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Full Length Research Paper

Street foods: Handling, hygiene and client expectations in a World Heritage Site Town, Cape Coast, Ghana

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Handling, vending and hygienic quality of street foods available to local residents, internal and foreign tourists to Cape Coast, the most important tourism hub in Ghana, were investigated. Questionnaires assessed stakeholder commitment to and expectations of food hygiene. Laboratory analysis evaluated microbial contamination levels of the street foods. Patronised by both local residents and tourists, foreign tourists put the hygienic safety as the principal criterion over curiosity and price to patronise street foods. Although licences had been given to 27 (54%) of the 50 investigated food vendors, only 15 (55.5%) of the licensed vendors had had medical examination (8 only once and 7 annually). Food vending premises visibly needed improvement in sanitation. The foods had the following bacterial contamination levels in colony forming units per gram (cfu/g): meat pie (1.3×10^5), khebab (5×10^4), rice with stew (4.1×10^5), fried fish (8×10^4), pepper sauce (1.4×10^5), *etsew* or banku (3×10^5), beans with *gari* (2×10^4), *fufu* (1.6×10^5) *wakye* (6.6×10^5) and *dakua (*2.3×10^5). Presence of *Escherichia coli* of faecal origin was detected in all investigated food samples. Khebab, fried fish and beans with *gari* had acceptable bacterial contamination levels of <5 $\log_{10}$ cfu/g. The following major fungi were identified in the street foods: *Aspergilus flavus, Aspergillus niger, Aspergillus candidus, Cladosporium herbarum, Necrospora crassa, Penicillium citrinum, Fusarium, Mucor* and *Rhizopus* species. Yeasts were found in all investigated food items. The street foods were, therefore, found to have threatening unacceptable microbial contamination levels. Stakeholder education, legislation, verifiable microbiological standards, inspections and environmental sanitation improvement are necessary.

Key words: Tourism, street foods, Cape Coast, Ghana.

INTRODUCTION

Cape Coast, the capital of the Central Region of Ghana, is both the tourism and education hub of the country. The town has a UNESCO world-heritage castle that played a very prominent role in the history of the exit of Africans who went into the Diaspora and is endowed with most of the premier high schools of Ghana and a university. Further, it has a lot of low-salaried government workers and small-scale entrepreneurs.

On July 11, 2009 the American President, Barrack Hussein Obama and family visited this world-heritage castle. This visit boosted the tourist patronage of the castle and the town. Foreign tourist visitations increased by 6.6%, local tourists by 24.7% and Ghana Government foreign dignitary visitation by 61.7% (GMMB, 2009). Tourists and local residents, especially school children, patronise street foods. Parents even supplement their babies' diet with street foods (Mensah et al., 2002). Street foods are ready-to-eat foods and beverages, pre-pared and sold by stationary or itinerant hawkers in the streets and other similar places, including around these tourist sites (FAO, 1990). Street food preparation and sale preserve traditional cultural foods, provide employ-ment, and contribute to the liveliness of streets. Street foods are expected to have the organoleptic and hygienic qualities that are acceptable to consumers (Mensah et al., 2001). This is because street foods are prone to microbial contamination that are of public health concern.

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Among some of the microbes whose presence in food is considered gross contamination and a threat to human health are *Escherichia coli*, *Salmonella*, *Clostridium*, *Staphylococci* and *Listeria*. The presence of some of these microbes in street foods had caused acute and persistent diarrhoea in children in Ghana (Mensah, 1997); 14 deaths in Perek, Malaysia; illness in 300 people in Hong Kong and; cholera in Pune City in India (FAO, 1990). For these reasons, street food quality and hygiene must be appraised and the result used for improvement of food presentation, and by extension, public health protection in Cape Coast, especially in view of the town's tourism status.

Aims

The aims of this study were to assess: the relevant background of street food vendors of the Cape Coast; how these vendors handled food; the criteria that foreign and local tourists as well as local residents used to patronise the street foods; evaluate the microbial contamination levels and the presence of *E. coli* and *Salmonella* in these street foods.

METHODOLOGY

Instrument

Content-validated questionnaires were administered to the following randomly selected respondents from seven randomly selected locations in the Cape Coast: 50 each of street food vendors, indigenous residents and foreign tourists.

Food samples

Microbial contamination levels were determined for the following cooked food items: meat pie, khebab (spiced, grilled beef or mutton), rice and stew, fried fish, pepper sauce, *etsew* (also called *banku*, a cooked fermented corn dough), beans with *gari* (roasted fermented cassava flour), *fufu* (pounded mixture of cooked cassava and plantain), *wakye* (cooked mixture of cowpea and rice) and *dakua* (ground, spiced mixture of roasted groundnuts and millet). It is relevant to note that unlike in America and European countries, the reality is that types of street foods in the Cape Coast are rather limited. Approximately 100 g of the same food item was purchased from different vendors in seven randomly selected locations in the Cape Coast. The food samples were put into sterilised containers, labelled, put on ice and were worked on immediately in the laboratory or frozen till analysis.

Microbial assays

Peptone water (MERCK, Darmstadt, Germany) was used to prepare 10-fold serial dilutions of 20 g of the various food items. Bacterial contamination levels per gram of food items were determined by surface-plating 0.1 ml of the serial dilutions of the food items in duplicate on nutrient agar (MERCK, Darmstadt, Germany), incubating them at 37°C for 24 h and counting the number of colonies.

Presence of *E. coli* was determined by placing 1 ml of homogenised food items in 5 ml MacKonkey broth (MERCK, Darmstadt, Germany) with an inverted Durham tube and incubated at 37°C for 24 h. A change in colour from purple to yellow with gas production in the Durham tubes suggested the presence of *E. coli*. This was confirmed by placing a few drops of the suspected sample in peptone water and incubated at 44°C in a water bath. If the solution turned turbid, Kovac's reagent was added. A red colour at the top of the solution confirmed the presence of *E. coli* of faecal origin.

For *Salmonella* isolation, 25 g of the food samples was placed in 100 ml of Selenite broth (bioMèrieux, Charbonnières les Bains, France) and incubated at 37°C for 48 h after which 0.1 ml was subcultured on Wilson Blair Agar (bioMèrieux, Charbonnières les Bains, France) and incubated for 24 to 72 h. *Salmonella*, if present, was expected to show black shining colonies.

Fungi were determined by surface–plating food samples from the above serial dilutions on Saboraud Agar (MERCK, Darmstadt, Germany). These plates were kept at a room temperature of 29±3°C for 5 to 7days. Fungi and yeasts were identified by their morphological characteristics and reproductive structures according to the keys in Sampson et al. (1995).

DISCUSSION

The findings, as presented in Table 1, suggested that middle-aged local female indigenes mostly prepared and sold street foods in the Cape Coast. Though most of these vendors had been trained by their parents for the job of street food preparation and vending, small initial capital rather than continuation of a family tradition motivated them into the trade. However, the generally low education of the vendors suggested that it will impact on their appreciation of good food handling and hygiene practices. Education of these vendors was expected to create awareness amongst them about food poisoning microorganisms like *E. coli*, *Salmonella*, *Clostridia*, *Listeria*, *Staphylococcus* etc. as well as keeping them informed of the necessity of keeping good sanitation on their sales premises.

Medical examinations were expected to check the health status of the vendors in order to protect their own health and that of the public from the aforementioned food-poisoning microbes. The findings of this study suggested that the authorities were lax about the enforcement of this important criterion for obtaining license for undertaking and continuing in the enterprise of street food vending.

Further to the results presented in Table 2, a visual appraisal of the vending sites found some food items sold in mosquito-proof vending tables and glass cages but others sold the food in the open- air (which was rather dusty), under the shade of trees (whose leaves could freely fall), near drainage gutters and some near garbage bins. Leftover food from the day's sale were kept at room temperature and reheated for sale. The modes of transportation of the food, the location of sales, the use of leaves and newsprint in serving and how left-over food was kept were circumstantially adjudged as likely sources for food contamination with and multiplication of microbes.

Table 1. Information on street food vendors in the Cape Coast.

Attribute	No.	Percentage
Total number of vendors	50	100
Ghanaian vendors	44	88
Non-Ghanaian vendors	6	12
Female food vendors	49	98
Male food vendors	1	2
Married vendors	27	54
Vendors aged 15 to 48 years	44	88
Illiterate food vendors	25	50
Literate with basic education	21	42
Literate (post-basic education)	2	8
Vendors continuing family tradition	19	38
Vendors to whom small initial capital was reason to vend	31	62
Vendors trained by parents	44	88
Vendors with organised vocational or apprenticeship training	6	12
Licensed vendors	27	54
Medically certified vendors	15	55.5
Vendors with one-time medical examination	8	53.3
Vendors with annual medical examination	7	46.6

Table 2. Cooking and handling of street foods in the Cape Coast.

Attribute	No.	Percentage
Total number of vendors	50	100
Cooking at location of sale	12	24
Home cooking and transported to site on the head	28	56
Home cooking and transportation to sale point by taxis	9	18
Food serving in enamel or plastic plates	20	40
Food serving in leaves	5	10
Food serving in newsprints	6	12
Food serving in polythene bags	20	20
Keeping of leftover food at room temperature and reheating	14	28
Refrigeration of leftover food	3	6

Table 3 suggests that foreign tourists came to the Cape Coast from Africa itself, the Americas, Europe and Asia. With the world now a global village, a disease contracted in one locality can easily be transferred to another geographical region. For this reason, majority of tourists have received pre-visit briefings on food hygiene. It was, therefore, expected in this study that foreign tourists placed major emphasis on food hygiene. This is a fact that all stakeholders of the tourism enterprise in the Cape Coast should bear in mind so that they do not scare away tourists.

Table 4 shows that contrary to the importance of food hygiene to foreign tourists for choice of street foods, local clients based their patronage on taste, cheapness and ease of their packaging rather than good sanitation. The street foods examined in this study were of local cuisine. Besides, local clients are not rich. Their principal criteria of taste and cheapness for patronage of the street food were expected. It is also inferable from Table 4 that formal education about food hygiene was low. It is imperative that awareness is created among local clients that their health is as important as that of tourists and that it costs more to treat food- borne diseases than to pay a bit more for hygienic food. Local clients, as well as local authorities, have a stake in consumer protection.

Table 5 suggested *wakye* had the highest bacterial contamination level followed by rice and stew. It is speculated that dishing of *wakye* and rice with bare fingers contributed to microbial load in the food items (Heinze and Yackovich, 1988; Mensah et al., 2002). This was because these fingers were also used to receive the currency used in purchasing. Circumstantially, currency

Table 3. Information on foreign clients (tourists) and their expectation of street foods.

Attribute	No.	Percentage
Total no. of foreign tourists	50	100
African tourists	11	22
European tourists	21	42
Asian tourists	12	24
American	6	12
Tourists with pre-visit education on street foods	32	64
Tourists who have tasted street foods in the Cape Coast	36	72
Tourists using hygiene and health as consideration for food choice	38	76
Tourists choosing street food out of curiosity	28	14
Tourist with combined hygiene, cost and curiosity	9	18

Table 4. Information on local clients of street foods in the Cape Coast.

Attribute	No.	Percentage
Total number of local clients	50	100
Clients who are workers	27	54
Clients who are schooling children	21	42
Clients above 60 years (pensioners)	2	4
Purchasing frequency of once daily	7	14
Purchasing frequency of twice daily	17	34
Purchasing frequency of thrice daily	9	18
Clients with taste as sole criterion for buying street food	30	60
Clients with ease of packaging as sole criterion for buying street food	5	10
Clients with hygiene consideration as sole criterion for buying street food	2	4
Clients with intuition as sole source of awareness about hygiene	28	56
Clients with school education as sole source of awareness about hygiene	10	20.3
Clients with education from health personnel, media and parents as source of awareness about hygiene	4	8

Table 5. Bacterial contamination levels of popular street foods in the Cape Coast.

Food item (n=5 samples)	Range of bacterial load (cfu/g)	Mean bacterial load (cfu/g)	Log_{10} of mean bacterial load
Meat pie	1.6×10^4 - 3.4×10^4	1.3×10^5	5.1
Khebab	2.0×10^4 -9.0×10^4	5.0×10^4	4.7
Rice and stew	3.6×10^4 - 1.0×10^6	4.1×10^5	5.6
Fried fish	0 - 1.7×10^5	8.0×10^4	4.9
Pepper sauce	1.0×10^3 -5.9×10^5	1.4×10^5	5.2
Etsew (Banku)	0 - 1.49×10^6	3.0×10^5	5.5
Beans with *gari*	0 - 5.0×10^4	2.0×10^4	4.3
Fufu	0 - 9.0×10^5	1.6×10^5	5.2
Soups	5.4×10^4 -8.0×10^5	4.9×10^5	5.7
Wakye	2.6×10^4 - 1.29×10^6	6.6×10^5	5.8
Dakua	0 - 5.0×10^5	2.3×10^5	5.4

notes could be suspected to have microbial contamination and the role of currency in the spread of microbes lends itself for study. At the time of purchase, both the vendor and the client communicated verbally over the food item being bought. This inadvertently produced aerosols due to talking. These aerosols are suggested to carry their own microbial loads that are likely to contaminate the food items. Given that *fufu* is prepared by pounding in a mortar and turning it with bare hands, its bacterial contamination level in this study seemed

Table 6. Presence of fungi in various street food items in the Cape Coast.

Fungal isolates	Food items										
	Meat pie	Khebab	Rice and Stew	Fried fish	Pepper and sauce	Banku or Etsew	*Gari* and beans	Fufu	Wakye	Dakua	Food items that a fungal species contaminates (n=10; {%})
Aspergilus flavus		X			X	X	X		X		5 (50)
Aspergillus niger	X	X	X	X	X	X	X	X	X	X	10 (100)
Aspergillus candidus	X									X	2 (20)
Aspergillus sp.					X	X	X	X			4 (40)
Cladosporium herbarum	X	X		X	X	X		X	X	X	8 (80)
Fusarium sp.	X		X	X	X	X	X	X	X	X	9 (90)
Mucor sp.		X								X	2 (20)
Necrospora crassa						X	X				2 (20)
Penicillium sp.	X	X		X	X			X	X	X	7 (70)
Penicillium citrinum	X	X	X	X	X	X		X	X	X	9 (90)
Rhizopus sp.			X			X	X	X			4 (40)
Sterile mycelium	X		X		X	X		X	X	X	7 (70)
Yeasts	X	X	X	X	X	X	X	X	X	X	10 (100)

No. and %: 8 (61.5) 7 (53.8) 6 (41.2) 6 (41.2) 9 (69.2) 10 (76.9) 7 (53.8) 9 (69.2) 8(61.3) 8(61.3).

low for unexplained reasons.

That *Salmonella* was not isolated in this study does not in any way give room for complacency about sanitation. For, it is worrying that all the food items with bacterial contamination had *E. coli* of faecal origin. It confirmed that there was lack of good sanitary practice and flagged that such contamination could easily give rise to food-borne diseases and cause spoilage of food items. Given that tourists considered hygiene as the principal criterion to buy street food, the aforementioned findings are likely to impact negatively on tourist visitation and also the length of time visitors spend in the town.

The acceptable microbial contamination level of foods is <5 $\log_{10}$ cfu/g (Mensah et al., 2002). This suggests that whereas khebabs, fried fish, beans with gari had acceptable contamination levels, the remaining investigated food items had bacterial levels exceeding acceptable limits of safety.

Table 6 shows that etsew (*banku)* had the highest contamination of fungi and yeasts isolated from all the food items. It is suggested that although fermentation of the corn dough for making *etsew (banku)* was likely to reduce pathogenic bacteria contamination as a result of the presence of organic acids (Cuk et al., 1987*;* Mensah et al., 1991), these organic acids will not eliminate fungal spores, not even after the heating process by which this food item is prepared. However, only two *etsew (banku)* samples contained bacteria (Table 5) . These were purchased in the evening when the sample was cold. This suggests that this food item, like all other food items must be purchased when they are freshly prepared and hot. Similarly, *gari* as a fermented cassava product may have organic acids that will reduce bacterial populations. Pepper sauce is not a cooked item. It is prepared by grinding, usually in earthenware bowl. Peppers were often obtained from gardens irrigated with unwholesome water and were usually not thoroughly washed before grinding (Mensah et al., 2002). Its fungal and bacterial loads were, therefore, not surprising. Although *fufu* had low bacterial counts, it had heavy fungal presence in this study. *Aspergillus niger* and yeasts contaminated all the food items. These were followed closely by *Fusarium* species and *Penicillium citrinum*. *Aspergillus*, *Penicillium* and *Fusarium* all produce mycotoxins that deteriorate the liver and kidney, interfere with protein synthesis with subsequent skin sensitivity or necrosis and extreme immunodeficiency (Sweeny and Dobson, 1998; Rundberget et al., 2004).

Aspergillus flavus produces mycotoxins like sterigomaticystein, 7,8-dihydrofuro (2,3,) furan, cyclopiazonic acid and aflatoxin. Aflatoxin is the most potent liver carcinogen with limits of 0.01 to 0.05 g kg^{-1} set for infant foods (Sweent et al, 2000). Besides, *Aspergillus flavus* may form spore dusts and cause lung infection in immuno-compromised patients (Schuster et al., 2002) and had caused endocarditis in an immuno-competent patient (Kreiss et al., 2000). Penicillium produces ochratoxin which is a nephrotoxin, immunosupressor and teratogen (Sweeny et al., 2000).

Conclusion

The role of street foods in offering employment, provision of daily diet to many, preservation of cultural foods among others make its production and patronage a reality. Street foods in the Cape Coast have threatening microbial contamination levels.

Efforts should be made to create producer and consumer awareness, enact and enforce legislation and inspection, set standards and improve the general sanitation of food handling and sale premises. Because some of these microbial contaminants come from the ingredients with which the food were prepared (Mensah et al., 2002), a careful selection of food material to be processed, the control of the environmental and technical sources of contamination are necessary to protect the consumer.

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