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Microbial Implications in Vended Street Foods in Kumasi, Ghana

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Street foods are foods and beverages that are ready to be eaten and usually sold on the streets. This practice is common in the heart of cities in Ghana providing valuable services by supplying easy access of food to the public at a low cost. However, the safety of these foods is not assessed, in particular, the evaluation of the handling that can result in a contamination. In this study, we assessed the microbial contamination due to the handler involved in the processing of the ready-to-eat-foods (RTE) and with the use of a survey researchers highlighted the critical points in order to assess the hygiene practices observed. The study recruited 45 vendors using the random sampling method. Water samples were collected aseptically from the container where the food handlers use in washing their hands during the production of RTE. A structured questionnaire and an observational checklist were used to gather environmental and personal hygiene data from the vendors. Samples were analysed for the detection of different microbiological parameters including food-borne pathogens and 16 resulted positive (37.21%) for *Escherichia coli*, 12 (27.91%) for *Salmonella* spp., 8 (18.60%) for *Staphylococcus aureus* and 7 (16.28%) for *Klebsiella* spp. These

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results highlighted the importance of different management of the critical points in the RTE production, including guidelines for vendors, in order to guarantee the safety of handled foods that must be taken in consideration will from policy makers in order to guarantee the hygiene practices of these businesses.

Keywords: Street food vendors; microbial; Kumasi; ready-to-eat.

1. INTRODUCTION

Street foods are foods and beverages that are Ready-to-Eat and are usually sold on the street, market and other public locations [1]. Street foods are very popular in Ghana and contribute greatly to the diet of most Ghanaians. Street vending is a traditional activity, common in many societies and provides a valuable service by supplying food to the public at low cost [2,3]. Street vended foods (SFV's) are preferred as a result of their distinctive tastes, convenience and their dietary significance in the traditions of communities' [4]. The sale of street foods also offers business opportunities for emerging industrialists while making a substantial influence on the financial system of many developing countries [5,6]. Currently many local and international organisations as well as consumer associations are fully aware of the socioeconomic importance [7] as well as the risk associated with street vended foods since quite a number of research have linked the practice to presence of both pathogenic and some non-pathogenic microorganisms [2]. Foodborne diseases, which result from the consumption of contaminated foods of microbial or chemical origin, include a wide spectrum of illnesses, which has become a global public health concern [8]. Microbial agents of infection and chemical agents that cause food borne diseases include *Escherichia coli*, *Bacillus cereus*, *Staphylococcus aureus*, *Salmonella*, *Shigella spp*, and lead, copper and cadmium, respectively [9,10].

When food are not properly handled right from production, preparation to the final consumer there is the likelihood of contamination [11]. Improper food handling by street food vendors coupled with poor personal and environmental hygiene are very important contributory factors for food contamination [2,12,13,14].

This current research has become necessary because, practices involved in street food vending have become a major public health issue and a great concern to researchers and policy makers due to their contribution to food

borne diseases [15]. Also, there is an overwhelmingly increase in food vending due to the financial support it contributes to the livelihood of vendors and the family [15]. However, the majority of these vendors lack an appropriate understanding of the basic food safety policies [16,17]. Research in other parts of the globe has indicated that approximately 2 million people annually, mostly children die as a result of diseases caused by the consumption of contaminated food and water [18]. Again, previous research has revealed considerable amount of street-vended foods having the potential to cause diseases [19].

However in Ghana, report has indicated that annually, total number of out-patients with food borne diseases is about 420,000, with a death rate estimated at 65,000 and total cost to the economy at US\$69 million [20]. The core objective of this study is to assess vendors' hand as a route of food contamination to consumers and possible measures to be taken to control food borne disease outbreak to some extent. Outcomes from this research will reveal to some extent diseases caused by unhygienic food resulting from hand contamination. This will pave way for providing possible precautionary measures to be taken by all and sundry to avert the situation and taken pragmatic decisions to improve the health status of the people.

2. METHODOLOGY

2.1 Study Area

The study was conducted within the Kumasi Metropolis which is divided into Sub-Metropolitan Assemblies (Sub-Metros), namely Oforikrom, Asokwa, Manhyia, Tafo, Suame, Bantama, Kwadaso, Subin, Nhyiaeso and Asawase. Each of these Sub-Metros serves as sub administrative body within the Kumasi Metropolitan Assembly (KMA). KMA is the highest governing political authority in the Metropolis, responsible for, among other things, waste management and waste collection,

revenue mobilisation, provision of basic socioeconomic infrastructure, and the maintenance of peace and security. It is the most populous District in the Ashanti region; it has a population density of 5,782 persons per square kilometer, second only to that of the Accra Metropolitan Assembly (GSS, 2014). Subin-sub metro which represents one of the considerably large sub-metros in the Kumasi Metropolis was used as the study area (Fig. 1a).

2.2 Design of Study

Mixed method design approach involving survey, observation and experimental was employed. The survey and observation were used to gather data on the demographic and hygiene practices of the selected street food vendors and sites of

vending. The experimental design was also used to determine the microbial contamination on the hands of the street food vendors. Questionnaires were coded with specific serial numbers which consisted of an area code (AS/001-AS/015 for Asafo food vendors, AF/016-AF/030 for street food vendors around the Aful Nkwanta whiles CM/030-CM/045 was coded for food vendors at the Kumasi Central market. The codes were also given to each sample which corresponded with the code on the respective questionnaires.

Forty-five (45) street food vendors in the Subin sub metro in the Kumasi Metropolis were recruited for the study. The study area was sectioned into three (3) zones where fifteen (15) street food vendors who consented to take part in the study recruited.

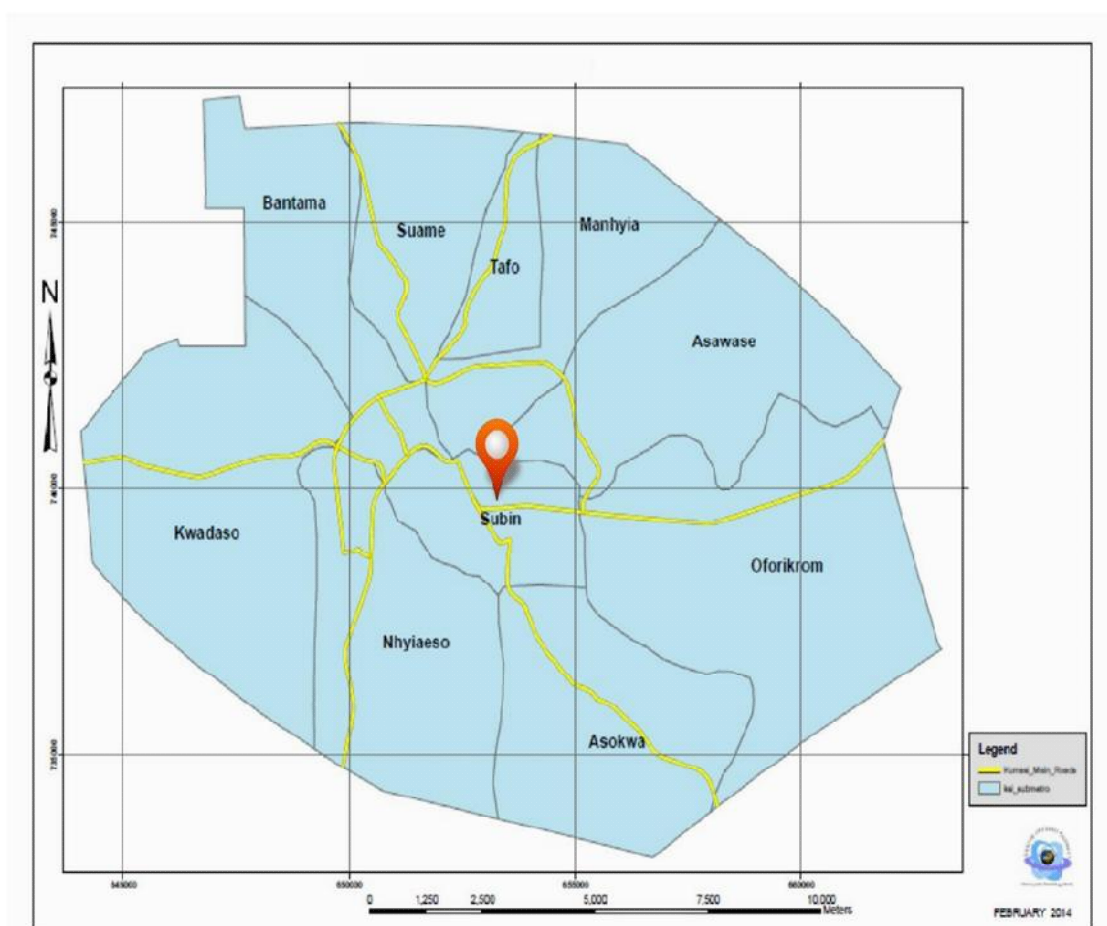


Fig. 1a. Map of Kumasi showing all Sub-Metros with a red navigation sign at Subin sub metro where this current study was conducted

2.3 Sample Collection

Contaminated water samples from hands of vendors were aseptically collected from forty-five (45) street food vendors (SFV's) into sterile appropriate sampling containers. The samples were kept refrigerated until they reached the laboratory at 4°C.

A structured and pre-tested questionnaires as well as observational checklist were used to collect data from 45 street food vendors recruited for the study and the environment where food is prepared. The questionnaire was initially prepared in English and translated into Twi (local language) for data collection. The questionnaires were read and thoroughly explained to those who could not read and write where appropriate points suiting their choice selected.

2.4 Laboratory and Data Analysis

A sterile loop (0.1ml) was used to inoculate each of the contaminated water samples into petri dishes containing nutrient agar (Oxoid Ltd, Basingstoke, Hampshire, England). Each petri dish was divided into five sections and labeled with their corresponding ID's. The plates were incubated at 37°C for 24 hours. Colonies were subsequently picked up and sub-cultured on MacConkey, Blood agar (Oxoid Ltd, Wadde Road, Basingstoke, Hants, RG24 8PW,UK) and CLED (Oxoid Ltd, Basingstoke, Hampshire, England) and again incubated at 37°C for 48

hours. Pure colonies were picked and smear prepared on slide glasses for examination under the microscope for motility and biochemical assessment were conducted for confirmation and establishment of result. Result obtained was analysed statistically using Statistical Package for the Social Sciences (SPSS) Version 20 and Microsoft Excel 2016.

3. RESULTS

A total of 16 samples (37.21%) showed growth of *Escherichia coli*, 12 samples (27.91%) for *Salmonella typhi*, 8 and 7 samples (18.60% and 16.28%) for *Staphylococcus aureus* and *Klebsiella spp*, respectively (Fig. 1).

3.1 Knowledge Level of Respondents during Survey

Thirty-nine (39) SFVs admitted the fact that they have heard about food hygiene prior to our visit with six (6) claiming they did not know anything like food hygiene (Fig. 2). Again majority (56.41%) stated that, they heard the advocacy on food hygiene through radio and 23.08% through television while 7.69% and 12.82% through friends, nurses and public vans, respectively (Fig. 3). During the survey and interactions through conversations and questionnaire administration almost all the recruited SFV's agreed that there is the need to practice food hygiene though initially some of them did not have idea about it (Fig. 4).

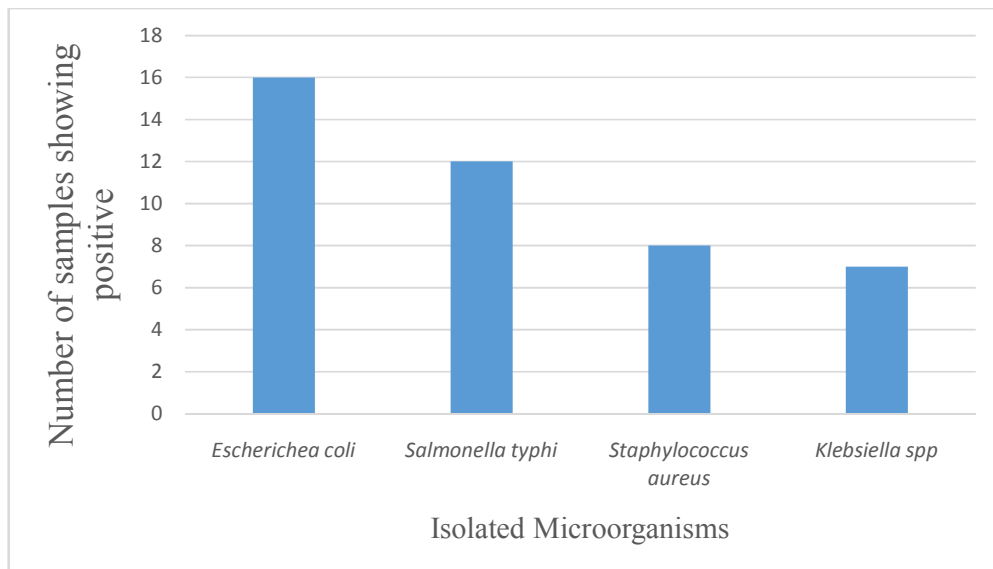


Fig. 1. Number of samples showing microbial growth

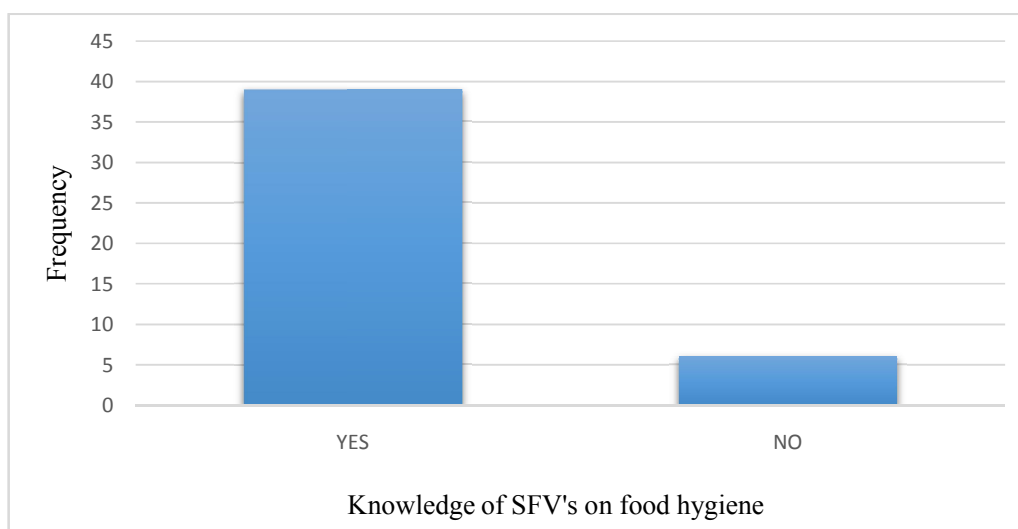


Fig. 2. SFV's and knowledge on food hygiene

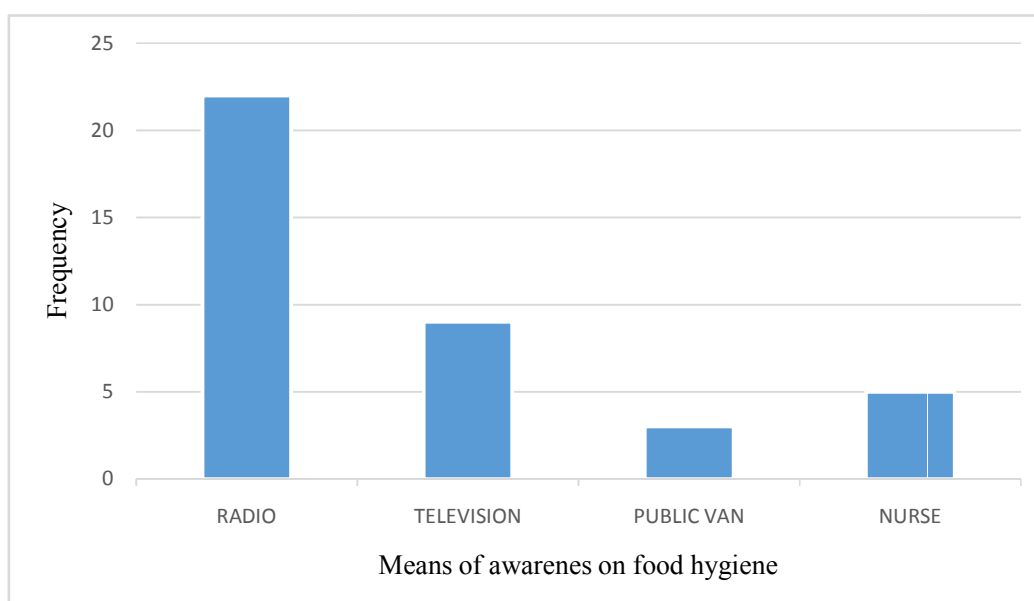


Fig. 3. Means by which SFV's heard about food hygiene

3.2 Observational Checklist Outcome

When the observational check list method was applied 93.33% of the SFVs were not in protective clothes, while 6.67% of the SFVs were seen wearing appropriate clothes for the sale of food.

It was also observed that thirty-eight (38) of the SFVs had their serving area very close to opened gutters. None of the SFVs had a visible sore on any part of their body though this was

captured on the check list. There was evidence of flies within twenty (24) vending sites as well as rodents. Again forty-four (44) SFV's handled money with bare hands while serving food with only 1 SFV having someone to handle the money.

Spitting and cleaning of nose while serving food which was also captured on the check list as unhygienic practices was observed among fourteen (14) SFV's.

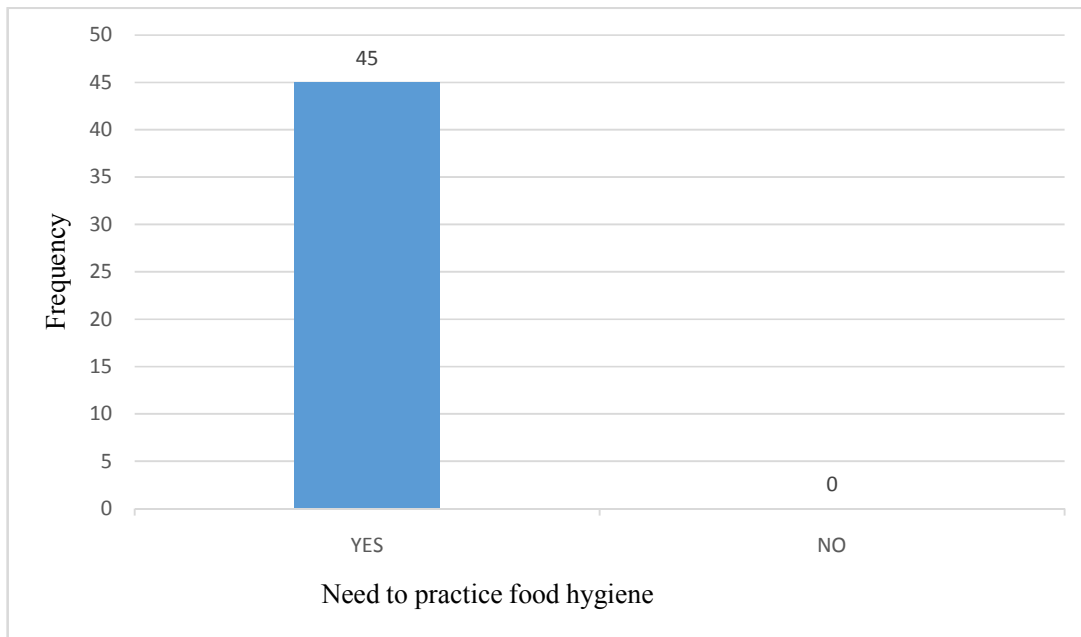


Fig. 4. SFV's response on the need to practice food hygiene

Table 1. Observational check list outcome

Unhygienic Practices	Frequency		Percentage	
	Yes	No	Yes	No
SFV's in protective clothing	3	42	6.67%	93.33%
Serving area close to open gutters	38	7	84.44%	15.56%
SFV's with visible sores on any part of the food vendor	0	45	0%	100%
Presence of appropriate refuse containers	18	27	40%	60%
Refuse containers covered	3	15	16.67%	83.33%
Presence of stagnant waters around the serving area	12	33	26.67%	73.33%
SFV's nails short and clean	34	11	75.56%	24.44%
Evident flies and other rodents	21	24	46.67%	53.33%
Proper disposal of waste food	27	18	60%	40%
SFV's used the same hands for money collection	44	1	97.78%	2.22%
Food sold at opened spaces	38	7	84.44%	15.56%
Spitting, cleaning nose, ears, sneezing, cough touching other body part while serving or handling food	14	31	31.11%	68.89%

4. DISCUSSION

The significant contribution of poor food hygiene practices to the occurrence of foodborne outbreaks has been widely supported by many previous studies [20,21,22]. However, the routes of contamination has been given little attention in some parts of the world where policies as well as rules and regulation are less enforced and grossed over by stake holders and society in general. The indication of the presence of microorganisms including *Escherichia coli* in this study establishes contamination from environmental faecal origin which may result from poor hygiene practices. These could be

carried out by the SFV's at the point of sale such as lack of effective hand washing with soap after using the toilet or touching other unwholesome substances [23]. Non adherence to important practices during food preparation as well as serving may lead to the unacceptably high presence of microorganism on the hands of SFV's affecting both the health of consumers and the SFV's as well [23]. Though majority of the SFV's indicate having knowledge on the hygiene practices, they were not sufficient to really back the campaign for safe food consumption [11]. In this regard the study revealed that, SFV's only knew that clean food must be prepared and served with clean hands to prevent diseases but

how to achieve this task was something herculean for them [8,24]. This study also revealed that some considerable number of SFV's knew that microorganisms may get access to food production sites or environments, therefore, food should be covered as much as possible [25] but research also shows that this contamination could be established through the use of poorly cleaned cooking utensils and accessories, such as spoons, plates or leakage and openings within cooking areas [26]. Again, there is also the possibility that these microorganisms may be passed on to raw materials during production and processing as well as poor observation of personal hygiene [27] and contamination through dust particles from the air or via aerosols from stagnant [28]. Standard waste disposal facilities are fairly adequate which lead to improper disposal of waste foods and other materials by SFV's which agrees with [29]. Contamination may correspond with the waste produced from food processing activities that are mostly discarded close to the vending sites. These could include insufficiency of facilities for liquid and waste water drainage as well as garbage disposal which encourages waste to be thrown into neighbouring streets and gutters. Different studies related to fresh produces and RTE, have also highlighted the possible contamination due to other microbial agents, including enteroviruses, HAV and Norovirus [30,31]. The cause of the contamination can be found along all the food-chain and different approaches have been assessed also to evaluate the primary production [32]. In this study viruses were not taken in consideration but can be introduced in other pilot studies considering their importance as food contaminants [33]. Another observation that was established during the study was the SFV's money collection from food sales, the same hand was virtually used for money collection as well as serving of food which poses risk to consumers [34].

5. CONCLUSION

This research establishes that, hands of SFV's within the environs of Kumasi contain to some extent *Escherichia coli*, *Staphylococcus aureus*, *Salmonella typhi* and *Klebsiella spp.* that could potentially cause serious gastrointestinal infections.

Unacceptable practices such as using bare hands to collect money from consumers and serve food at the same time and selling in

unhygienic open spaces were observed with these SFV's.

6. RECOMMENDATION

The Metropolitan Assembly should organize attractive and less expensive seminars and workshops for the SFVs to increase their knowledge on Food Safety and Hygiene.

Also, incentives should be provided for food vendors who are adhering to good practices.

Appropriate policies and regulations governing this practice must be enforced.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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