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Food safety hygiene practices among street food vendors in Demerara-Mahaica, Guyana

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ABSTRACT

Food safety and hygiene are essential, particularly in limited. Street vending poses a public health risk due to the potential for foodborne illnesses. Literature indicates that many vendors fail to meet basic hygiene standards, highlighting the need for local evaluations. The Demerara-Mahaica region has the highest population density in Guyana as it serves as the social, economic, and administrative hub of the country. While street food vending is popular across this region, it is without adequate regulations and oversight. Moreover, there are no prior known studies on the hygiene practices of street food vendors in Guyana. This study examines the hygiene practices of street food vendors in this region of Guyana. It involves a direct cross-sectional observational assessment based on data collected in a broader survey in 2024, where a total of 104 street food vendors were selected via convenience sampling. The assessment focuses on hygiene indicators, including handwashing, attire, money handling, and grooming. Descriptive statistics summarized hygiene practices, while inferential analysis explored associations between observed hygiene behaviors and vendors' demographics. Less than 32% of vendors washed their hands while handling food, and among those observed using toilet facilities, the majority did not wash their hands afterward. Similarly, about 46% vendors handled money while serving food, and most of these failed to wash their hands afterward. Despite these poor hand-washing practices, over 60% of the vendors handled food with their bare hands. Just over 90% of vendors wore masks while handing food, and fewer than 54% wore aprons. Jewelry use was common (39%), often uncovered. Chi-squared analysis and odds ratio tests revealed no statistically significant associations between hygiene practices and demographics. The findings are concerning, as they reveal a substantial shortfall in hygiene practices and point to a potential increase in food-borne illnesses. A more comprehensive study, such as a census, is recommended to validate the findings.

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1. Introduction

The popularity, utility, and importance of street food vending is a global phenomenon that has significant Nutritional, economic, social, and cultural implications. Globally, it is estimated that 2.5 billion people consume street food daily (1), with this trend being particularly prevalent in developing countries. It serves as an

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important means of providing affordable and accessible food options for urban populations (2–4).

According to the available evidence, street food vending is a crucial source of employment and income for many individuals, particularly those from low-income backgrounds who struggle to find work in the formal job market (5–7). The industry has been shown to make significant contributions to the economies of developing countries. Studies have found that street food vendors often earn above the minimum wage in their respective countries (5), and street food vending accounts for a substantial portion of urban food consumption and economic activity (6,8). In many regions, street food vendors offer a diverse range of indigenous and culturally significant dishes, contributing to the preservation of local culinary traditions (2).

Notwithstanding its immense importance, this informal food sector poses significant public health challenges that need to be addressed. One of the primary concerns is the risk of foodborne illnesses. Studies have shown that street food in developing countries is often prepared and handled in unsanitary conditions, increasing the likelihood of microbial contamination (9,10). Additionally, the lack of proper infrastructure for vendors, including access to clean water supplies and waste management systems, contributes to the high prevalence of foodborne diseases (9). With limited knowledge and poor food safety practices among street food vendors, the problem is further exacerbated (11,12). Another issue is the potential exposure to environmental hazards. For instance, the use of unsafe water for cleaning and processing food is a key risk factor for foodborne and waterborne diseases, particularly in low- and middle-income countries (13). The effects of climate change, such as increased temperatures and floods, can also exacerbate the challenges in ensuring food safety. Furthermore, the informal nature of street food vending poses regulatory and oversight challenges (12). For example, a study in rural areas of South Africa reveals that estimating the true burden of foodborne diseases is challenging due to the lack of effective epidemiological surveillance systems (14). These challenges have sparked widespread academic interest in assessing vendors' hygiene practices and their impact on consumers' health. Research from developing nations, where street food consumption is high, dominates the literature (15). Some studies have found favorable hygiene practices among vendors (16,17). For instance, a study conducted in Ghana found that, although a few hygiene variables performed poorly, the vendors achieved a total food handling score of approximately 70% (18). In contrast, several studies have found poor hygienic practices among vendors (19,20). For example, a study conducted in Brazil found that over 90% of vendors displayed unhygienic practices, including inadequate hand washing, failure to wear hair coverings, and limited access to water (21). Unsatisfactory hygienic practices are often cited as the primary cause of food contamination (22). On the global scale, hygiene scores are estimated to range between 35% and 64% among street food vendors (23). These findings highlight the global issue of hygiene compliance among street food vendors and underscore the need for context-specific, observational studies. However, despite widespread

concern about food safety and hygiene practices, many developing nations lack studies on these topics.

In the case of Guyana, street food vending is particularly popular along the coastal region, with a higher concentration in the Demerara-Mahaica region (Region 4), which includes the capital city of Georgetown. Despite the growing presence of street food vendors in this area, there is a notable absence of studies assessing the vendors' hygiene practices. This is particularly concerning given the potential health implications for consumers and the broader community. Considering this gap, this study aims to assess the hygiene practices of street food vendors operating in the Demerara-Mahaica region of Guyana. It answers the research question: What is the level of hygiene practices among street food vendors in Demerara-Mahaica, Guyana? The study utilizes data collected through direct observational methods to assess key hygiene indicators, including handwashing, clothing cleanliness, use of protective gear, grooming, and food handling behavior, which can significantly increase the chances of contamination. The findings aim to inform public health policies and interventions that improve food safety in the informal food sector in Guyana and similar contexts worldwide.

2. Materials and Methods

2.1. Study area

This study employed a quantitative, cross-sectional, observational survey design to assess hygiene practices among street food vendors in the Demerara-Mahaica region of Guyana. The study area lies within the coastal belt of Guyana, includes the capital city, accounts for a substantial fraction of the country's population, and serves as the hub for social and commercial activities.

2.2. Sampling

The data used in this study is based on a broader survey conducted between April and June 2024 (11,24). The targeted population consisted of night street food vendors who operate along major roads and intersections in the study area. As a result of the unregulated nature of street food vending and the absence of a sampling frame, the convenience sampling method was applied to reflect the diversity within the population. Appropriate IRB approval (See appendix) and informed vendor consent were obtained to enable the survey. A total of 104 vendors were drawn from several locations within the city and rural communities within the study area.

2.3. Instruments, data collection, and procedure

This paper utilizes data collected in a 2024 survey (11,24) involving a structured questionnaire-observation tool, which was adopted from other studies where it was similarly employed (25–27). During our survey, it was least disruptive to the vendors' trade to administer the instrument via structured interview and direct observations. We relied on two main sections of the instrument and dataset: demographic characteristics and food hygiene practices of street food vendors. The demographic section included questions on gender, age, ethnicity, education level, years of experience as a food vendor, training, type of district (urban or rural), and whether or not the vendors obtained their education in Guyana. The hygiene practices section consisted of 13 structured observation items (Items 14–26), covering hand hygiene, attire (including use of masks, aprons, hair coverings), and behaviors such as money handling, jewelry use, and smoking while serving food. All

observations were conducted discretely and recorded in real time and stored in categorical form, that is, 'Yes,' 'No,' or, in the case of items 15 and 23, 'practice not observed' was also an option (see Table 1).

2.4. Data analysis

The data was analyzed using the Statistical Package for Social Sciences (SPSS) version 29.0 software. The dataset contained only categorical variables, and so the descriptive statistics include frequencies, percentages, charts, and tables. These were used to present summarized results of the variables measuring vendors' characteristics and hygiene practices. Furthermore, to better answer our research question, we utilized inferential statistics with a 5% significance level applied throughout.

First, inferential statistics were employed to determine possible influential relationships between each pair of the hygiene variables and demographic variables. For example, we compared the gender of vendors with whether they engaged in hand washing while serving food. We relied on the Chi-square test of independence at a 5% significance level. To ensure that the data met the assumptions of this hypothesis test, particularly given our sample size of 104, we regrouped those demographic variables with three or more options into binary variables. Our null hypothesis suggests that the hygiene variable is independent of the demographic characteristics. We present these findings and highlight the cases of statistically significant dependent pairs ($p < 0.05$). Furthermore, we included the odds ratio as a measure of quantifying such relationships where they exist.

Second, we conducted analyses to assess the combined hygiene scores of each vendor and their relationship to demographic characteristics. Except for one hygiene variable that had three options, all other variables were coded 1 if the observation was favorable and 0 if it was unfavorable. The total for each vendor represents their hygiene score out of a maximum of 12 points. The Shapiro-Wilks test for normality proved that the hygiene scores of the vendors are not normally distributed. Therefore, we categorized these scores into poor and good, and relied on a non-parametric approach, specifically the Chi-square test, to determine the extent to which the hygiene scores of vendors depend on their demographic characteristics.

3.Results

The study included 104 respondents. Some of the demographic variables had multiple options/responses and were regrouped to form binary variables. Males and females represented 38.5% and 61.5%, respectively. Youths (18–35 years old) and Seniors (36 years and older), accounting for 53% and 43% of the sample, respectively. A slight majority of the respondents were Africans (51%) compared to the combined other ethnicities (49%). Those with Up to Secondary education made up 81% of the sample, and those with post-secondary education accounted for the remaining 19%. Most (82%) of the vendors received their education in Guyana, while 18% received it outside of Guyana. 59% of respondents did not receive any food safety training, compared to 41% who did. A slight majority (56%) of respondents had up to 5 years of experience, while the others (44%) had more than 5 years. The majority of respondents (65%) operate in urban/city settings, and 35% in rural areas.

Figure 1. Distribution of vendors by demographic variables

Table 1. Observed personal hygiene of vendors

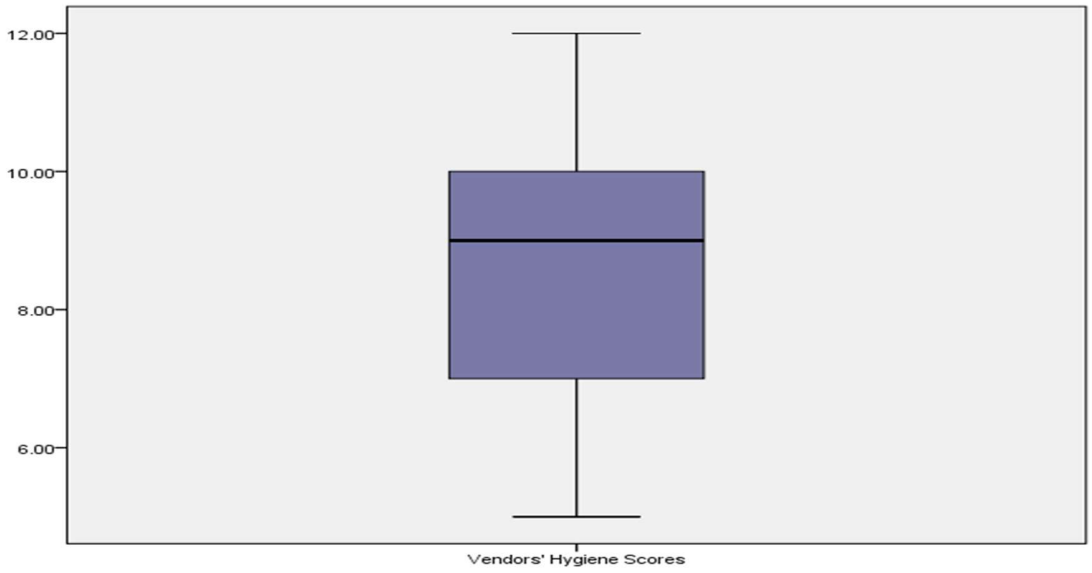
Questionnaire Items		Response n (%)	
		Yes	No
P14	**Operators washed their hands in clean water each time before handling, preparing, or serving food**	**33(31.7%) CI: 22.7% - 40.7%**	**69(66.3%)**
P15	Operator washed their hands each time after visiting the toilet. *Not observed in 60(48.1%) of the cases.*	41(39.4%) CI:30.0% - 48.8%	13(12.5%)
P16	The operators' clothes were clean and presentable	100(96.2%) CI: 92.5% - 99.8%	4(3.8%)
P17	Operator used an apron when handling, preparing, or serving food	56(53.8%) CI: 44.3% - 63.4%	48(46.2%)
P18	**Operator handled food with bare hands**	**64(61.5%) CI: 52.2% - 70.7%**	**40(38.5%)**
P19	The operator's nails were clean and short	95(91.3%) CI: 85.9% - 96.7%	9(8.7%)
P20	Operator hair was covered when handling, preparing or serving food	63(60.6%) CI: 51.2% - 70.0%	41(39.4%)
P21	**Operator wore a mask when handling, preparing, or serving food**	**10(9.6%) CI: 3.9% - 15.3%**	**94(90.4%)**
P22	Operator handled money while serving food	47(45.2%) CI: 35.6% – 54.8%	57(54.8%)
P22Y	**If answer to Q22 is yes: Did operator wash their hands after handling money before handling food again?**	**6(12.8%) 6.4% - 19.2%**	**41(87.2%)**
P24	Operator wore jewelry while handling food	40(38.5%) CI: 29.1% - 47.8%	64(61.5%)
P24Y	**If answer to Q24 is yes: Was the jewelry adequately covered?**	**5(12.5%) CI: 6.1% - 18.9%**	**33(82.5%)**
P25	Operator smoked while handling food	1(1.0%) CI: 0.0% - 2.8%	103(99.0%)
P26	Operator used the same utensils to prepare raw and cooked food	14(13.5%) CI: 6.9% - 20.0%	90(86.5%)

Table 2. Observed personal hygiene of vendors (dust and dirt removal)

Questionnaire Items		Response n (%)				
		Apron	Bare (uncovered) hands	Dirty cloth	Clean cloth	Activity not observed
P23	Dirt or dust was removed using:		3 (2.9%)	7 (6.7%)	79 (76.0%)	15 (14.4%)

Table 3. Chi-square analysis and Odds Ratio of dependent variables.

Dependent variable 1	Dependent variable 2	p-value	Odds Ratio



Minimum score = 5, the maximum score =12, and the median score = 9

Figure 2. Box plot of vendors' hygiene scores (Median =9)

Tables 1 and 2 present findings from observations concerning the personal hygiene practices of street food vendors. First, it provides the list of the hygiene indicators and the observed counts and percentages in the sample. Second, it includes the 95% confidence interval for the corresponding true percentages of the population of all street vendors in the study area. The results highlight several areas of concern. Fewer than 32% of the sample were observed washing their hands before handling food; the confidence interval estimates the population percentage to be as low as 22.7% and at most 40.7%. Furthermore, among the 54 vendors observed visiting the toilet, 13 did not wash their hands afterwards. In terms of apparel, while the majority wore clean and presentable clothing (96.2%), and had clean and short nails (91.3%), the use of hair coverings was absent from over 39% of the vendors, and is estimated to be almost half of the population. Wearing masks was notably poor, as over 90% of the sample did not, and close to 96% of the population is estimated not to wear masks. Bare-hand food handling was widespread, accounting for over 60% of the sample, with population estimates of almost 70%. Additionally, of the 47 (45.2%) vendors who handled money while serving food, most (41) did not wash their hands afterward. Similarly, of the 40 vendors who wore jewelry, in most cases (33), the jewelry was not adequately covered. One vendor was observed smoking while handling food. 13.5% used the same utensils for both raw and cooked food. In terms of removing dirt and dust, 76.0% used a clean cloth, while 6.7% used a dirty cloth, 2.9% used bare hands, and in 14.4% of cases, this activity was not observed.

Table 3 presents the results of the chi-square test for association and the odds ratio that were significant at the 5% level. Our analysis revealed that the practice of washing hands while handling food is influenced by whether the vendor operates in an urban or rural area (p-value = 0.040). City vendors are 2.69 times more likely to wash their hands while handling food compared to those who operate in rural areas. Fingernails being clean and short were found to be dependent on the type of district (p-value = 0.034), where vendors from urban districts are 4.33 times more likely to have clean and short fingernails than their compatriots in rural areas. Wearing jewelry depends on the district (p-value = 0.040), where those from rural areas are 2.51 times more likely to wear jewelry while handling food. Wearing a mask when handling food is found to be dependent on gender (p-value = 0.031). Males are 4.31 times more likely to wear a mask while handling food than females. Handling food with bare hands was found to be dependent on whether or not the vendors received education in Guyana (p-value = 0.022). Guyana-educated vendors are 4.20 times more likely to handle food with their bare hands. Wearing aprons varies by age group (p-value = 0.012), with seniors (36 years and older) being 2.75 times more likely to wear an apron when handling food. Handling money while serving food was dependent on ethnicity (p-value = 0.019). Africans were 2.56 times more likely to handle money while serving food than the other ethnicities.

A total hygiene score was calculated by summing the favorable responses for each vendor. Follow-up items and those without yes/no responses were excluded, leading to a maximum possible score of 12 points. The

summary statistics included the mean hygiene score=8.42, standard deviation=1.73, and mode=9. Fig. 2 illustrates the distribution of these scores using a box plot, where the minimum score was 5, the maximum score was 12, and the median score was 9. The larger lower half of the boxplot indicates mild skewness measured at -0.22. Furthermore, the Shapiro-Wilk test for normality revealed that the hygiene scores are not approximately normal (p-value = 0.001).

Consequently, to facilitate nonparametric tests involving the hygiene performance of the vendors, the scores were categorized as poor (0 – 7) and good (8 – 12). A total of 69.6% of the vendors received good scores, while the other 30.4% received poor scores. Notwithstanding the creation of this binary variable for hygiene, it was not found to be dependent on any of the demographic characteristics.

4. Discussion

The findings indicate that there were more (61.5%) female street food vendors than male vendors. This finding is similar to studies in other countries (28,29), but nowhere near the extremes observed in other jurisdictions (16,25). The age of vendors in Guyana spans all groups, with just over 50% being below 36 years old. This finding aligns with some studies (30), but contrasts with others that show seniors dominating the industry (21) or youths dominating it (19). Despite Guyana being a multi-ethnic society, our findings reveal a predominance of African street food vendors. These results may relate to social constructs beyond the scope of this paper. Regarding education, our finding that the majority of vendors have up to secondary education matches well with studies conducted elsewhere (19,30,31) and suggests that the less educated individuals are more inclined to earn a living from street food vending. Furthermore, considering that most vendors are locally educated, it can be inferred that these vendors are likely citizens or have spent a substantial part of their lives in Guyana. Training in food handling is essential to the industry; however, similar to other studies (19,30,31), most street food vendors in Guyana received no such training. This contrasts with a study conducted in Ghana, where 61% of the vendors received formal training (16). In terms of experience, just over half the vendors in our study had up to five years of experience in food handling. This contrasts with other studies where the ratio was much lower (25) or much higher (32), suggesting varying results globally. Regarding the type of district, our findings, which indicate 65% of vendors are urban, match studies conducted in Bangladesh (25). These demographic characteristics are known to play an essential role in understanding the hygiene aspects of street food vendors.

The results for hygiene practices illustrate both positive areas and aspects that require improvement, potentially through targeted training and oversight. Clean clothes, short and clean fingernails, non-smokers, and using different utensils for raw and cooked foods are the highlights of this study. It serves to eliminate specific sources of food contamination. In contrast, seldom washing of hands and not wearing face masks are the main areas of concern, as vendors' hands are known to come into contact with money, utensils, structures, and other unsanitary objects. These poor hand-washing habits and non-compliance with measures such as mask-wearing are similar to those observed in other studies (19,28,30,31) and suggest a

more widespread phenomenon. Guyana's lower handwashing rates, compared to countries like Ghana, Vietnam, and Brazil, may reflect contextual challenges such as limited access to clean water or less stringent regulatory oversight. Studies in Accra and Ho Chi Minh City found better compliance potentially due to stronger municipal infrastructure or enforcement (16,25), while research in Brazil similarly noted critical hygiene lapses despite more developed urban systems (21). In contrast, studies conducted in more urbanized or formally regulated environments may report better compliance due to stronger infrastructure or institutional presence. The findings also indicate that some hygiene practices were properly applied by 40% to 62% of the vendors. These include using aprons, covering hair, not handling money, and not wearing jewelry. Nevertheless, considering that only a few of the hygiene variables showed excellent compliance, this suggests that the overall hygiene compliance is inadequate. This provides an answer to our research question and points to a greater likelihood of issues with monitoring, enforcement, and legislation.

Unlike many other studies (33), our findings established only a few dependent relationships between a given hygiene variable and vendors' demographic characteristics. Most notable is that the type of district was related to three hygiene variables: washing hands, having short and clean fingernails, and wearing jewelry. Another study in Ghana similarly found that the hygiene practices depended on the areas within which the vendors operated (16). Moreover, these findings, combined with the observation that the total hygiene score was not associated with any of the demographic variables, suggest that demographics do not impact hygiene practices significantly. The findings contrast with other studies, where hygiene practices are associated with demographic variables (17,28,32). This is likely due to the absence of a food safety authority, a regulatory framework, and the monitoring and enforcement of standards and legislation (24).

These findings underscore the importance of effective oversight and enforcement of legislation governing street food vending. If vendors are left to determine which hygiene practices to adopt, then food safety will be adversely affected, and good health and lives may be at risk. We posit that strong legislation, oversight, and enforcement by regulatory bodies shape the hygiene practices of street food vendors. Our findings can be used to encourage public health and food regulation bodies to become more proactive in establishing and enforcing better hygiene among the street food vendors. Moreover, this study paves the way for a more comprehensive understanding of the hygiene practices of street food vendors in Guyana. It also serves to ignite interest in this field locally and in similar jurisdictions across the Caribbean and the world. We recommend conducting additional studies, possibly including a census of street food vending, to verify the accuracy of these findings and expand the knowledge base within this field.

5. Conclusion

This study addresses a globally prevalent issue of street food vending and its consequences for health and lives, including food contamination resulting from inadequate food hygiene. It aimed to investigate the extent to which street food vendors in Demerara-Mahaica, Guyana, exhibit hygiene practices and how these might relate to the vendors' demographic characteristics. Data collected from a broader research

survey of 104 vendors were utilized and analyzed using SPSS software. The results show that the demographic breakdown of vendors resembles that found by studies conducted in other countries. More pertinent is that the vendors' hygiene practices, measured by 13 variables, were not uniformly good. The most alarming results were for hand washing and the use of face masks. Furthermore, seven of the hygiene indicators were found to be dependent on demographic variables, where the type of district was the most common indicator variable. The overall hygiene score had a mean of 8.4 out of 12, with more than just over 50% of the respondents scoring above the mean. Moreover, we found no significant association between the overall hygiene scores and the demographic characteristics. This paper is the first of its kind to assess the hygiene practices of street food vendors in Demerara-Mahaica, Guyana. It provides valuable insights for policymakers and practitioners within the Ministry of Health, Guyana, as well as for other cities or countries with similar contexts.

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Authorship contribution

Conceptualization, Linda Francois and Dwayne Shorlon Renville; methodology, Tandeka Barton, Dwayne Shorlon Renville and Linda Francois; software, Linda Francois, Dwayne Shorlon Renville and Bunnel Bernard; validation, Tandeka Barton and Dwayne Shorlon Renville; formal analysis, Linda Francois and Dwayne Shorlon Renville; investigation, Linda Francois, Dwayne Shorlon Renville, Tandeka Barton and Bunnel Bernard; resources, Linda Francois, Dwayne Shorlon Renville, Tandeka Barton and Bunnel Bernard; data curation, Dwayne Shorlon Renville, Tandeka Barton and Linda Francois; writing—original draft preparation, Linda Francois and Dwayne Shorlon Renville; writing—review and editing, Linda Francois, Dwayne Shorlon Renville; visualization, Linda Francois; project administration, Linda Francois. All authors worked together to ensure the success of completing and delivering the project.

Declaration of competing interest

The authors declare that they have no conflict of interest.

Data availability

The raw data supporting the conclusions of this article will be made available by the authors on request.

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