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Assessment of Food Safety Knowledge and Hygienic Practices among Butchers and Milk Vendors in the Informal Meat and Milk Sector: Implications for Public Health

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Abstract
Food safety is a critical public health issue, particularly in the informal meat and milk sector, where inadequate hygiene practices may increase the risk of foodborne diseases. This study assessed food safety knowledge and hygienic practices among butchers and milk vendors operating in the informal meat and milk sector of Hyderabad District, Sindh, Pakistan. A cross-sectional survey was conducted among 60 respondents, comprising 30 butchers and 30 milk vendors. Primary data were collected through a structured questionnaire and an observation checklist. Descriptive statistics were used to summarize respondents' characteristics, food safety knowledge, and observed hygiene conditions. Cross-tabulations were used to examine patterns between knowledge, training, education, and hygiene. Overall, 46.7% of respondents had moderate food safety knowledge, 33.3% had low knowledge, and 20.0% had high knowledge. Functional handwashing facilities were observed at 40.0% of vending points, protective clothing at 33.3%, proper waste disposal at 46.7%, and protection of food from flies and dust at 36.7%. Trained respondents showed a more favourable knowledge distribution than untrained respondents, and higher educational attainment was associated with a greater proportion of

high knowledge. Respondents with high knowledge were also more likely to demonstrate good hygiene practices in the presented cross-tabulation. These findings indicate gaps in food safety awareness and hygiene infrastructure in the study sample. Regular vendor training, improved access to handwashing and storage facilities, and proportionate regulatory monitoring are recommended.

Keywords: Food safety; hygienic practices; butchers; milk vendors; informal sector; foodborne diseases; public health;

1. Introduction

Food safety is a fundamental public health concern because the consumption of contaminated food can cause a wide range of foodborne diseases, adversely affecting human health, productivity, and socioeconomic development. Safe food is essential for sustaining life, promoting good health, and ensuring food security. However, contamination resulting from biological, chemical, and physical hazards continues to pose significant challenges worldwide. The World Health Organization (WHO) identifies food safety as an important component of public health and emphasizes the need to prevent foodborne risks throughout food systems.

The burden of foodborne illness is particularly challenging in low- and middle-income countries, where food safety systems may be constrained by inadequate sanitation, weak regulatory enforcement, limited surveillance, poor infrastructure, and insufficient awareness among food handlers. Strengthening food safety practices across food supply chains is therefore essential for reducing foodborne disease risks and protecting consumers.

Meat and milk are important animal-source foods and provide high-quality protein, vitamins, minerals, and other essential nutrients. Despite their nutritional value, both products are highly perishable and susceptible to microbial contamination when hygiene is not maintained during production, processing, transportation, storage, and retail distribution. Meat may become contaminated through unclean equipment, contaminated surfaces, cross-contamination, inadequate storage, and poor personal hygiene. Milk may be exposed to contamination during milking, collection, transportation, handling, and retail sale, particularly when refrigeration and sanitary measures are inadequate.

In Pakistan, informal food markets play an important role in providing affordable meat and milk to consumers. Informal butchers and milk vendors contribute to local food distribution systems and improve the availability of animal-source foods for urban and rural populations. However, vendors may operate with limited access to clean water, handwashing facilities, refrigeration, appropriate waste disposal, and regular food safety guidance. These constraints can increase the likelihood of food contamination and create public health concerns.

Food safety knowledge is an important factor influencing hygienic behaviour. Knowledge of personal hygiene, handwashing, equipment sanitation, contamination prevention, product storage, and foodborne disease transmission can help food handlers adopt safer practices. Training and education may improve vendors' understanding of food safety principles and their ability to apply them during routine handling activities. Previous studies have examined food safety knowledge and practices among food handlers, meat handlers, and dairy vendors, including the role of training and education (Ahmed et al., 2021; Insfran-Rivarola et al., 2020; Sharma et al., 2022).

Despite this evidence, relatively limited research has comparatively assessed butchers and milk vendors within the same informal food distribution setting and examined how food safety knowledge relates to education, training, experience, and observed hygiene. Therefore, this study assessed the socio-demographic and vending characteristics of butchers and milk vendors, evaluated their food safety knowledge, examined hygienic practices and facilities at vending

points, and explored the observed relationships between knowledge, education, training, and hygiene. The findings are intended to inform targeted training, improvements in hygiene infrastructure, and food safety monitoring in the informal meat and milk sector.

2. Literature Review

2.1 Food Safety and Public Health

Food safety is a critical component of public health because contaminated food can transmit biological, chemical, and physical hazards. Foodborne diseases contribute to illness, mortality, healthcare costs, and productivity losses. Inadequate food handling, poor sanitation, and limited food safety awareness increase the risk of contamination along food supply chains. Improving food handlers' knowledge and hygienic behaviour is consequently an important element of food safety interventions (WHO, 2022; WHO, 2026).

2.2 Food Safety Knowledge among Food Handlers

Food safety knowledge refers to an individual's understanding of food contamination, personal hygiene, cross-contamination, foodborne diseases, and safe food handling procedures. Studies in Pakistan have reported gaps in food safety knowledge and practices among food handlers (Ahmed et al., 2021; Khan et al., 2022). Systematic review evidence also indicates that knowledge, attitudes, and practices among street food handlers can vary and that training is an important intervention area (Nawawi et al., 2022).

2.3 Hygienic Practices among Butchers

Butchers contribute directly to meat safety because contamination can occur during slaughtering, cutting, storage, transportation, and retail display. Poor hygiene may facilitate the transmission of pathogens, including Salmonella spp., Escherichia coli, Campylobacter spp., and Staphylococcus aureus. Research among abattoir and butcher shop workers has identified the importance of food safety knowledge and hygienic practice for managing health risks (Gebeyehu & Tsegaye, 2022). Studies have also examined meat-handler knowledge and practices in Ghana and Bangladesh (Asati et al., 2024; Hasan et al., 2024).

2.4 Food Safety and Hygiene among Milk Vendors

Milk is susceptible to microbial contamination throughout the dairy value chain. In informal dairy markets, risks may be elevated by inadequate hygiene, unsuitable containers, poor storage, and limited refrigeration. Sharma et al. (2022) examined knowledge and practices among milk vendors in India's informal dairy value chain and highlighted the importance of improving handling practices. Research on food handlers and microbial contamination in Pakistan also reinforces the need for hygienic handling and monitoring (Ali et al., 2022).

2.5 Influence of Education and Food Safety Training

Education and food safety training may improve food handlers' awareness of foodborne hazards and recommended hygiene practices. A systematic review and meta-analysis by Insfran-Rivarola et al. (2020) reported positive effects of food safety and hygiene training on food handlers. Young et al. (2020) likewise reviewed food safety education and training interventions and identified their potential to improve food safety outcomes. These findings support examining the relationship between training, education, knowledge, and hygiene.

2.6 Research Gap

Previous studies have investigated food safety knowledge and hygienic practices among different categories of food handlers, but many have focused on meat handlers or dairy vendors separately. There is a need for local comparative evidence on butchers and milk vendors operating within the same informal food distribution setting. The present study addresses this gap by describing knowledge and observed hygiene among both groups and examining available cross-tabulations for training, education, and hygiene.

2.7 Research Objectives

To assess the socio-demographic and vending characteristics of butchers and milk vendors and their level of food safety knowledge.

To evaluate the hygienic practices and facilities observed at meat and milk vending points in the informal sector.

To examine the relationship of food safety knowledge with training and education, and its association with observed hygiene practices, in order to identify gaps with public health implications.

3. Materials and Methods

3.1 Study Area

The study was conducted at selected informal meat and milk vending locations in Hyderabad District, Sindh, Pakistan. These markets are important sources of animal-source foods for local consumers and include small-scale butcher shops and milk vending points. The study area was selected because of the presence and local importance of informal meat and milk vendors.

3.2 Research Design

A cross-sectional survey design was employed to assess food safety knowledge and hygienic practices among butchers and milk vendors. Questionnaire-based interviews were combined with direct observations of vending facilities and hygiene conditions.

3.3 Target Population

The target population comprised butchers and milk vendors operating within the informal meat and milk sector of the study area. These vendors were selected because they are directly involved in handling, storing, transporting, and selling meat and milk products to consumers.

3.4 Sample Size and Sampling Technique

A total of 60 respondents were included, consisting of 30 butchers and 30 milk vendors. The study reports that respondents were selected using a simple random sampling technique from eligible vendors operating in the study area.

Table 3.1. Sample distribution

Respondent category	Frequency	Percentage (%)
Butchers	30	50.0
Milk vendors	30	50.0
Total	60	100.0

3.5 Data Collection

Primary data were collected during 2026 through a structured questionnaire and an observation checklist. The questionnaire covered socio-demographic characteristics, education, vending experience, food safety training, food safety knowledge, and food handling practices. Direct observations assessed cleanliness of vending areas, handwashing facilities, use of protective clothing, waste disposal, storage conditions, and protection of food from flies and dust.

3.6 Measurement of Variables

Table 3.2. Food safety knowledge categories as reported

Knowledge category	Assigned code
Low	1
Moderate	2
High	3

Note:

Observed hygienic practices were classified as good hygiene (1) or poor hygiene (0). The observation checklist covered vending-area cleanliness, handwashing facilities, protective clothing, safe storage, waste disposal, and protection from flies and dust.

Table 3.3. Coding of observed hygiene

Category	Value
Poor hygiene	0
Good hygiene	1

Table 3.4. Independent variables

Variable	Description / coding
Education	Illiterate, Primary, Secondary, Higher Secondary+
Food safety training	Yes = 1; No = 0
Experience	Years of vending experience
Occupation	Butcher = 1; Milk vendor = 0
Age	Age in years

3.7 Analytical Framework

The study considered food safety knowledge as an outcome associated with education, food safety training, experience, age, and occupation. Hygienic practices were considered in relation to food safety knowledge and the available socio-demographic and vending characteristics. These relationships were examined descriptively through the cross-tabulations available in the results.

3.8 Data Analysis

The collected data were reportedly coded and entered into SPSS Version 26. Frequencies and percentages were used to summarize respondents' characteristics, knowledge levels, and observed hygiene conditions. Cross-tabulations were used to describe the distribution of knowledge by training and education, and hygiene by knowledge level. Cross-tabulations were used to describe the distribution of food safety knowledge by training and education, and observed hygiene by knowledge level.

3.9 Ethical Considerations

Participation was voluntary. The purpose of the research was explained to respondents before data collection, verbal informed consent was obtained, and confidentiality of the collected information was maintained. The data were used for academic and research purposes.

4. Results and Discussion

4.1 Socio-Demographic and Vending Characteristics of Respondents

The study included 60 respondents, comprising 30 butchers (50.0%) and 30 milk vendors (50.0%). The age distribution indicated that 35.0% of respondents were 31–40 years old, followed by 26.7% aged 20–30 years, 25.0% aged 41–50 years, and 13.3% above 50 years. Regarding education, 30.0% had primary education, 28.3% had secondary education, 23.3% had no formal education, and 18.4% had higher secondary education or above. The largest reported experience group was 5–10 years (31.7%), while 20.0% had less than five years of experience. The remaining experience categories were not fully tabulated in the supplied results.

Food safety training was limited: 18 respondents (30.0%) reported having received training, whereas 42 (70.0%) had not. This indicates that most respondents in the sample had not attended formal food safety training.

Table 4.1. Respondent occupation and food safety training (n = 60)

Variable	Category	Frequency	Percentage (%)

Occupation	Butchers	30	50.0
Occupation	Milk vendors	30	50.0
Food safety training	Yes	18	30.0
Food safety training	No	42	70.0

4.2 Food Safety Knowledge Level

Food safety knowledge was assessed through ten questions addressing contamination, personal hygiene, disease transmission, refrigeration, cross-contamination, and safe food handling. Of the 60 respondents, 28 (46.7%) had moderate knowledge, 20 (33.3%) had low knowledge, and 12 (20.0%) had high knowledge. Thus, the largest group demonstrated moderate knowledge, while one-third of respondents were classified as having low knowledge.

Table 4.2. Food safety knowledge level of respondents (n = 60)

Knowledge level	Frequency	Percentage (%)
Low	20	33.3
Moderate	28	46.7
High	12	20.0
Total	60	100.0

4.3 Observed Hygienic Practices

Direct observations at vending points identified differences across the hygiene indicators. Clean vending areas were observed at 65.0% of sites, while safe storage was recorded at 58.3%. However, functional handwashing facilities were present at 40.0% of sites, protective clothing was observed at 33.3%, and proper waste disposal was available at 46.7%. Only 36.7% of vending points adequately protected food from flies and dust. These findings indicate gaps in basic hygiene facilities and environmental protection.

Table 4.3. Observed hygienic practices at vending points (n = 60)

Observed practice	Yes, n (%)	No, n (%)
Clean vending area	39 (65.0)	21 (35.0)
Functional handwashing facility	24 (40.0)	36 (60.0)
Protective clothing	20 (33.3)	40 (66.7)
Safe storage	35 (58.3)	25 (41.7)
Proper waste disposal	28 (46.7)	32 (53.3)
Protection from flies and dust	22 (36.7)	38 (63.3)

Note: Frequencies are calculated from the reported percentages using n = 60; percentages may show minor rounding.

4.4 Relationship between Food Safety Training and Knowledge

The cross-tabulation shows a more favourable knowledge distribution among trained respondents. Of the 18 trained respondents, 7 (38.9%) had high knowledge, compared with 5 of 42 untrained respondents (11.9%). Low knowledge was recorded for 2 trained respondents (11.1%) and 18 untrained respondents (42.9%). This descriptive pattern suggests that training may be associated with better food safety knowledge in the sample.

Table 4.4. Food safety training status and knowledge level

Training status	Low	Moderate	High	Total
Trained	2	9	7	18
Untrained	18	19	5	42
Total	20	28	12	60

4.5 Relationship between Education and Food Safety Knowledge

The cross-tabulation indicates that high knowledge was more common among respondents with higher educational attainment. Six of the 11 respondents in the higher secondary education category had high knowledge, compared with none of the 14 respondents who were illiterate. Low knowledge was most frequent among illiterate respondents (9 of 14). These results show a descriptive positive pattern between education and food safety knowledge.

Table 4.5. Education level and food safety knowledge

Education level	Low	Moderate	High	Total
Illiterate	9	5	0	14
Primary	7	9	2	18
Secondary	3	10	4	17
Higher secondary+	1	4	6	11
Total	20	28	12	60

4.6 Association between Food Safety Knowledge and Hygienic Practices

The cross-tabulation indicates that good hygiene was more common among respondents with higher food safety knowledge. Among respondents with low knowledge, 5 of 20 (25.0%) were classified as having good hygiene, whereas 10 of 12 (83.3%) respondents with high knowledge demonstrated good hygiene. In the moderate knowledge group, 18 of 28 (64.3%) demonstrated good hygiene. This descriptive pattern suggests that higher food safety knowledge coincided with better observed hygiene in the sample.

Table 4.6. Knowledge level and observed hygienic practices

Knowledge level	Good hygiene	Poor hygiene	Total
Low	5	15	20
Moderate	18	10	28
High	10	2	12
Total	33	27	60

4.7 Discussion

The results show that food safety knowledge among the sampled butchers and milk vendors was most commonly moderate, while one-third of respondents had low knowledge. This indicates that awareness of food safety principles was not uniformly strong. The finding is consistent with previous research reporting gaps in food safety knowledge and practices among food handlers (Ahmed et al., 2021; Khan et al., 2022).

Observed hygiene conditions also revealed practical shortcomings. In particular, handwashing facilities, protective clothing, waste disposal, and protection from flies and dust were not consistently available or observed. These issues are important because meat and milk are perishable foods and can be exposed to contamination during handling and retail sale. Research on butcher shop workers and informal milk vendors similarly highlights the importance of hygiene practices and food safety management (Gebeyehu & Tsegaye, 2022; Sharma et al., 2022).

The training and education cross-tabulations showed more favourable knowledge distributions among trained and more educated respondents. This descriptive pattern is in line with literature identifying food safety education and training as useful interventions (Insfran-Rivarola et al., 2020; Young et al., 2020). The knowledge-hygiene table also showed that respondents with high knowledge more frequently demonstrated good hygiene. Nevertheless, these are cross-sectional descriptive relationships; they do not prove causation. Further, no occupation-specific cross-tabulation was supplied, so differences between butchers and milk vendors cannot be established from the current tables.

5. Conclusion and Recommendations

5.1 Conclusion

This study assessed food safety knowledge and hygienic practices among 60 butchers and milk vendors operating in the informal meat and milk sector of Hyderabad District, Sindh. The findings showed that 46.7% of respondents had moderate food safety knowledge, 33.3% had low knowledge, and 20.0% had high knowledge. Food safety training was limited, with 70.0% of respondents reporting that they had not received training.

The observation checklist identified gaps in hygiene conditions at vending points. Functional handwashing facilities were available at 40.0% of sites, protective clothing was observed at 33.3%, proper waste disposal at 46.7%, and protection from flies and dust at 36.7%. The cross-tabulations showed more favourable knowledge distributions among trained and more educated respondents, while higher knowledge levels coincided with better observed hygiene.

Overall, the findings indicate that the sampled informal vendors faced both knowledge-related and infrastructure-related food safety challenges. The results support practical interventions focused on training, handwashing facilities, protective clothing, waste management, safe storage, and routine monitoring.

5.2 Recommendations

Regular food safety training programs. Food safety authorities and local government agencies should organize accessible training for butchers and milk vendors. Training should cover personal hygiene, handwashing, cross-contamination prevention, sanitation, foodborne diseases, safe storage, and hygienic handling.

Strengthening hygiene infrastructure. Vending points should have access to clean water, functional handwashing facilities, appropriate waste disposal systems, suitable storage or refrigeration, and practical measures to protect food from flies, dust, and other contaminants.

Promotion of protective clothing. Vendors should be encouraged and supported to use clean aprons, gloves where appropriate, caps, and clean work clothing during food handling.

Increased regulatory monitoring. Relevant food safety authorities should conduct regular, supportive inspections and provide vendors with clear guidance on minimum hygiene requirements.

Public awareness campaigns. Community awareness activities should inform vendors and consumers about contamination risks and the importance of safe meat and milk handling.

Vendor registration and support. Local authorities should consider accessible registration and licensing arrangements that can facilitate training, communication, and gradual improvement in hygiene standards.

Future research. Future studies should include larger samples, additional districts, respondent-level statistical analysis, and microbiological testing of meat and milk samples where feasible.

5.3 Policy Implications

Improving food safety in the informal meat and milk sector requires coordinated action involving education, infrastructure, and proportionate regulatory support. Policy interventions should

prioritize practical training and basic hygiene facilities for small-scale vendors. Monitoring should be accompanied by guidance and feasible improvement measures so that vendors can progressively meet food safety requirements. Such steps may help reduce contamination risks and strengthen consumer protection.

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