International Journal of Science, Technology, Engineering and Mathematics
Volume 2 Issue 1 March 2022
DOI: https://doi.org/10.53378/352874

Street Food's Microbiological Load and Vendors' Food Hygiene and Safety Practices Compliance in the Schools of Cebu City

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Abstract

This study utilized descriptive statistics to assess the microbiological load and the vendor's compliance with eight international codes of food safety and hygiene principles among 51 randomly chosen street food vendors in the north and south district schools of Cebu City. Samples of *kwekwek* and two kinds of dipping sauce were collected and sent to the Department of Science and Technology (DOST) laboratory. The compliance levels were rated based on a yes/no scale calculated from the compliance scores of every food hygiene and safety principle. The E. coli count reported from the laboratory tests showed that every food sample from all locations suggested fecal contamination. Results of the compliance scores showed that food vendors from the selected study areas have very good compliance with the use of protective clothing, provision of water at vending point, cleanliness of fingernails, and use of appropriate kitchenware for dishing out food to consumers but very poor compliance with the use of head covering, obtaining a business permit and sanitary/health card. Although the study revealed a marginally good overall compliance score, the result could imply no possible association between the vendors' food safety and hygiene practices and the presence of E. coli in the food samples tested.

Keywords: *Street Foods, Food Consumption, Food Security, Food Safety and Hygiene, Microbiological Assessment, E. coli*

Received: January 13, 2022 **Revised:** February 4, 2022 **Accepted:** March 3, 2022

Suggested Citation: Origenes, R.W., Espinosa-Gelisanga, R. & Alturas, S.B. (2022). Street Food's Microbiological Load and Vendors' Food Hygiene and Safety Practices Compliance in the Schools of Cebu City. *International Journal of Science, Technology, Engineering and Mathematics*, Volume 2 Issue 1, pp. 48 - 60. DOI: https://doi.org/10.53378/352874

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1. Introduction

Street vended foods are not only liked by the public for their tasty flavors, but also because of their cheap price, availability, and accessibility. These are beverages or drinks and ready-to-eat food prepared and sold in the streets and other public places (Ekanem, 1998; FAO, 1997). Like its Southeast Asian neighbors, Philippine's street foods are meant to ease hunger. Because the Filipinos have a knack for combining flavors and making the most of any ingredients at their table, they have developed sumptuous quick bites that have a variety of flavors (Fernando, 2021). Just like the consumers of street foods from other countries, Filipinos are increasingly fascinated by traditional or ethnic foods (Winarno & Allain, 1991). These street foods are also liked by the school children because they are not just delicious but also cheap and easy to find. School children are found to be the important consumers of street food and most of them eat street food every day (Poster, 1983; Chauliac et al., 1994; Webb & Hyatt, 1998). The hygienic and nutritional quality of this street food gave satisfaction to most of the school children but the opinion of their parents differ (Neffati, 2004).

In spite of the importance of nutrition value, taste, and affordability of the street food, they are mostly criticized because vendors do not normally follow personal, food and environmental safety and hygiene (Selepe et al., 2017; Joglekar, 2013). Without proper and safe personal and food hygiene, these foods could be contaminated by microorganisms like species of Salmonella, Bacillus, E. coli, among others, which can cause serious food infections. Some microorganisms produce toxins in foods eventually leading to food-borne illnesses mainly due to the unhygienic practices while preparing and serving food (Chakravarthy, 2003). Street vended foods can cause foodborne diseases such as diarrhea and food poisoning (Sofos, 2013). The leading cause of death in children is a diarrheal disease and it is causing more than 1,400 childhood deaths per day worldwide and about 526,000 childhood deaths per year (WHO, 2015). Though there is a dearth of data focusing on the health risks of street food in school areas, still school children are at risk of these foodborne diseases.

An incident related to health risks and hazards of street foods happened in CARAGA Region, Philippines where almost 2000 school children were affected by food poisoning due to eating street food. These children experienced stomach cramps, diarrhea, vomiting, and headaches (Llacuna, 2015). Another related incident happened in Calasiao, Pangasinan where thirty-three grade school children were hospitalized for food poisoning after eating "*isaw*" burgers sold by a

vendor outside the school (Cardinoza, 2017). However, there are no reported incidents of food poisoning due to street food and no available information on the health risks of street food to school children in Cebu City. But the DepEd Region VII reminded the schools to advise the parents to make sure that their children buy only from the school canteen. The DepEd Region VII also reminded the schools to regulate vendors operating in the vicinity (Cabahug, 2017).

Regulating street vendors operating in the streets and in the school is a must to avoid such incidents. In order to prevent possible food contamination, proper food handling and storage for better sanitary and hygienic control must be observed (Barcelon et. al, 2015). Although there is an existing act to strengthen the food safety regulatory system in the country (Republic Act No. 10611), it is obvious that the government does not have full management of the local food and food products. The missing pieces of the management are close monitoring and evaluation of the foods sold locally and a strict food safety regulatory system. The incidents of food poisoning and lack of management of the government of the street foods are issues concerning the health safety of the school children and the public. For instance, Rustia et al. (2021) cited the identified gap in the concept of food safety in the street food industry and ambulant vendors in the country was generally influenced by the practice of a vendor compromising food safety for business profits. The food safety practices such as display of sanitary permits, health certificate IDs, washing of raw fruits with potable water, washing hands thoroughly with soap and water, and use of chlorine solutions for utensils were not properly demonstrated by the street food vendors (Rustia et al., 2017). With this food handling issues, Van Olem and Olmogues (2021) recommend local government constant monitoring on these street food vendors to strengthen food safety practices as these vendors serve different types of consumers.

Given the vast impact of the street foods on the health of school children, this study assessed the microbiological load of the street food in the North and South District Schools of Cebu City. It also assessed the food safety and hygiene practices of the street food vendors. Since there is no available information on the correlation between the microbiological load and existing local and international code of practices in handling food, this study evaluated the possible association of the microbiological load of the street food and the vendors' food handling practices.

2. Methodology

2.1. Research Design

This study employed a cross-sectional analytical study and descriptive-correlational research design. For the cross-section analytical study, the food samples were bought from the street food stalls in the north and south districts of Cebu City and analyzed in the laboratory for bacteriological contamination by *Escherichia coli*. For the descriptive-correlational research, the street food vendors' food hygiene and safety practices compliance was investigated through the characteristics of a given population.

2.2. Respondents and Sampling Technique

The study utilized a stratified random sampling method in selecting its respondents. Stratified sampling is where the population is divided into strata (or subgroups) and a random sample is taken from each subgroup (Taherdoost, 2016). The researchers randomly selected 2 street food stalls in the north district of Cebu City near the schools and the other 2 street food stalls in the south district also near the schools. The study also randomly selected 26 street food vendors in the north district and 25 street food vendors in the south to answer the survey questionnaire on food hygiene and safety practices compliance.

2.3. Microbiological Analysis

Samples of Filipino street food like *kwek-kwek*, which is a deep-fried hard-boiled quail egg covered with orange batter and two types of dipping sauce were collected directly from different street food stalls located outside the top four most populated public elementary schools in the northern and southern zones of Cebu City. These food samples were collected aseptically in pre-sterile polybags and sterile bottles, kept in an ice-box, and labeled accordingly. Samples were then transferred to the Department of Science and Technology (DOST) laboratory and were stored at 4°C until being analyzed following Bacteriological Analytical Manual 8th ed. Online 1998 Rev., Chapter 4: *Escherichia coli* and the *Coliform Bacteria.* The microbiological analysis performed in the DOST Laboratory was Total Coliform Count. A colony-forming unit per gram (cfu/g) was used as the measuring unit of the presence of E. coli in this study. A level of <3 cfu/g has been given as the satisfactory criteria for this organism. Levels exceeding 100 cfu/g are unacceptable and indicate a level of contamination (Food Standards Australia New Zealand, 2001).

2.4. Food Hygiene and Safety Practices Compliance Assessment

For the food hygiene and safety practices compliance assessment, 51 randomly selected street food vendors from the northern and southern zones of the Cebu City division were asked to answer the survey questionnaire. This survey questionnaire assessed the vendors' compliance on selected food hygiene and safety principles from the recommended international code of practice, general principles of food hygiene developed by the World Health Organization which include, (1) the use of protective clothing such as apron or vest (2) provision of water and food vending site (3) cleanliness of fingernails (4) dishing out of food with appropriate kitchenware (5) protection of food from flies and dust (6) head covering (7) sanitary permit and (8) business permit. The assessment of the vendors' compliance to the selected food hygiene and safety principles was based on a yes/no scale (Monney et al., 2014) which assigns a compliance level to a particular principle based on a computed compliance score (C-score) as shown in Table 1. The Overall C-scores (OC- scores) were then computed separately for each location based on the C-scores for the food hygiene and safety principles.

Table 1

Compliance scores and corresponding compliance levels

Compliance Score	Compliance Level	Description
0.0 – 0.20	Very Poor	0% - 20% of food vendors comply with a particular food hygiene and safety principle
0.20 – 0.40	Poor	20% - 40% of food vendors comply with a particular food hygiene and safety principle
0.40 – 0.60	Average	40% - 60% of food vendors comply with a particular food hygiene and safety principle
0.60 – 0.80	Good	60 % - 80% of food vendors comply with a particular food hygiene and safety principle
0.80 – 1.00	Very good	80% - 100% of food vendors comply with a particular food hygiene and safety principle

Source: Adapted from Rajan & Aruna, (2017)

2.5. Statistical Technique

The data gathered were analyzed using descriptive statistics such as frequencies and percentages.

2.6. Ethical Considerations

In the conduct of the research, the ethical considerations including the risk-benefit assessment, content, comprehension, and documentation of risk-benefit assessment, authorization to access private information, confidentiality procedures, and conflict of interest were considered.

Risk-Benefit Assessment. The possible problem involved in the conduct of this research was the research respondents' lack of cooperation. The benefits of this research were for the improvement of the food hygiene and sanitation practices among street food vendors. The objectives of the study were properly communicated to the respondents.

Authorization to Access to Private Information. The study obtained the authorization to access to private information once the informed consent letter was signed and permission was granted by the respondents. The study assured that data were gathered with authority and permission.

Confidentiality Procedure. The study assured confidentiality of data and information gathered. The respondents were oriented that the study is for research and academic purposes only. No personal or business information of the respondents were disclosed during and after the data gathering.

Conflict of Interests. The conflict of interest is declared before the administration of the questionnaire. The respondents were informed that they can withdraw from answering the survey at any time should they feel uncomfortable answering any question or they have any conflicts answering any questions.

3. Results and Discussion

3.1.Microbiological Analysis

Table 2

E.Coli Count Of Different Food Samples

Food Samples	Location A	Location B	Location C	Location D
Dipping Sauce: Vinegar	<1 x 10 cfu/g	<1 x 10 cfu/g	<1 x 10 cfu/g	<1 x 10 cfu/g
Dipping Sauce: Sweet	<1 x 10 cfu/g	<1 x 10 cfu/g	<1 x 10 cfu/g	<1 x 10 cfu/g
Kwek-kwek	<1 x 10 cfu/g	<1 x 10 cfu/g	<1 x 10 cfu/g	2 x 10 cfu/g

Table 2 shows the E. coli count in the samples from the street food vendors. The laboratory tests showed every food sample from all locations with *E. coli* count. This is similar to the study of Rajan and Aruna, (2017) on street foods in India with minimal but still showed in the results. This is an implication of fecal contamination in the food samples. This is also congruent to the studies conducted in Brazil and Kenya that the presence of E. coli indicates fecal contamination (Kothe et al., 2016; Kariuki et al., 2017).

Ideally, E. coli should not be detected, and as such a level of <3 cfu/g has been given as the satisfactory criteria for this organism. Levels exceeding 100 cfu/g are unacceptable and indicate a level of contamination which may have introduced pathogens or that pathogens, if present in the food prior to processing, may have survived (Food Standards Australia New Zealand, 2001). The presence of *E. coli* in the sample street food is not desirable because it signifies poor hygienic practices which have led to not adequate heat treatment and contamination. Ideally, *E. coli* should not be detected in ready-to-eat foods. Even though some *E. coli* are safe and harmless, *Enterohaemorrhagic E. coli* (EHEC) can produce one or more toxins and a specific serovar O157:H7 has been related to the haemolytic uraemic syndrome, thrombotic thrombocytopaenic purpura, and haemorrhagic coliti. Enterotoxigenic *E. coli* (ETEC) is also associated or related to traveler's diarrhea (Madueke, et al., 2014).

Food Hygiene and Safety Practices Compliance Assessment

Table 3

Vendors' Compliance Scores in 8 Food Hygiene and Safety Practices

Food Hygiene and Safety Practices	Responses (%)		Compliance Score
	Yes	No	
the use of protective clothing such as apron or vest	82	19.6	0.82
provision of water and food vending site	92.2	7.8	0.92
cleanliness of finger nails	96.1	3.9	0.96
dishing out of food with appropriate kitchenware	100	0	1
protection of food from flies and dust	92.2	7.8	0.92
head covering	31.4	68.6	0.31
Business permit	5.9	94.1	0.06
Sanitary card	5.9	94.1	0.06

Table 3 showed that food vendors from the selected study areas have a very good compliance with the use of protective clothing (C-score= 0.82), provision of water at vending point (C-score = 0.92), cleanliness of fingernails (C-score = 0.96), and use of appropriate kitchenware for dishing out food to consumers (C-score = 1). This is very important because FAO/WHO on "Basic texts on Food Hygiene" (2009) necessitates that food vendors should have access to clean water for washing utensils and hands regularly as the fingernails and hands could serve as harbourages for pathogens and lead to possible results in contamination of food upon contact (Edima et al., 2014; Nurudeen, 2014). The vendor's hygiene is very crucial because the microbial that can cause foodborne disease transmission can be found in the skin, nose, and mouth (Pascual et al., 2019). The FAO/WHO also recommended that food handlers to ensure food protection from contamination including dust and flies, and wear appropriate protective attire and head covering, results showed very poor compliance with this hygiene and safety practice (C-score = 0.31), very poor compliance score in obtaining a business permit (C-score = 0.06) and sanitary / health card (C-score = 0.06) with only 3 out of 51 respondents admitting to having their food stalls registered. This is in contrast with the findings in Iloilo City, Philippines where food vendors always practiced availing sanitary permits or registration (Calopez et al., 2017). This implies that the street food vendors in Cebu City do not comply with City's ordinance on getting mandatory health cards and sanitary permits.

The overall score (OC- scores) calculated as 0.61 represents a marginally good overall average compliance to all the internationally required food hygiene and safety principles used in the study. This good overall compliance is also the same as the overall result of degree of practice among street food vendors in Iloilo City in terms of their food hygiene and safety practices (Calopez et al., 2017). This is also the same as the findings of the research conducted in Vietnam (Minh, 2017). However, it was found that *E. coli was* present in the tested food samples. This could mean that there is no possible association between the vendors' food hygiene and safety practices and the presence of *E. coli* in the food samples tested. This further indicated that the results did not convene with the guidance on the hygiene indicator organisms in ready-to-eat food, in which *E. coli* is a commonly used fecal indicator organism (Buttiaux & Mossel, 1961; Food Safety Authority of Ireland, 2007). This also further implies that there are poor sanitary conditions and poor food hygiene practices of the street food vendors that potentially led to the presence of *E.coli* in the tested samples. Kariuki et al. (2017) cited Yeboah- Manu et al. (2010) that the

presence of E. coli in food types is an indication of fecal contamination probably at one stage of preparation or from the materials used by the street food vendors.

Generally, the respondents in this study were predominantly men which is consistent with the reports of Muinde and Kuria (2005) in Kenya, Chander et al. (2013) in India, Rosnani et al. (2014) in Malaysia, Minh (2017) in Vietnam and Calopez et al. (2017) in Iloilo City, Philippines. However, this contrasts with the studies of Apanga et al. (2014) and Monney et al. (2014) in Ghana, Tessema et al. (2014) in Ethiopia, Chukuezi (2010) in Nigeria and Van Olem and Olmogues (2021) in Dipolog City, Philippines which showed that street food vending business in developing countries is a trade predominated by women. These different results further reveal that gender of food vendors is dependent on the geographical region being studied. However, Mekasha et al. (2016) found out that females were shown to be better at following food safety practices than males, and sex was found to be substantially associated with hygiene practices.

In terms of the highest level of education attained by food vendors, the results pointed out that the majority of them reached the high school level and have been in the street food industry for more than five years which means that they are already familiar with food handling. This finding is consistent with that of Minh (2017), Calopez et al. (2017) and Van Olem and Olmogues (2021). Rebouças et al. (2017) believe that level of food vendors' formal schooling is one of the factors that contribute to food safety. Thus, secondary education as well as college and university training may imply that street food vendors are giving better quality and safe food.

4. Conclusion

The overall good compliance score of the vendors' food hygiene and safety practices did not give a comforting feeling of security towards the health of the school children due to the presence of *E. coli* in the food samples. In addition, the non-compliance of the vendors in obtaining a health card and business permit poses great risks to all children in the nearby schools as these food stalls have not been checked by the city health office. These vendors could have diseases that are contagious and hazardous to the school children's health. A compliant food vendor is more likely to practice good hygiene, thus, it is advisable that the street food vendors should obtain sanitary and business permits. Good hygiene practices prevent food-borne illness, which could be

done through education of the food handlers on food safety practices and close and strict supervision of street foods prepared and served in the school areas.

Food safety is an utmost priority anywhere in the world and for this to be achieved, appropriate legislation and strict implementation should be done. Over the years, Cebu City has developed quite a number of enforcements as reported by their city health officer but findings from this study revealed that these legal instruments and institutional frameworks on food safety and hygiene have not achieved their goals. There should be a strengthened implementation of the Republic Act No. 10611, the Food Safety Act of 2013, in the local government to address this current dilemma in the city.

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