer groups; restaurants, food vendors, chop bar and one corner eating places customers. However, to determine the sample size for each customer group, the Cochran's sample size formula for continuous data as cited in Bartlett *et al.* (2001) [5] was used to calculate the sample size for each identified cluster. Hence, with an estimated alpha value of 0.01, t-test value of 2.58 and error of margin of 0.03 and the calculated sample size for Restaurants is 79. Also, Food vendors stands at 44, chop bar operators also stood as 108 and then one corner eating places is 79. This means that 310 customers along the different categorization of food service providers were selected. The breakdown of the population size and sample size of the respective cluster has been presented in Table 2.

Table 2: Description of Population and Sample Size

Cluster of Sample of Customers along the different catering facilities	Population size	Sample size
Chop Bar	150	108
Restaurant	100	79
One corner shop eating places	100	79
Food vendors	50	44
Total	400	310

Data Collection instrument and procedure

Questionnaire was used as the data collection tool. Specifically, the study adapted Nasreen & Ahmed (2014) [17], Pal & Jain (2018) and Cartín-Rojas (2017) [7] measuring scale to assess the respondents level of awareness and knowledge about food adulteration. In all the knowledge and awareness scale had 13 items and it assessed consumer's level of awareness and knowledge on food adulteration. The items were measured on a 3-likert scale; 1-certainly not, 2- am not sure and 3- certainly yes. A personal visit was made to the targeted catering facilities where these different groups of customers can be identified. Subsequently, discussions were held with the respective heads about the purpose of the study. Moreover, the data collection dates for each selected facility were based on the approved dates and time given by the facilities. The entire administration of the questionnaire was done by the researchers.

Reliability and Validity

Saunders, Lewis, and Thornhill (2007) [19] described reliability as the extent to which data collection techniques used in a study are able to produce consistent results or observations gained in a study could be linked to prior studies or there is an assurance of transparency in how sense is made out of the raw data. Validity on the other hand is the degree to which an instrument measures what it is intended to measure and whether it measures the concept accurately (Saunders *et al.*, 2007) [19]. In this study, experts in the field of catering and hospitality were approached to evaluate the validity of the questionnaire. Equally, the reliability (internal consistency) of the items comprising each construct were examined using Cronbach's alpha. A Cronbach Alpha value of 0.70 or more was used as a criterion to ascertain the reliability of each measuring scale. Nunnally and Bemstein (1994) added that the reliability scores for all the constructs that ranges between 0.70 and 0.90 proves that the instrument is highly reliable. Kline (2005) [14] affirms Nunnally and Bemstein view, when the author argues that coefficient alpha values within the ranges of 0.7 and 0.8 are usually the acceptable indicator that a scale is reliable. However, when dealing with psychological constructs, values less than 0.7 (but more than 0.6) are acceptable because of the diversity of the measured constructs (Kline, 2005) [14].

Data Analysis

Data analysis usually involves reducing the raw data into a manageable size, developing summaries and applying statistical inferences. The data collected were keyed into

The IBM Statistical Package for Social Sciences (SPSS) version 20.0 and the results were analysed on the basis of descriptive statistics. The data were analyzed using descriptive statistics (i.e., frequencies, percentages).

Results and Discussion
Demographic Profile of Customers
The demographic profile of the customers of the respective food service providers have been presented in Table 3. With the customers, the study distributed a total of 310 questionnaires to the selected customers of the various food service providers. From the distributed questionnaire, a total of 285 of them were received, 40 of them were unusable because of their incompleteness and 245 were used for the analysis giving a response rate of 85.9%. Going by the recommendation of Babbie (2007) [4] having a response rate of over 85% suggests that the received questionnaire is sufficient for the study analysis.

The demographic profile of the surveyed customers of the identified food service providers in Table 3 showed that 165(67.3%) were males and the remaining, 80(32.7%) were females. This suggests that most of the customers were males confirming the long-held view that men are more likely to have their meals outside from home than women. Moreover, with reference to the ages of the respondents, 15(6.1%) of the respondents had their ages within the 50 years and above category. On the other hand, 155(63.3%) of the respondents had their ages within the age bracket of 21-40 years' and 55(22.4%) of the respondents had their ages within the age bracket of 41-50 years. With reference to the catering facility the respondents took their food from during the time of the study, it was established that 30(12.2%) of the respondents took their meal from restaurants, 50(20.4%) took their meals from food chop bar operators, 75(30.6%) took their meals from food vendors, 35(14.3%) had their meal at corner shop food joints and the rest that is

55(22.4%) had their meals at other food joints.

When it comes to the educational qualification of the respondents, results from Table 3 suggest that 45(18.4%) of the respondents had no formal educational qualification, 50(20.4%) had their education up to the basic level, 40(16.3%) had their educational qualification up to the secondary level, 15(6.1%) of the respondents respectively had National Vocational Training Certificate and diploma/HND as their highest form of qualification, 65(26.5%) on the other hand had bachelor's degree as their highest level of academic qualification and the rest that is, 5(2.0%) had master's degree as their highest level of academic qualification. More so, as to whether the respondents had been diagnosed of any chronic ailments, result from the study suggest that more than half of the respondents 190(77.6%) had no history of chronic ailment. In contrast, 2(10.2%) had a chronic disease and lastly 30(12.2%) of the respondents had no knowledge of whether they are suffering from a chronic ailment or not. Moreover, as to whether the respondents were on any special diet, results from Table 3 show that majority of the respondents that is, 220(89.8%) were not on any special diet. In contrast, only a small section of the respondents that is 15(6.1%) were on special diet with the rest that is 10(4.1%) not having any idea whether they are on special diet or not.

Lastly, when it comes to the respondent's average monthly income, results from the study suggest that most of the respondent's that is, 30.6% have their average monthly income within the range of ¢2,600-3000. Also, only, 6.1% had a monthly income within the range of ¢3100-3500. Again, 22.4% of the respondent's average monthly income was below ¢1000, 16.3% of the respondents had their average monthly income within the range of ¢1500-1900, 14.3% had their monthly income within the range of ¢2,000-2500 and finally 10.2% of the respondent's average monthly income was 3,600 at each given month.

Table 3: Demographic Profile of Customers

Demographic variable	Category	Frequency	Percentage
Gender	Male	165	67.3
	Female	80	32.7
	Total	245	100%
Where they patronize their food from	Restaurant	30	12.2
	Food vendors	50	20.4
	Chop bar operators	75	30.6
	one corner shop eating places	35	14.3
	Others	55	22.4
	Total	245	100%
Educational qualification	No formal education	45	18.4
	Basic education	50	20.4
	Secondary education	40	16.3
	National vocational Training certificate	15	6.1
	Diploma/HND	15	6.1
	Bachelor's degree	65	26.5
	Master's degree	5	2.0
	Total	245	100%
Diagnosed of any chronic ailment (i.e. diabetes, high blood pressure, cancer, etc.)	Yes	25	10.2
	No	190	77.6
	Am not aware	30	12.2
On special diet	Yes	15	6.1
	No	220	89.8
	Am not aware	10	4.1
Average monthly income	Below ¢1,000	55	22.4%
	¢1,500-1,900	40	16.3%
	¢2,000-2,500	35	14.3%

¢2,600-3000	75	30.6%
¢3100-3,500	15	6.1%
Above ¢3,600	25	10.2%

Consumer's knowledge and awareness on food adulteration

Table 4 sought to assess consumer's level of awareness and knowledge on food adulteration. Therefore, the respondents' responses with regards to how they answered the given questions either correctly or incorrectly. Evidently, results from Table 4 show that question one was the question with the highest percentage of correct answers. The correct answer to this question is "Certainly Yes". Specifically, out of the total of 245 consumers, 81.6% responded correctly to this question. Conversely, only, a small section of the consumers that is, 18.3% couldn't identify the correct answer on this question. Clearly, this goes to suggest that most of the consumers were very well aware that food adulteration could result in the addition of a harmful substance or the removal of a vital component from a food. Moreover, question three became the question with the second highest percentage of correct score specifically, 77.6% of the consumers responded correctly on this question. The answer to this question is 'True'. In contrast, 22.5% of the respondents responded wrongly. The question with the next highest answers or correct responses went to question six, with this question the correct response is 'True'. Results from Table 4 suggest that 75.5% of the respondents responded correctly whereas 24.5% responded incorrectly. Question two became the item with fourth highest correction score of 73.5%. This means that 73.5%. On the other hand, 26.6% of the consumers responded incorrectly.

However, the question with lowest rate of correct answers went to question ten. With this question only 18.4% of the consumers were able to select all the foods that are highly vulnerable to food adulteration. Conversely, 81.6% of consumers were not able to select all the foods that are highly susceptible to food adulteration. Likewise, question four received the second lowest rate of correct responses

(generally, it is very difficult to adulterate package foods). With this question, the correct answer is certainly not however, most of the respondents that is, 77.6% of the consumers felt that it is very difficult to adulterate package foods which tend not to be the case. This presupposes that only 22.4% of consumers were able to realize that it is not very difficult to adulterate package foods. Again, the next question with the lowest rate of correct answers for the understudied consumers went to question five. With this question, the correct response was ''True'' however, only 36.7% of consumers were able to respond correctly to this question. In contrast, 63.3% of consumers responded wrongly as they selected ''False''.

Results from the study suggest that generally the respondents' knowledge and awareness on food adulteration were above average with most of them having a fair knowledge as to how food adulteration occurs and what food adulteration mean. Again, results from the study show that a significant number of the consumers knew that food adulteration could occur unintentionally by preparing or storing food in unsanitary conditions. Similarly, most of the respondents were well aware that adulteration could result in the addition of a harmful substance or the removal of a vital component from a food. Also, findings from the study suggest that the only areas most of the respondents had little or less knowledge about food adulteration were their inability to tell whether package foods constituted the categories of foods that were difficult to adulterate. Again, it was also established that most of the respondents could not select all the foods that were highly adulterated in the Ghanaian market. Lastly, it was established that most of the respondents could not tell whether spices such as, ground black pepper, vanilla extract, turmeric, star anise, paprika, and chili powder are the spices prone to food adulteration in Ghana.

Table 4: Consumers knowledge and awareness on food adulteration

Items	True Freq (%)	False Freq (%)
1. Food adulteration could result in the addition of a harmful substance or the removal of a vital component from a food.	200(81.6%)	45(18.3%)
2. Food adulteration could occur unintentionally by preparing or storing food in unsanitary conditions.	180(73.5%)	65(26.6%)
3. Food adulteration could occur intentionally by adding a substance in a food product to increase its quantity or reduce the cost of its production (e.g. adding water to milk to increase its quantity, or adding sugar to honey to increase its quantity or sweetness).	190(77.6%)	55(22.5%)
4. Generally, it is very difficult to adulterate package foods.	55(22.4)	190(77.6%)
5. Ground black pepper, vanilla extract, turmeric, star anise, paprika, and chili powder are spices prone to food adulteration.	90(36.7%)	155(63.3%)
6. Juices may be diluted with water or adulterated with a cheaper juice.	185(75.5%)	60(24.5%)
7. In some cases, juices may be only water, dye, sugar, and flavors.	135(55.1%)	110(44.9%)
8. Olive oil can be adulterated with a lower-cost substitute, such as olive oil from a different origin or any other type of oil.	145(59.2%)	100(40.8%)
9. Tea can contain leaves from other plants, and colored saw dust to increase its quantity.	105(42.9%)	140(57.2%)
10. Mark all the foods (may be more than 1) that are vulnerable to food adulteration practices.	45(18.4%)	200(81.6%)

Conclusion and Recommendation

The study has shown that the respondents' knowledge and awareness on food adulteration were above average with most of the respondents having a fair knowledge as to how food adulteration occurs, the things used to adulterate certain foods and the foods that are often susceptible to food

adulteration. Also, the study results has revealed that most of the respondents could not select all the foods that were highly adulterated on the Ghanaian market. An appreciable number of respondents could not tell whether spices such as, ground black pepper, vanilla extract, turmeric, star anise, paprika, and chili powder are the spices prone to food

adulteration in Ghana. It was recommended that the Ghana Tourism Authority and District Assemblies should increase the level of consumers awareness by sensitizing them on the dangers of food adulteration. Again, the Public Health Directorate of the Ghana Health Service at the various district should team up with the district information service department to educate the local people in their native language to increase information adoption by the local community.

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