



Assessment of Hygiene and Food Safety Compliance among Ramadan Bazaar Hawkers in Kota Kinabalu Using a Risk-Based Inspection Checklist

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KEYWORDS

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ABSTRACT:

Introduction: Food safety in temporary food markets such as Ramadan bazaars present significant public health challenges due to high demand, open-air preparation, and diverse vendor practices. Despite regulatory frameworks, compliance among hawkers remains inconsistent, increasing the risk of foodborne diseases. This study assessed hygiene and food safety compliance among Ramadan bazaar hawkers in Kota Kinabalu using a standardized risk-based checklist.

Objectives: To determine the hygiene and food safety compliance of food vendors at Ramadan bazaars in Kota Kinabalu in 2025 and provide recommendations for future improvement.

Methods: A retrospective cross-sectional study was conducted using official inspection records of 293 food vendors assessed during the 2025 Ramadan period. A standardized risk-based inspection checklist, adapted from the Ministry of Health Malaysia guidelines, evaluated domains such as food handlers' hygiene, equipment and storage practices, sanitation, and waste management. Descriptive statistical analyses were applied to summarize compliance levels.

Results: Findings showed high compliance in the cleanliness of food-contact and non-food-contact surfaces, as well as in waste management and training documentation. Moderate adherence was noted in personal hygiene practices and health check requirements. The lowest compliance was observed in the use of protective clothing, such as aprons, gloves, and hair coverings, which vendors often neglected due to cost, inconvenience, and discomfort due to weather conditions.

Conclusions: There are still gaps in personal hygiene even though environmental and structural hygiene practices were adequate. To improve compliance and minimize the risks of foodborne illness during Ramadan bazaars, it is essential that we strengthen enforcement, offer behavior-focused training, subsidize health screenings, and encourage the use of protective clothing.

1. Introduction

Food safety is a paramount public health concern globally. The World Health Organization (WHO) estimates that unsafe food causes approximately 600 million cases of foodborne diseases and 420,000 deaths annually, with the Southeast Asian region bearing a

significant burden of these illnesses [1]. In Malaysia, foodborne diseases remain a pressing issue, with numerous outbreaks reported each year, often linked to improper food handling and inadequate hygiene practices among food vendors [2]. The Malaysian Ministry of Health (MOH) has recognized the critical importance of food safety and has implemented various measures to



safeguard public health. These include the enforcement of the Food Act 1983 and the Food Regulations 1985, which provide a legal framework for ensuring food safety standards across the country [3]. Additionally, the MOH has established the Food Safety and Quality Division (FSQD) to oversee food safety policies, conduct inspections, and promote awareness among food handlers and consumers [4].

Ramadan bazaars are a distinctive feature of Malaysian culture during the Islamic holy month of Ramadan. These temporary markets offer a wide array of traditional foods for iftar (breaking of fast) and are immensely popular among the Muslim population. In cities like Kota Kinabalu, Sabah, Ramadan bazaars attract large crowds daily, leading to increased demand for ready-to-eat meals [5]. However, the high volume of food preparation and sales, often in open-air settings with limited facilities, poses substantial challenges to maintaining food hygiene and safety standards. The transient nature of these bazaars, coupled with the diverse backgrounds of food vendors, necessitates stringent monitoring and enforcement of food safety practices to prevent potential health hazards [6].

Despite the implementation of food safety regulations and inspection protocols, compliance among hawkers at Ramadan bazaars remains inconsistent. Studies have highlighted that many hawkers lack formal training in food safety, leading to practices that may compromise food quality. Common issues include inadequate hand hygiene, improper storage of perishable items, and insufficient temperature control during food preparation and display [7]. Furthermore, the absence of comprehensive data on hygiene and food safety compliance among Ramadan bazaar hawkers hampers efforts to develop targeted interventions [8]. Without a clear understanding of the current practices and challenges faced by these vendors, health authorities and policymakers struggle to implement effective strategies to ensure food safety during the fasting month [9].

To address these concerns, Malaysian health authorities have adopted risk-based inspection approaches in food safety assessments. Risk-based inspections prioritize resources and attention to areas with the highest potential for food safety hazards, allowing for more efficient and effective monitoring. This approach involves identifying critical control points in food handling processes and focusing inspections on these areas to mitigate risks effectively.

The adoption of risk-based inspection checklists enables inspectors to systematically evaluate food vendors, focusing on critical areas that pose the highest risk to food safety. These checklists assess various factors, including personal hygiene, food storage practices, equipment cleanliness, and temperature control, among others. By utilizing such systematic tools, inspectors can identify and address potential hazards more effectively, enhancing compliance with food safety regulations among food vendors [10].

The study focuses on selected Ramadan bazaars within Kota Kinabalu, Sabah, during the fasting month. It involves direct observation and assessment of food vendors using a standardized risk-based inspection checklist. For the hawkers, the study offers insights into best practices and areas requiring improvement, potentially leading to better business outcomes and consumer trust. For consumers, improved food safety standards translate to reduced risk of foodborne illnesses, contributing to overall public health and well-being during the Ramadan period.

2. Objectives

The aim of this study is to determine the hygiene practices of food vendors at selected Ramadan bazaars in Kota Kinabalu in 2025. Second, based on the findings, the study intends to provide practical recommendations for improving food safety compliance in future Ramadan bazaars. These recommendations will focus on enhancing vendor awareness, strengthening monitoring mechanisms, and introducing sustainable interventions to safeguard public health while ensuring the success of Ramadan bazaar operations.

3. Methods

This study was conducted at selected Ramadan bazaars within the Kota Kinabalu district, Sabah. The bazaars were organized and regulated by the Kota Kinabalu City Hall (DBKK) and monitored by the Kota Kinabalu District Health Office during the fasting month of Ramadan. This research was adopted a retrospective cross-sectional study design using a standardized riskbased inspection checklist to assess hygiene and food safety compliance among hawkers at the Ramadan bazaar. The research population refers to each individual food hawkers identified from the records who meet the specified inclusion criteria that involved involved a total



of 293 food vendors operating at Ramadan bazaars in Kota Kinabalu.

The inclusion criteria for this study focused on hawkers who were operating food stalls at selected Ramadan bazaars in Kota Kinabalu. Only food premises that had been inspected by the Kota Kinabalu District Health Office using the standardized checklist were considered, and records included in the analysis were required to have complete data available. Meanwhile, the exclusion criteria applied to hawkers who did not have formal stall registration or were operating unofficially. In addition, inspection forms that were incomplete or contained illegible data were excluded. Vendors who sold only prepackaged food items that required no handling or preparation were also not part of the study. Purposive sampling was used to all Ramadan bazaars hawkers in Kota Kinabalu that met the inclusion criteria and were recorded in Kota Kinabalu between 1st March 2020 and 31st March 2024.

The primary research tool used in this study was a standardized risk-based inspection checklist, adapted from the Ministry of Health Malaysia's food safety guidelines. The checklist evaluated multiple domains, including process control, food handling practices, equipment and utensils, sanitation, stall cleanliness, and garbage and waste management, using predefined scoring criteria.

The data for this study were obtained exclusively from official food premises inspection records collected by the Food Safety Quality Unit of the Kota Kinabalu District Health Office during routine risk-based inspections conducted at Ramadan bazaars within the Kota Kinabalu district. These records included detailed checklist scores, inspection dates, stall information, and documented observations on hygiene and food safety compliance for each hawker stall assessed during the fasting month. Data were collected from completed inspection forms during field assessments conducted by authorized health officers. The forms were subsequently digitized and organized into a secure spreadsheet for analysis.

Descriptive statistics such as frequencies, means, and percentages was used to summarize compliance levels. All analyses will be conducted using R software.

Ethical approval was obtained from the Medical Research, Ministry of Health Malaysia, with NMRR ID25-01869-T12 (IIR). As a retrospective study using

secondary data, there was no direct contact with participants. The research was conducted in compliance with the Malaysian Good Clinical Practice Guidelines, ensuring responsible data handling, transparency, and protection of privacy throughout the study.

4. Results

In Kota Kinabalu, the evaluation of food vendors' hygienic practices during Ramadan bazaars in 2025 showed various levels of compliance as in Figure 1. The highest compliance was maintaining safe and clean foodcontact surfaces either during preparation, cooking, or serving. Non-food-contact surfaces and appropriate waste disposal management showed the vendors generally kept their stall infrastructure and surrounding environment in good condition. Good findings were observed in training and record-keeping, suggesting that many vendors had received hygiene education and were able to apply it in practice. Both the general practices of food handlers and the regularity of health checkup showed only moderate adherence to personal and operational hygiene standards. The usage of protective clothing, such as aprons, gloves, or hair coverings, which many vendors still ignore, was found to be the low compliance.

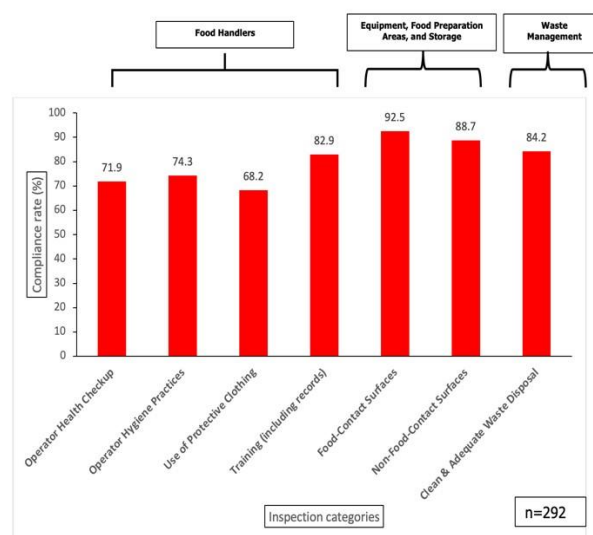


Fig.1 : Finding of assessment of food vendors' hygiene practices at Ramadan bazaars in Kota Kinabalu in 2025.

5. Discussion

Most vendors in Malaysia consistently maintained good practices in the cleanliness of food-contact surfaces [11]. Clean food-contact surfaces during preparation, cooking,



or serving are essential for preventing crosscontamination and reducing the risk of foodborne illness. Compliant vendors frequently follow procedures like washing utensils promptly, using sanitizers or detergents, and keeping raw and cooked food separate [12]. Assessments of street food vendors and food trucks also showed that adherence to surface hygiene standards is a crucial measure of overall food safety performance and is frequently correlated with improved vendor awareness and knowledge [13, 14].

Another high level of compliance among the vendors was non-food-contact surfaces, such as stall walls, equipment exteriors, and storage areas. This is important because although these surfaces do not directly touch food, they can act as indirect sources of contamination through dust, pests, or contact with utensils and workers' hands. Regular cleaning of these areas minimizes crosscontamination risks and reflects good overall hygiene practices [15]. (Rahman et al., 2021). Halal standard MS1500, HACCP/ISO-based initiatives, Food Act 1983, Food Regulations 1985, Food Hygiene Regulations 2009, and agri-GAP frame controls from farm to table. Thus, these can enhance the compliance of the vendors to be more focus on the safety aspect with national foodsecurity target [16]. Similar patterns were documented in Indonesia and Thailand, where non-food-contact surface maintenance is generally adequate but often dependent on enforcement intensity and infrastructural support [17].

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Waste management practices were also well practice by majority of vendors. They provide clean and adequate waste disposal facilities. This is in line with national enforcement activities such as "Ops Bazaar Ramadan," where local health authorities in Malaysia have increasingly emphasized waste control to prevent pest infestation and environmental contamination [19]. In Philippines, market vendors have complied to maintain good waste disposal procedures, particularly when municipal waste collection systems are reliable (Ramos, 2025). Then, the Vietnam street vendor also showed that the presence of adequate disposal infrastructure significantly improves hygiene practices (Huynh-Van et al., 2022). In the other hand, street food vendors in Ethiopia revealed low hygienic practice with only 16% of vendors demonstrated good hygienic practice and only 6.8% of vending stalls met good sanitary condition [22]. The key issues include inadequate safe water access that

affect the lack of handwashing facilities and poor waste disposal areas.

The Food Act 1983 requires all food handlers to complete training. There were significant improvements in food safety knowledge, attitudes, and practices after training, especially in hand hygiene and temperature control. However, without continuous monitoring, there are still issues with long-term adherence and reinforcement of safe practices [23]. The management support, workplace culture, and refresher courses can increase the food safety procedures and hazard awareness [24]. Additionally, in Indonesia, where information, education, and communication (IEC) interventions significantly improved vendor knowledge and hygiene practices during Ramadan bazaars [25]. It also suggests that to maintain compliance, refresher courses and continuing education programs are essential.

Handwashing, personal hygiene, and safe food handling, on the other hand, were only moderately compliant with operator hygiene standards. Although a lot of handlers followed basic hygiene procedures like washing their hands before preparing food or wearing aprons, there were some examples where they failed to wear gloves, keep their fingernails short, or wear jewelry when handling food.

In Malaysia, where food handlers often show sufficient awareness but neglect to consistently implement hygiene practices, this knowledge-practice gap has been thoroughly reported [26]. This "knowledge-practice gap," in which food handlers recognize the value of hygiene but do not consistently implement it in their daily duties [27]. In Padawan, Sarawak traditional practices more prioritize because of the rapid and customer interaction than the proper hygiene, handwashing and the use of gloves [28].

Wearing gloves, aprons, or full uniforms in hot and humid conditions leads to excessive sweating and fatigue [29]. Many of vendors had low margins of profit. It is considered an extra expense to buy and maintain appropriate clothing (aprons, gloves, or caps), especially in seasonal or informal markets [30]. According to vendors in Vietnam, wearing protective gear slows down their work, restricts their range of motion, and increases preparation time. Convenience frequently takes priority over compliance in crowded bazaar or street food environments [31].



According to Ministry of Health guidelines, food handlers in Malaysia must go through medical examinations to make sure they are free of communicable diseases like typhoid, hepatitis A, and skin infections [32]. Enforcement is still uneven, though, especially when it comes to transient or unofficial vendors like those at night markets and Ramadan bazaars. There are gaps where vendors lack current health certifications or routine medical screening, resulting in moderate compliance levels, even though many licensed vendors comply [33].

Recommendation

The findings of the study suggested several important areas where Kota Kinabalu's Ramadan bazaar vendors could improve their adherence to food safety regulations. A lack of compliance was observed when it involved wearing protective clothing, such as aprons, gloves, and hair covers. Since wearing protective clothing is essential to avoiding cross-contamination when handling food, this weakness needs immediate intervention. Enforcement from Kota Kinabalu District Health Office and local council should strengthen through regular spot checks and penalizing for those who was noncompliance. They play key role through inspections, registration requirements for food businesses, training requirements for food handlers, and enforcement of waste management, sanitation, and pest control procedures. These strategies have been reported to improve compliance with the Food Hygiene Regulations 2009 in Malaysia [32].

The food handler training frequently increases their knowledge. However, the actual practice particularly related to the personal hygiene remains inconsistent. This disparity showed the necessity of behavior-change strategies instead of delivering the knowledge and information to the vendors. Peer-to-peer learning, practical demonstrations, workplace reminders, and regular refresher courses should all be a part of the program [34]. Behavior modification-based information, education, and communication (IEC) strategies significantly improve food vendors' hygienic practices in Malaysia and Indonesia [35, 36].

Infrastructure support is important especially for waste disposal and water supply. For example, the local authorities should provide and maintained timely waste collection and access to clean waste across each bazaar area. Local authorities must ensure regular and

availability of waste collection across bazaar areas. The limitation of the service often leads to waste accumulation, attracts rodents, flies, and cockroaches and increasing contamination risks which can spread diseases [37]. The significance of continuous government investment in environmental health and sanitation will directly improves street vendors' adherence to hygiene (Insfran-Rivarola et al., 2020). Moreover, proper waste management ensures better coverage and prevents waste from entering nearby water bodies, reducing environmental pollution.

The affordable and accessible health check-up play an important role in preventing foodborne disease outbreaks and improving public health resilience. For small vendors, routine health screenings can be expensive, which restricts their ability to comply with regulations. Screenings require lab tests, consultations, and sometimes follow-ups, which can be expensive without subsidies [38]. To promote broader participation, vendors should be provided with subsidized health checks. For small-scale and informal food vendors, especially those operating temporary markets like Ramadan bazaars. Low-cost or government-subsidized health services can greatly increase compliance rates and lower the risk of foodborne illness outbreaks

Many vendors operate in temporary or informal settings, making travel to health facilities inconvenient [39]. By delivering services to the vendors' operational locations, time, logistics, and transportation barriers have been reduced, which boosts participation. Through district health outreach, similar programs have been put into place in other parts of Malaysia and have proven successful in increasing adherence to preventive health regulations [40].

Additionally, to reduce administrative burdens for vendors, certification processes need to be simplified and digitalized. Digital systems that enable online health certificate registration, renewal, and verification may significantly minimize paperwork and waiting times while easing compliance for small-scale vendors who often face resource constraints. Digitized platforms eliminate the need for repeated physical visits to health offices, lowering costs and encouraging higher participation in certification schemes [41]. Singapore demonstrates success with e-licensing systems for hawkers, where digital records have strengthened both



vendor convenience and regulatory monitoring, supporting overall food safety compliance^[42].

Finally, active community involvement and ongoing monitoring will be necessary for improvements in food safety. Authorities' routine inspections should be complemented by consumer and vendor participation in the promotion of safe practices. Campaigns for health education and community-based monitoring can strengthen the culture of food safety and reinforce accountability. Initiatives like "Ops Bazaar Ramadan" have proven successful in Malaysia, but they could be improved even more by involving local communities in awareness-raising and supervision^[32].

Conclusion

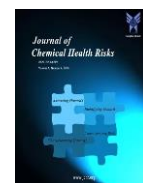
This study assessed hygiene compliance among food vendors at Ramadan bazaars in Kota Kinabalu using a standardized risk-based checklist. Overall, structural and environmental standards, including food-contact surfaces, non-food-contact surfaces, and waste management, were well maintained, and training compliance was encouraging. However, gaps persisted in personal hygiene and health inspections, with protective clothing showing the lowest adherence. Strengthening enforcement, promoting behaviour-focused training, providing accessible health checks, and reinforcing protective attire use are essential to improve food safety and reduce risks of foodborne illnesses in temporary food service settings.

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