

ASSESSING *Escherichia coli* CONTAMINATION AND VENDOR PRACTICES IN STREET FOOD DIPS AROUND LYCEUM OF ALABANG: A MIXED-METHOD APPROACH

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ABSTRACT

Despite the known health threats associated with street food, its high demand continues to thrive among the public. This study responds to Sustainable Development Goal 12 on responsible consumption by addressing the lack of localized literature on *Escherichia coli* (*E. coli*) contamination, particularly in street food dips around Lyceum of Alabang. The primary goal of this research is to develop an intervention plan through assessing the *E. coli* contamination levels in dips and evaluating the knowledge, attitude, and practices (KAP) of vendors regarding food sanitation and hygiene. Using a sequential explanatory research design, the quantitative phase involved microbiological testing of three street food dip samples from three different vendors. Results revealed that one out of three samples contained 4.23 MPN/g of *E. coli*, indicating a high contamination level. The qualitative phase, through vendor interviews, generated the following themes: (1) Knowledge – Limited Formal Knowledge on Food Sanitation and Awareness of Water Safety Varies; (2) Attitude – Value for Cleanliness Despite Lack of Training, Openness to Learning, and Pragmatic but Sometimes Complacent; and (3) Practice – Inconsistent Hygiene, Basic Food Protection, and Improvised Storage and Reuse. An evidence-based intervention plan was formulated to address the findings. Overall, the study emphasizes the urgent need for targeted training, resource support, and collaborative health policies to ensure safer street food consumption.,

Keywords: *E. coli* contamination, Street food sanitation, Vendor food safety practices, SDG 12

INTRODUCTION

Street food has long been an integral part of Filipino culture and daily life. Found on nearly every street corner, these affordable, flavorful, and accessible food options cater to a wide demographic, particularly students, workers, and lower-income groups. The street food industry supports many informal workers and contributes to the local economy. However, it also presents significant public health challenges, especially concerning food safety and hygiene. Despite numerous health warnings and sanitation campaigns, the consumption of street foods continues to thrive, underscoring a cultural and economic reliance that cannot be ignored.

In the context of the Philippines, sauces or dips used in street foods hold cultural significance and have evolved into iconic flavor elements in the local food scene. Much like how soy sauce plays a central role in Japanese cuisine, Filipino street food is often incomplete without its characteristic sweet, spicy, or vinegar-based sauces. However, these dips—often shared, reused, and exposed—are prime candidates for microbial

contamination. Among the most concerning of these microbial threats is *Escherichia coli* (*E. coli*), a bacterium known for its potential to cause serious foodborne illnesses.

While many strains of *E. coli* are harmless and naturally inhabit the human intestinal tract, pathogenic strains, especially Shiga toxin-producing *E. coli* (STEC), can lead to severe gastrointestinal conditions, including diarrhea, hemorrhagic colitis, and hemolytic uremic syndrome (HUS), a potentially fatal condition. The World Health Organization (2018) has noted that *E. coli* contamination in food, particularly from unsanitary preparation and handling, is a significant contributor to global foodborne diseases. In a developing country like the Philippines, where food safety regulations are often inadequately enforced at the grassroots level, the threat is exacerbated.

The health implications of ingesting *E. coli*-contaminated food can be severe, particularly among vulnerable populations such as children, the elderly, and individuals with compromised immune systems. Yet, street food vendors often operate without proper food safety training, and consumers may overlook hygiene practices for the sake of convenience or affordability. A study by Dagalea et al. (2021) identified multiple risk factors contributing to bacterial contamination in street food, including poor vendor hygiene, lack of knowledge about foodborne illnesses, unhygienic food preparation areas, and the communal nature of dips that are often exposed and reused.

While studies have highlighted the general risks associated with street foods in the Philippines, there is a notable gap in localized research focusing specifically on microbial contamination in street food dips—especially in regions such as Muntinlupa City. More importantly, there is a lack of integrated studies that examine both the microbiological safety of these food items and the behavioral practices of vendors that might contribute to or mitigate contamination. The absence of localized data hinders the creation of context-specific interventions, leaving the public at continued risk.

This research specifically responds to Sustainable Development Goal (SDG) 12, which emphasizes responsible consumption and production. By focusing on the potential presence of *E. coli* in street food dips around Lyceum of Alabang, and evaluating the knowledge, attitudes, and practices (KAP) of street food vendors regarding food safety, this study seeks to bridge a critical gap in both academic literature and public health policy.

The objective of this study is twofold: First, to quantitatively assess the levels of *E. coli* contamination in a variety of commonly used street food dips in the vicinity of Lyceum of Alabang; and second, to evaluate the food sanitation and hygiene practices of street food vendors through a structured KAP survey. By combining microbial analysis with sociobehavioral assessment, the study aims to provide a comprehensive overview of food safety risks in street food environments and offer evidence-based recommendations for intervention.

Moreover, this study holds significant implications for local governance and educational institutions. With empirical data on microbial presence and vendor practices, policymakers can design more targeted interventions, including training programs and health awareness campaigns. Schools and universities can also take a proactive role in informing students—many of whom are among the primary consumers of street food—about the risks involved and safer consumption practices.

This study is not intended to vilify street food or discourage its consumption. On the contrary, it recognizes the socio-cultural and economic importance of this food sector.

Rather, it seeks to enhance public health awareness and encourage safer food handling and consumption practices. If successful, this research can serve as a model for other urban areas in the Philippines and similar developing countries, aiming to balance cultural food practices with modern health and safety standards.

While previous studies have explored microbial contamination in various street foods, the specific issue of *E. coli* presence in street food dips remains under-researched, particularly in localized contexts like Muntinlupa City. By addressing this gap, the present study contributes valuable insights to public health literature, promotes responsible consumption aligned with global sustainability goals, and paves the way for safer street food practices in the Philippines.

RESEARCH QUESTIONS

1. How much *E. coli* count present in the street food dips sold in various food stalls around Lyceum of Alabang?
2. What is the knowledge, attitude and practice of street food vendors in line to food hygiene and sanitation?
3. Based on the premise of the findings, what is the intervention plan that may be proposed?

HYPOTHESIS

Ho: There is no significant presence of *E. coli* in the street food dips sold in various food stalls around the Lyceum of Alabang.

ASSUMPTIONS

1. Vendors have varying levels of knowledge about proper food sanitation and hygiene, mostly based on personal experience rather than formal training.
2. Food safety practices are inconsistent and depend on personal routines, availability of resources, and convenience (e.g., boiling water, cleaning surfaces, covering sauces).
3. Attitudes toward hygiene and cleanliness are positive but not always followed through due to fatigue, lack of time, or lack of access to facilities.
4. Most vendors lack access to formal training on food handling, relying more on self-taught or family-based practices.
5. Environmental conditions (like heat and crowd size) affect how vendors handle food, with minimal adjustments being made to ensure safety.
6. Water sources used for preparing food and dips may be unregulated or untreated, increasing the risk of contamination like *E. coli*.
7. Street food dips are often reused or stored improperly, potentially allowing bacterial growth over time.
8. Cleanliness of utensils and vendor setups may not meet proper sanitation standards, especially during busy periods or late at night.

9. Improper or inconsistent cleaning practices could contribute to microbial contamination in street food dips.
10. Most vendors are open to improvement if provided with free or accessible training and support.
11. Simple and practical interventions (e.g., better containers, covered displays, clean water access) are more likely to be adopted.
12. Vendors may prioritize income generation over attending seminars or trainings unless they are flexible and directly beneficial.
13. Vendors express a willingness to improve their stalls if given resources like umbrellas, display cases, or portable sinks.

METHODOLOGY

This study employed a sequential explanatory mixed-methods research design, wherein the quantitative phase was conducted first to determine the presence and level of *Escherichia coli* contamination in street food dips, followed by a qualitative phase that explored the vendors' knowledge, attitudes, and practices (KAP) related to food sanitation and hygiene. This design was chosen to allow for numerical measurement of contamination levels and contextual explanation through real-life vendor experiences. The respondents were three street food vendors located within a 300-meter radius of Lyceum of Alabang in Muntinlupa City, selected through availability sampling based on accessibility, logistical, and financial constraints. For the quantitative phase, the researchers adopted experimental procedures based on the FDA's Bacteriological Analytical Manual (BAM) Chapters 1 and 4 by Andrews and Hammock (2022). Street food dip samples (100 mL each of sweet and spicy variants) were collected using sterile equipment, stored in leak-proof containers on ice, and transported to DOST Paranaque within one hour to maintain integrity.

Laboratory analysis included blending with Butterfield's phosphate-buffered saline, serial dilution, incubation, MPN analysis, and isolation on L-EMB agar to identify and quantify *E. coli* colonies in CFU/mL. Biochemical confirmatory tests (IMViC) ensured accuracy. For the qualitative phase, semi-structured interviews were conducted with the same vendors to assess their food safety practices. The interview guide underwent content validation through expert review to ensure alignment with KAP constructs. To test reliability, trial interviews were conducted with unrelated vendors to ensure clarity and gauge natural reactions. Interview responses were transcribed and analyzed thematically. Ethical considerations included deception by omission to prevent the Hawthorne effect—respondents were not informed of the exact purpose during sampling to preserve natural behavior—but confidentiality was strictly maintained. After the study, researchers conducted a debriefing session to return results to the vendors. Quantitative data were processed using descriptive statistics, particularly MPN calculations to estimate *E. coli* levels. Qualitative data was coded manually and grouped into themes to understand patterns in vendor practices. The integration of both data sets allowed the researchers to design a targeted intervention plan aimed at reducing *E. coli* contamination through educational and procedural improvements.

RESULTS AND DISCUSSION

Table 1.

Escherichia coli level present in the street food dips.

Food Stall	Result	Interpretation
1	<0.3 MPN/g	Acceptable/Low Level
2	<0.3 MPN/g	Acceptable/Low Level
3	4.3 MPN/g	High Contamination Level

The findings reveal that Stalls 1 and 2 had minimal *E. coli* presence, with levels recorded at <0.3 MPN/g, which falls within acceptable safety thresholds (FDA, 2017). However, Stall 3 recorded 4.3 MPN/g, a level considered to be above the acceptable range, indicating significant microbial contamination.

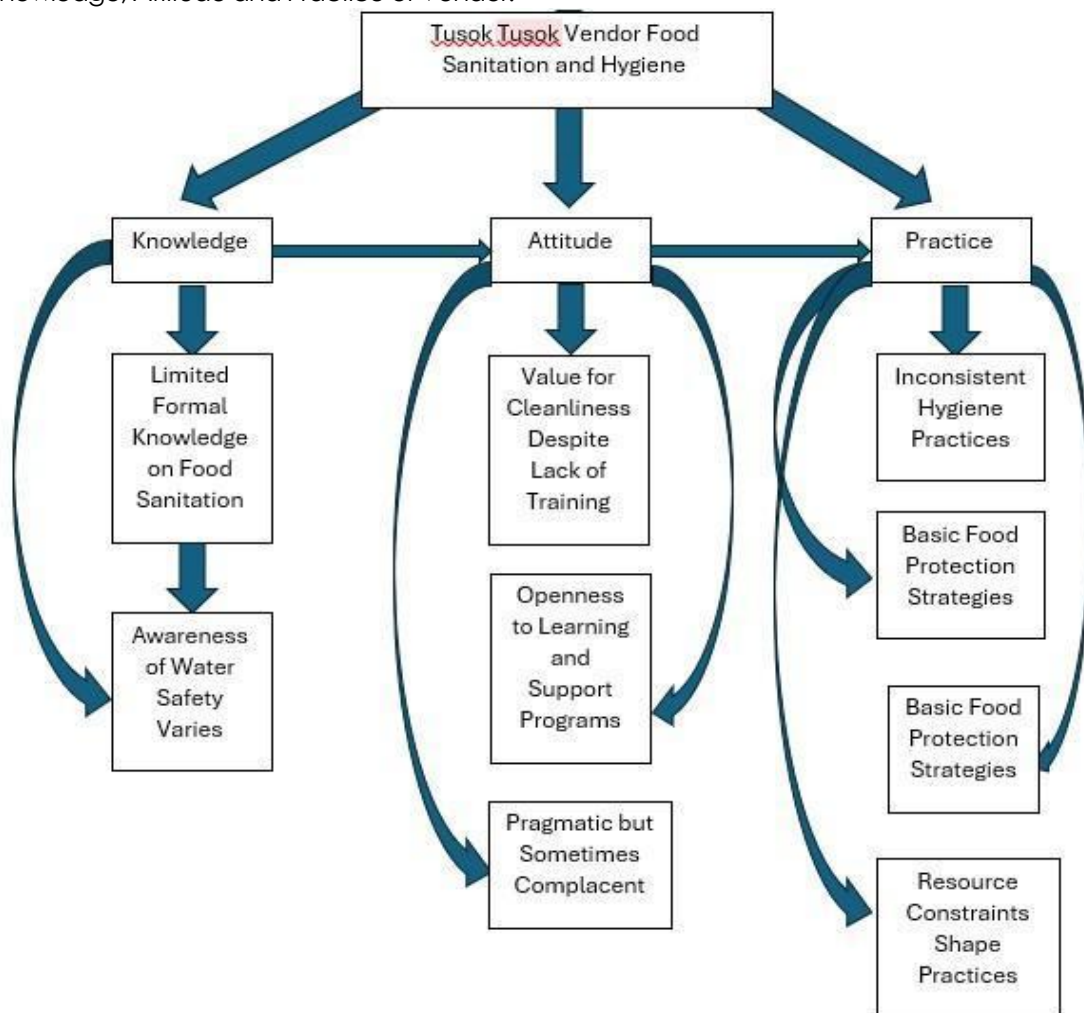
This result suggests that not all street food dips in the area pose the same level of health risk, and that specific vendor practices may contribute to differences in contamination levels. The presence of *E. coli*, a bacteria commonly found in fecal matter, often signifies unsanitary food handling, improper water use, or poor utensil hygiene (Mensah et al., 2002). This aligns with the qualitative themes extracted during interviews with vendors, particularly those related to inconsistent hygiene practices and improvised storage and reuse of sauces.

Furthermore, the high contamination level in Stall 3 may be attributed to the vendor's admission of not boiling water, reusing dips for multiple days, and rarely sealing sauce containers—all of which increase exposure to environmental and human-borne contaminants. This finding supports the WHO's (2020) assertion that street food contamination is closely tied to knowledge gaps and poor sanitary infrastructure.

Compared to literature, this study's findings mirror similar assessments conducted in other developing urban settings, where street foods are often microbiologically unsafe due to informal preparation and lack of regulatory oversight (Barro et al., 2006). The results emphasize the importance of localized surveillance, especially in high-traffic areas like school zones, where youth consumers are at greater risk.

Overall, this analysis confirms that the microbial safety of street food dips in Muntinlupa is inconsistent, and targeted interventions are necessary to reduce contamination. These include vendor training, provision of sanitary tools, and regular monitoring, which will be further addressed in the proposed intervention plan.

Figure 1.
Knowledge, Attitude and Practice of Vendor.



Knowledge: Experience-Based Understanding and Limited Formal Training

The findings reveal that most vendors lack formal education or training on proper food hygiene and sanitation. Instead, their knowledge is shaped by personal experience, intuition, or informal sources, such as children in senior high school who share lessons from their classes. As one vendor shared: "*Wala naman official training, pero ahmm, nanood ako minsan ng seminar online.*" This confirms Assumptions 1 and 4, and supports the claim by Fatimah et al. (2019), which emphasized that street vendors in developing countries often rely on informal learning and cultural practices rather than technical training in food safety. The lack of formal instruction poses challenges in standardizing safe practices. Furthermore, awareness of water safety varies, with some vendors boiling water for dips while others assume that clear water is safe: "*Basta malinaw naman yung tubig, okay na 'yan. Di ko na pinapakuluan, noh.*" This variation in awareness highlights Assumption 6 and suggests a gap in microbiological understanding. This aligns with the findings of Kumar et al. (2017), who noted that visual clarity is often misinterpreted by informal vendors as a sign of water safety, which poses a significant health risk.

Attitude: Positive Intentions, But Influenced by Constraints

The data indicate that vendors value cleanliness, even without technical knowledge. Vendors express a desire for safe food handling practices: "*Gusto ko rin naman na mas gumanda yung tinda ko at safe sa mga kumakain.*" This reflects Assumption 3, emphasizing that vendors' attitudes are generally positive, even if behaviors don't consistently align. Notably, the openness to learning and support programs was strongly expressed: "*Kung makakatulong po yun, bakit hindi?*" Such openness supports Assumptions 10 and 11 and suggests potential for sustainable behavior change if training programs are made flexible and accessible—a strategy supported by the WHO's community-based sanitation interventions (2020). However, some vendors demonstrate a pragmatic yet complacent attitude. Many admit to skipping proper sanitation due to fatigue or workload: "*Minsan hindi na rin kasi pagod na ako, eh.*" This supports Assumptions 2, 3, and 12, where income generation often takes precedence over safety practices. Similar patterns were observed in a study by Azanaw et al. (2020), where small-scale vendors prioritized sales volume over food handling protocols.

Practice: Inconsistent Methods Influenced by Resource Constraints

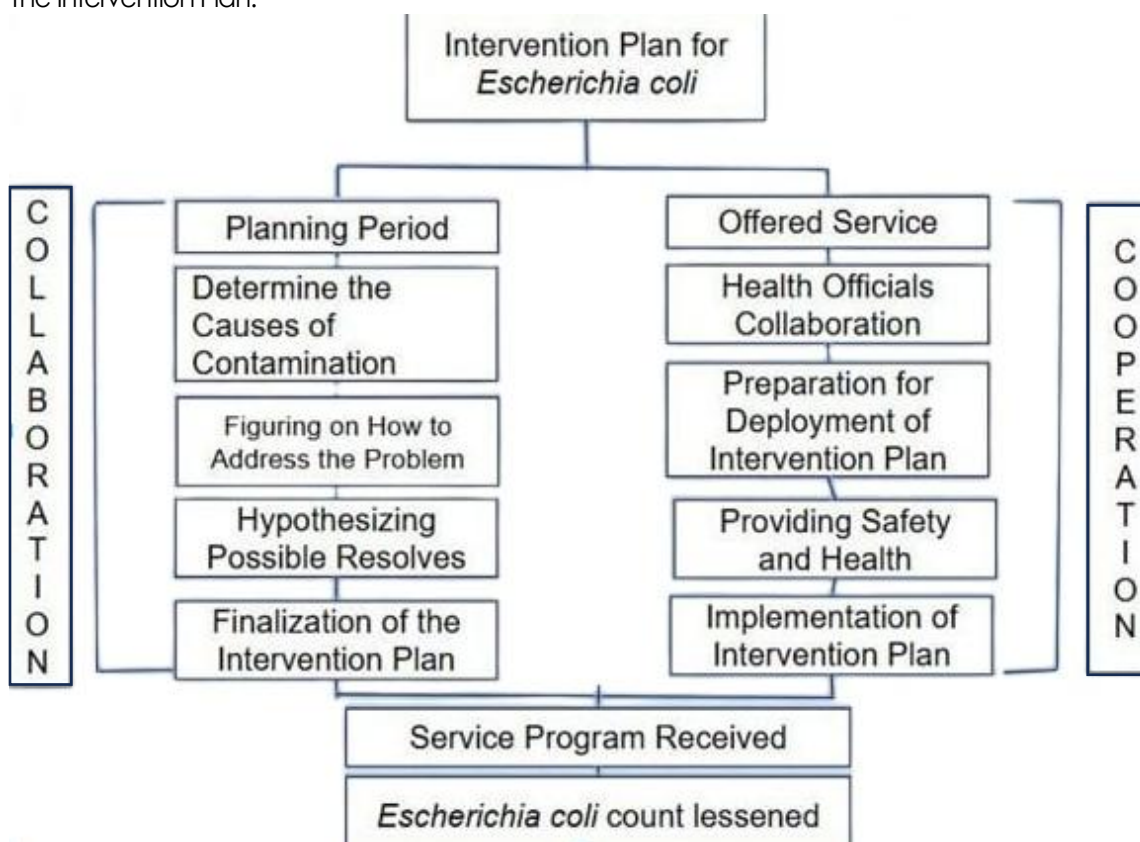
The practice dimension revealed significant inconsistencies. Cleaning behaviors varied greatly—some vendors cleaned daily, while others deferred sanitation tasks: "*Hinuhugasan ko yung mga bote ng sawsawan... pero kinabukasan ko na lang totally nililinis.*" Such practices support Assumptions 2, 8, and 9, indicating that street vendors may unintentionally expose consumers to microbial risks, especially during high-volume sales periods. This is consistent with the study of Muinde & Kuria (2005), which found that food safety practices in informal food sectors are often reactive rather than proactive. Despite limited means, some vendors apply basic food protection strategies, like using nets or coolers: "*Tinatakpan ko lang ng net yung mga tusok-tusok para hindi langawin.*" While basic, these strategies reflect awareness and initiative, echoing Assumption 5, which notes that vendors make small but meaningful adjustments during hot or crowded conditions. However, many vendors still reuse and store dips for multiple days without sterilization: "*Ginagawa ko na yun ng maramihan, mga tatlong araw bago ko pa gamitin.*" This supports Assumption 7, underscoring how improper storage can encourage *E. coli* growth—a finding also noted in the studies of Adzitey (2013) on microbial contamination from sauce reuse. Lastly, resource limitations clearly shape hygiene practices. Vendors improvise based on available space, water, and materials: "*May gripo sa loob, tapos minsan kung nauubusan, eh sa poso sa kanto.*" This affirms Assumptions 11 and 13 and suggests that interventions must be contextualized and low-cost to be effective. A portable sink or a storage cabinet, for instance, was mentioned as a desired improvement.

The findings reinforce the relevance of the KAP model, which asserts that knowledge, attitudes, and practices interact to influence behavior. However, in this context, practice is heavily moderated by socioeconomic constraints, rather than knowledge alone. This reflects what Ajzen's Theory of Planned Behavior (1991) emphasizes: behavior is shaped not just by intention but also by perceived behavioral control—what people believe they are capable of doing given their circumstances.

Figure

The Intervention Plan.

2.



The proposed intervention plan follows a systematic flow from planning to implementation, ultimately targeting the reduction of *Escherichia coli* contamination in food dips through a combination of collaborative design and cooperative deployment.

The intervention plan starts with Planning Period (Collaboration Phase) through determining the causes of contamination. Using the results of the microbial analysis and interview data, specific contamination sources are identified, such as improper dip storage and unsanitary water use. Next, a multidisciplinary team including researchers, public health officials, and community leaders evaluate which interventions are feasible and impactful. This planning stage is critical to ensure that proposed solutions fit the vendors' working environment. Then, ideas such as providing lidded containers, sanitation kits, or boiling guides are introduced. The plan also considers behavior change strategies informed by the KAP model and Theory of Planned Behavior (Ajzen, 1991), acknowledging that knowledge alone is not enough without motivation and resource access. Lastly, after assessing feasibility and vendor willingness, a finalized plan is drafted incorporating structured training, resource support, and monitoring.

On the other hand, Offered Service (Cooperation Phase) is conducted simultaneously through health officials' collaboration. The deployment of the intervention is coordinated with the barangay health office and/or DOST. This ensures that the plan has institutional backing and technical support. Next, training modules are created in Filipino and designed for delivery during vendor downtimes. Kits containing water containers, covered sauce dispensers, and food-safe materials are prepared

for distribution. Then, vendors are trained not only in what to do but also on why these actions are important in preventing *E. coli* contamination. This aligns with Rosenstock's Health Belief Model, which emphasizes perceived severity and benefit as motivators for health behavior. Moreover, the plan is rolled out over a defined timeline. Monitoring mechanisms such as vendor self-assessments and barangay visits are introduced to reinforce adherence. In addition to that, the final goal of the intervention is for vendors to receive not just information, but tangible support and guidance in improving their sanitation practices. With correct application, the anticipated outcome is a reduction in *E. coli* presence in dips, which will be validated through follow-up testing. "Escherichia coli counts lessened" serves as both the measurable impact of the program and a public health benchmark.

This intervention plan reflects best practices in community-based food safety programs, as described by FAO (2017), which recommend integrated training, accessible materials, and multisector involvement. The plan also aligns with the Knowledge-Attitude-Practice (KAP) framework used in this research, showing that interventions must target all three domains to be effective. In addition, it adopts the Theory of Planned Behavior, which posits that even when knowledge and attitude are favorable, actual behavior change requires perceived behavioral control—which the plan achieves through resource distribution and supportive monitoring.

CONCLUSION

This study has provided meaningful insights into the sanitation knowledge, attitudes, and practices of tusok-tusok street food vendors around Lyceum of Alabang, specifically in relation to *Escherichia coli* contamination in food dips. The major findings revealed that while vendors generally have a positive attitude toward food cleanliness, their practices are often inconsistent and largely influenced by resource constraints, fatigue, and lack of formal training. The presence of *E. coli* in tested samples further validated the need for systematic intervention.

The research confirms that vendors rely heavily on experiential learning and make decisions based on convenience, visual judgment, and affordability rather than scientific food safety principles. Despite these limitations, the vendors showed a high level of openness to learning and improving their hygiene practices, especially if the support provided is practical, accessible, and does not hinder their daily operations.

In light of these findings, it is recommended that local government units and public health agencies develop a structured yet low-cost intervention plan—such as short training programs, provision of hygiene kits, and recognition-based incentives—to promote safer food handling. Future programs must prioritize collaboration and cooperation, not only to reduce contamination risks but also to support the vendors' livelihoods while protecting public health.

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