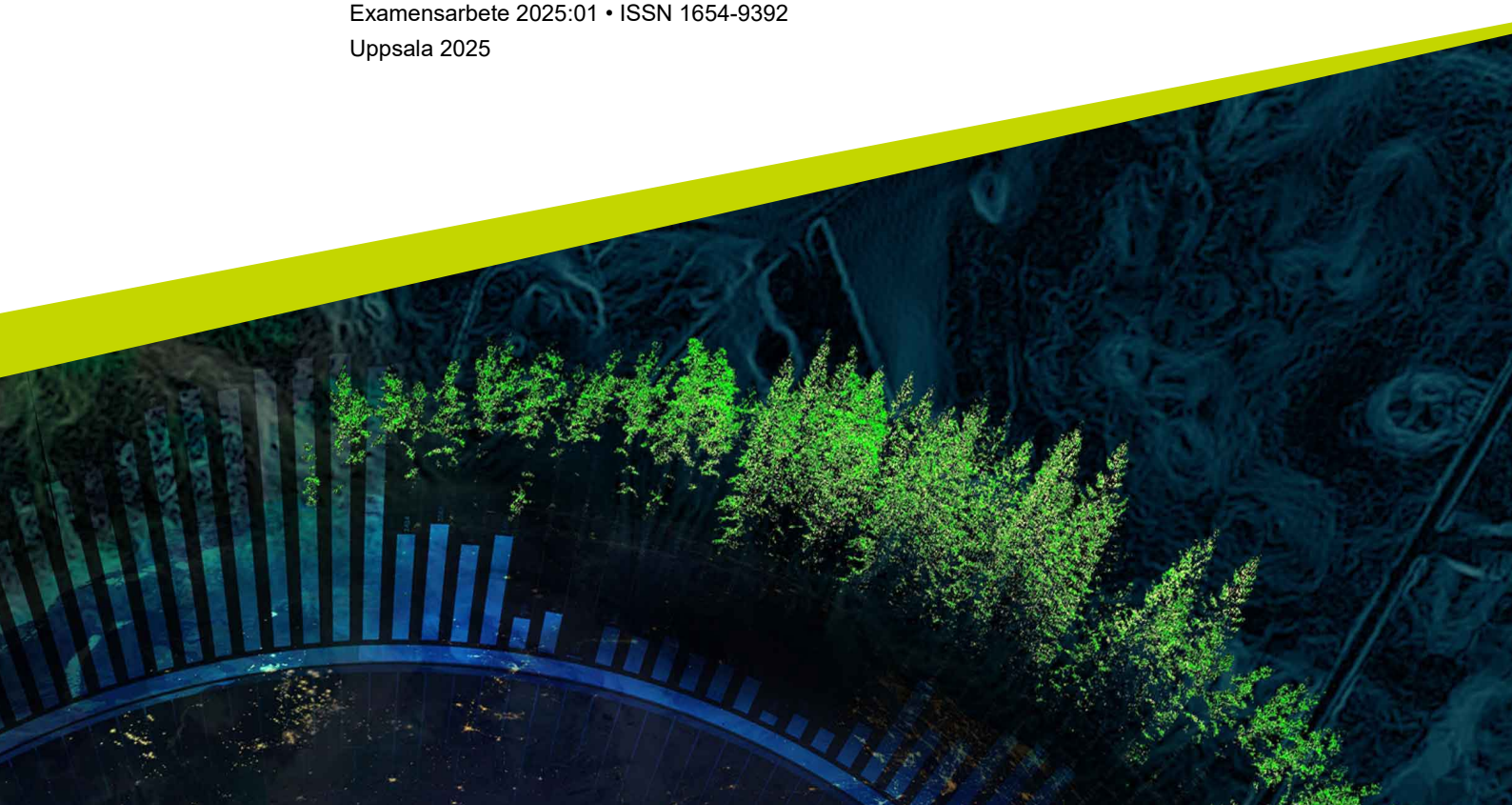
Food safety and hygiene practices in street food vendors in Kathmandu and Pokhara, Nepal

Sabita Sharma

Independent project • 15 credits
Swedish University of Agricultural Sciences, SLU
Department of Energy and Technology
Food inspection – Master's Programme
Examensarbete 2025:01 • ISSN 1654-9392
Uppsala 2025



Food safety and hygiene practices in street food vendors in Kathmandu and Pokhara, Nepal

Livsmedelssäkerhet och hygienrutiner hos gatumatsförsäljare i Kathmandu och Pokhara i Nepal

Sabita Sharma

Supervisor:	**Monika Johansson, Swedish University of Agricultural Sciences, Department of Molecular Sciences**
Assistant supervisor:	Ram Hari Timilsina, Assoc. Prof., Faculty of Agriculture, Agriculture and Forestry University (AFU), Chitwan, Nepal
Examiner:	Mattias Eriksson, Swedish University of Agricultural Sciences, Department of Energy and Technology

Credits:	15 credits
Level:	Master's degree A1E
Course title:	Independent project in Food Science - Food Inspection
Course code:	EX1008
Programme/education:	Food Inspection - Master's Programme
Course coordinating dept:	Department of Energy and Technology
Place of publication:	Uppsala
Year of publication:	2025
Copyright:	All featured images are used with permission from the copyright owner.
Title of series:	Examensarbete (Institutionen för energy och teknik, SLU)
Part number:	2025:01
ISSN:	1654-9392
Keywords:	*food hygiene, sanitation, food safety, survey, sustainable development goals*

Swedish University of Agricultural Sciences
Faculty of Natural Resources and Agricultural Sciences
Department of Energy and Technology

Abstract

Food hygiene is a critical component of food safety and public health, aiming to minimize contamination and prevent foodborne illnesses. Poor food hygiene practices can lead to severe health risks, including diseases caused by harmful bacteria, viruses, and parasites. This study examines food safety and hygiene practices among street food vendors in Kathmandu and Pokhara, Nepal, using a cross-sectional approach that combines Hazard Analysis Critical Control Point (HACCP) concepts with the assessment of social environments. The objective is to evaluate vendors' understanding of food safety, their hygiene practices, and their compliances with sanitation regulations, as well as the implications for public health, economic stability, and consumer confidence.

The study finds that many street food vendors in Nepal face challenges in maintaining proper hygiene due to a lack of formal training, inadequate resources, and inconsistent infrastructure. While some vendors exhibit good hygiene practices, such as regular handwashing and utensil sanitization, critical gaps still exist in majority of the respondents on food safety knowledge, risks and practices such as using food thermometers and proper waste management in vending sites. A significant number of vendors also lacks awareness of foodborne pathogens like E. coli. Despite these challenges, there is a strong willingness among vendors to engage in further training to improve their practices. This study highlights the need for targeted interventions, including educational programs, infrastructural improvements, and specific municipal policies to ensure safer food preparation and handling.

Keywords: food hygiene, sanitation, food safety, survey, sustainable development goals

Table of contents

List of tables

List of figures

Abbreviations

Abbreviation	Description
CFIA	Canadian Food Inspection Agency
E. coli	*Escherichia coli*
EFCA	European Food Safety Authority
EPA	Environmental Protection Agency
FAO	Food and Agriculture Organization
FBD	Foodborne Diseases
FDA	Food and Drug Administration
DGP	Gross Domestic Product
HACCP	Hazard Analysis Critical Control Point
HIV	Human Immunodeficiency Virus
SDG	Sustainable Development Goal
UNICEF	United Nations Children's Fund
USDA	United States Department of Agriculture
WHO	World Health Organization

1. Introduction

1.1 Background

Food hygiene plays an important role in maintaining food safety, which impacts global public health (WHO 1999). Food hygiene is therefore fundamental for ensuring safe food production, consumption and preventing foodborne illnesses in a country's population (WHO 2022). Proper food hygiene encompasses various practices and procedures that must be followed during food preparation, handling, and storage to minimize the risk of contamination. These practices are crucial in safeguarding consumer health, maintaining the quality of food, and preventing outbreaks of foodborne diseases (Uyttendaele et al. 2016). Food hygiene is interdependent with the food supply and safety, contributing to public health and benefits. Hence, food safety covers the issues regarding food supply chain and safeguarding from hazardous microbial and chemical agents (Grace 2015, Gizaw 2019).

Food hygiene is critical to public health because it helps prevent foodborne illnesses, ensures food safety, and promotes overall community health. Poor food hygiene can lead to contamination by harmful bacteria, viruses, parasites, or chemicals, causing foodborne illnesses like Salmonella, *E. coli*, and Listeria (Gallo et al. 2020). These illnesses can have severe consequences, particularly for vulnerable populations such as children, the elderly, and those with weakened immune systems. The World Health Organization (WHO) estimates that 600 million people fall ill from contaminated food every year, leading to 420,000 deaths globally (WHO, 2020).

Maintaining strict food hygiene practices boosts consumer confidence in the safety of food products (Henson and Jaffee 2006). This is especially important in times of public health crises, where consumers rely on safe, hygienically prepared food to prevent illness. Public trust in food systems is critical for sustaining economic activity in the food industry (Wilson et al. 2017).

Foodborne diseases can contribute to wider public health crises, especially when linked to food supply chains. In a globalized world, food hygiene practices can also help prevent the spread of foodborne pathogens and contaminants, contributing to global health security. However, poor hygiene practices in food production can contribute to the spread of antibiotic-resistant bacteria (Rahman et al. 2021). According to the European Food Safety Authority (EFSA), the misuse of antibiotics in food production is a leading cause of the development of resistant bacteria, posing a serious public health threat (Hazards 2011).

The World Health Organization (WHO) emphasizes that food hygiene is essential for ensuring food safety and preventing foodborne illnesses. According to WHO, food hygiene involves practices that prevent food contamination and ensure that food is safe for consumption (WHO 1999). It plays a critical role in protecting public health, especially by reducing the risks of diseases caused by bacteria, viruses, parasites, and chemicals present in contaminated food. The WHO's five keys to safer food guide outlines key hygiene principles: keeping food clean, separating raw and cooked food, cooking food thoroughly, storing food at safe temperatures, and using safe water and raw materials (WHO 2023). In addition, food hygiene is closely connected to the Sustainable Development Goals (SDGs), particularly those related to health, hunger, and sustainable consumption:

SDG 2: Zero hunger
Food hygiene is vital for achieving food security and ensuring access to safe, nutritious food. Contaminated food can worsen food insecurity and malnutrition, particularly in vulnerable populations. Ensuring good food hygiene practices helps prevent foodborne diseases, contributing to SDG 2's target of ending hunger and improving nutrition.

SDG 3: Good health and well-being
Proper food hygiene is directly linked to SDG 3, which aims to reduce the global burden of disease. According to WHO, foodborne diseases affect millions of people globally, with serious public health and economic consequences (WHO 2022). Safe food practices reduce foodborne illnesses and promote public health.

SDG 6: Clean water and sanitation
This goal is essential for health, as clean water and sanitation reduce the spread of diseases, improve nutrition, and promote overall well-being. It supports other SDGs by enabling safe hygiene practices.

SDG 12: Responsible consumption and production
Food hygiene is integral to sustainable consumption and production systems. Reducing food waste through safe food handling, preparation, and storage supports SDG 12, which promotes efficient use of resources and minimizes waste throughout the food supply chain.

SDGs and food hygiene are complexly connected, particularly through SDG 2 (Zero Hunger), SDG 3 (Good Health and Well-being), and SDG 6 (Clean Water and Sanitation). Proper food hygiene is essential to ensuring safe and nutritious food, which directly supports efforts to eliminate hunger and malnutrition (SDG 2). Food hygiene reduces the risk of foodborne diseases and contributes to improved health outcomes (SDG 3). Clean water

is also critical for effective food hygiene practices, linking it to SDG 6, as contaminated water can introduce pathogens into food processing and preparation. Hence, food hygiene is important in public health, strengthening the food security and supports sustainable development.

1.2 Importance of food hygiene

Food hygiene has vital role in public health. It can directly impact public health, consumer´s interest in street food, overall confidence, and ultimately the quality of life. Proper food hygiene practice can help prevent food related illnesses, which can otherwise lead to severe health complications, and even trigger to fatalities. It is important to maintain high standards of hygiene during food handling, preparation, and storage processes to keep food safe from harmful bacteria, viruses, and contaminants. Maintaining high standard of hygiene will not only safeguards the health of individuals but also help to reduce healthcare costs and economic burden in the society. It is also important to note that the food hygiene can help to create trust between consumers and vendors that contribute to the local economy.

Another aspect of food hygiene is regulatory compliance, where vendors must responsibly follow and support hygiene standards to operate their businesses. Food hygiene also determines the sustainability of any business and build public trust. Finally, prioritizing food hygiene contributes significantly to public health, enhances food security, and ensures a safer, healthier community. Here are some important sections on importance of food hygiene.

Prevention of foodborne illnesses

Foodborne illnesses caused by pathogens such as bacteria, viruses, and parasites, are a major public health concern. According to WHO, approximately 600 million people fall ill from contaminated food each year, leading to 420,000 deaths globally (WHO 2022). Effective food hygiene practices, including proper handwashing, cooking, and food storage, are essential to prevent these illnesses.

Reduction of healthcare costs

Foodborne illnesses place a significant burden on healthcare systems, leading to substantial economic losses. Foodborne disease caused 9.4 million illnesses, 55,961 hospitalizations, and 1,351 deaths each year Adhering to proper food hygiene practices can significantly reduce these costs by decreasing the incidence of foodborne diseases (Scallan et al. 2011).

Boosting consumer confidence

Maintaining high food hygiene standards is crucial for ensuring consumer trust in food safety. FAO emphasizes that public confidence in food systems

is vital for economic stability, particularly during health crises (FAO 2019). Ensuring safe food practices helps to build and maintain consumer trust.

Preventing antibiotic resistance

Improper food hygiene practices, particularly in animal farming, can lead to the spread of antibiotic-resistant bacteria. The European Food Safety Authority (EFSA) identifies the misuse of antibiotics in food production as a major factor contributing to the development of resistant strains, which poses a serious public health threat (WHO 2011).

Based on the points discussed above regarding the importance of food hygiene, assessing hygiene practices among street food vendors is essential for understanding and mitigating the risks associated with foodborne illnesses. Such a study can contribute to knowledge that promotes safer food practices and, ultimately, supports a healthier and more sustainable urban food system.

1.3 Current knowledge and relevance of the study

Urbanization has become a dominant phenomenon in Nepal, with urban areas experiencing a population growth of more than tenfold over the last 30 years, primarily due to migration (Pradhan, Sharma and Pradhan 2020). The capital city is receiving more population due to urban migration triggering an increase of street venders because it is an important source of income/employment in the city (Timalsina 2007). It means one section of urban population benefit from street vending because of affordable price of the foods. The hygiene conditions of street-vended foods in these areas appear to be a neglected issue but are one of the most important concerns in public health (Adhikari and Phil 2017).

Food hygiene is a fundamental public health issue irrespective of socio-economic and demographic status (Kamboj et al. 2020). It is particularly relevant in societies where foodborne illnesses are more frequent. Major urban cities offer many street-vended foods and beverages that can be consumed immediately in the streets and public places. It is because the street foods are highly convenient in busy cities because they are inexpensive, readily available for consumers, and mostly are attractive. The urban population requires food that is easily accessible, leaving little time to consider hygiene during consumption (Khanal et al. 2024).

Street food plays a significant role in urban economies, particularly in developing countries, where it serves as a vital source of affordable and accessible food for the working population. In large cities, street food provides quick, low-cost meals that meet the needs of urban residents, particularly those who has rush hours and lower incomes to rely on street vendors (WHO 1999). However, despite its economic importance, street food is frequently associated with public health concerns due to inadequate food

hygiene practices, resulting in a high risk of foodborne diseases (Alimi 2016).

Street food vendors also play a significant role in urban food systems, providing accessible and affordable food options to a large population (Bhattarai and Pathak 2020). However, the informal nature of street vending often results in inconsistent adherence to food safety standards (Adaku et al. 2024). Many vendors operate without formal training in food hygiene, leading to potential risks associated with improper handling, inadequate sanitation, and unregulated food storage conditions (Adaku et al. 2024).

The prevalence of street-vended foods in cities brings challenges related to food safety and hygiene. The owners or vendors may lack the necessary knowledge and resources to implement and maintain proper hygiene practices (Timilsina et al. 2024). The lack of knowledge and resources can result in the contamination of food, contributing to public health issues and undermining consumer confidence in street food (Gallo et al. 2020).

Kathmandu, the capital of Nepal, is the centre of the country's most populous urban area. Situated in a bowl-shaped valley in the central Himalayas, Kathmandu serves as a major hub that includes the interconnected metropolitan areas of Kathmandu valley. The valley is situated in an altitudinal plateau prevailing sub-tropical to temperate climate. The geographical position contributes to its attractive climate, drawing a significant population seeking economic opportunities. The city’s rapid urbanization has led to a remarkable increase in street vending, which serves as a crucial source of income for many residents.

Pokhara is a second largest metropolitan city in terms of population. It is a tourism hub known for its scenic lakes, temples, and adventure sports, attracting millions of visitors each year. The influx of tourists and migrants has fuelled both economic growth and significant urban expansion. This rapid development, however, has affected Pokhara’s population, leading to challenges in sanitation, food hygiene, and public health management, particularly in popular areas for street food. Street vendors cater to locals and tourists with a variety of traditional Nepalese snacks, but the lack of comprehensive urban planning and food safety regulations poses risks to food quality and public health.

While most street vending businesses in the urban areas contribute to income generation for many individuals and families (Bhattarai and Pathak 2020) those involved often have low educational training and frequently lack adequate food safety knowledge and skills. Few practices were executed for the food safety knowledge and skills trainings in the city to improve food hygiene (Gautam 2015). However, incidents of food contamination may occur at any stage of preparation, handling, and serving. There can be interconnected effects of various factors, including a lack of good hygiene, incorrect food temperatures, and inadequate storage facilities. In urban areas

however, the role of street vendors is questioned concerning their food safety and hygiene practices, as well as the occupation of spaces used by city walkers (Paudel and Pant 2023). There exists a state of confusion among municipal authorities regarding the role of street vendors in the city's pursuit of food safety (Lamichhane 2017), the creation of sustainable communities, and the promotion of responsible consumption among the public.

Overall, the rise in street vendors in both cities has brought to significant concerns regarding food safety and hygiene. Despite their economic contribution, many street vendors lack formal education and training in food safety practices. This gap in knowledge, combined with inadequate sanitary conditions, poses a serious public health risk, as the potential for foodborne illnesses increases in both metropolitan areas.

To evaluate the food safety practices in the streets and understand the current status of food hygiene, a comprehensive situational analysis is necessary. Recent studies on food safety situations in South Asian countries have identified issues such as the absence of laboratory tests for street food hygiene, insufficient support for hygiene training among street vendors, local policies and strategies to manage street vendors and regulate conflicting mandates, as well as a lack of data and adequate resources (Bhattarai and Pathak 2020, Bhandari et al. 2022, Saud et al. 2023). These studies have brought attention to food safety concerns, including sanitation issues, food contamination, and conflicts between authorities and vendors. While some studies were completed into very local areas, examining the implications of one or two food items, there is a need to expand such studies on a broader scale. This expansion aims to identify realistic and appropriate solutions to improve the situation in local areas and provide a comprehensive approach toward achieving Sustainable Development Goals (SDGs).

Therefore, the primary focus of this thesis is on these two major cities, where an examination of food safety and hygiene practices among street food vendors is essential. It is particularly relevant to assess vendors' perceptions and practices regarding food safety and hygiene, as well as to evaluate their compliance with sanitary requirements. Understanding these practices will provide valuable insights into improving food safety standards, contributing to public health, and ensuring safer food consumption within the city.

1.4 Objectives

The role of food safety and hygiene practices is important to understand the implication of severe health issues and foodborne diseases outbreaks. This study proposes the use of cross-sectional approach combining the concept of ‘hazard analysis critical control point (HACCP) and assessment of social environment to examine appropriate food handling behaviours. The principal purpose of this cross-sectional approach is to advance our understanding on street food vendor’s role in food safety and hygiene practices and combine

with the systematic approach of identification and assessment of hazards at the control points. Further, it aims to examine the food safety and hygiene practices from the perspectives of public health, foodborne disease product's shelf-life, economic impact, and consumer confidence. This project has specific objective to:

- Assess how street food vendors perceive the role of food safety knowledge in the preparation of food and the maintenance of hygiene in street foods.
- Assess the vendors level of understanding in food safety and hygiene practices and explore hygiene and sanitation status in vending sites.
- Examine the level of vendors' compliance with the sanitary requirements of their street food vending individuals and environment.
- Evaluate food safety and hygiene practices from the perspectives of public health, the self-life of foodborne disease products, economic impact, and consumer confidence.

By utilizing a questionnaire survey in a cross-sectional study, the results, onsite observations will be analysed. The proposed work will evaluate the food safety and hygiene practices in street food vendors in Kathmandu.

1.5 Scope and limitations

1.5.1 Scope of the study

This study focuses on assessing food safety and hygiene practices among street food vendors in the metropolitan areas of Kathmandu and Pokhara. The specific objectives include evaluation of vendors' perceptions of food safety knowledge, understanding their level of awareness and practices regarding hygiene, examining compliance with sanitary requirements, and assessing food safety practices from public health, economic, and consumer confidence perspectives. By targeting these two major cities, the study provides insights relevant to urban settings with high street food consumption, where effective hygiene practices are essential for public health.

The study aims to generate valuable data on current food safety practices among street vendors, which can provide information on status of food hygiene conditions of street vendors. The scope includes interviews and observations of vendors to understand their practices and the sanitation conditions at their vending sites. Findings are intended to create new knowledge on practices so that it can help local authorities and public health agencies develop strategies for improving food safety within street food systems.

1.5.2 Limitations of the study

The study is limited to the metropolitan cities of Kathmandu and Pokhara, and findings may not be fully generalizable to rural areas or other urban settings with different regulatory environments, economic conditions, or consumer behaviours.

Due to logistical constraints, the sample size of vendors assessed may not have included the full diversity of street food vendors in terms of type of food sold, experience, and socioeconomic background. This may limit the generalization of the findings. Since the study relies on questionnaire survey involving the researcher and vendors, there may be biases related to vendors' responses about their hygiene practices or perceptions of food safety.

The study provides a snapshot of food safety and hygiene practices within a specific time frame. Seasonal variations in vendor practices, consumer traffic, or sanitation challenges may not be fully captured, potentially affecting the applicability of the findings across different times of the year. The study assesses compliance with sanitary standards but does not include a detailed microbiological analysis of food samples. Therefore, conclusions are based on observed practices and vendor's reply on questions in the questionnaire.

These limitations should be considered when interpreting the findings, as they may influence the applicability and generalizability of the study's conclusions. Despite these limitations, the study provides important insights that contribute to a better understanding of food safety practices among street food vendors in urban Nepal.

1.6 Ethical, safety and logistical considerations

The study was conducted in both Kathmandu and Pokhara metropolitan cities and questionnaires were finally designed after a pilot practice in Kathmandu city. Then the required permissions from the study supervisors were granted to perform a full scale of the study. Although there were no food samples, laboratory analysis and respondent's identity were used in the study, the field study received a go-ahead clearance from the Swedish University of Agricultural Sciences (SLU) to conduct the study. The individuals involved in street food vending were approached and all participants were informed about the purpose of the study and consent was taken before the study conversation started. The participants were allowed of their right to withdraw from the study at any time, if they wish to do so. Data collection was carried out by means of a face-to-face interview which lasted approximately 45 minutes to 60 minutes per session.

2. Method

The study began by revisiting the objectives of the thesis that must be addressed through the fieldwork and by developing a working procedure comprising several steps necessary to complete the task. The specific objectives were:

- Assess how street food vendors perceive the role of food safety knowledge
- Assess the vendors level of understanding in food safety and hygiene
- Examine the level of vendors' compliance with the sanitary requirements

Assess food safety and hygiene practices from a public health perspective The first objective concerns the level of knowledge among food vendors, while the second objective addresses how vendors practice food safety. The third objective focuses on the rules and regulations that vendors need to understand or follow to meet sanitary requirements. The final objective is to evaluate these practices by vendors from a public health perspective. The working procedure involved conducting a literature review of food vendors' practices in developing (third world) countries to determine if the planned research was suitable and whether a pilot study was necessary before conducting a full-scale survey. This included reading published journal articles and reports and discussing the topic with relevant expert contacts in Nepal. The information obtained from the literature review for the proposal writing served as part of the study's background. The discussion with experts also served as a baseline for designing or formatting the questionnaire.

2.1 Study area

Nepal (Figure 1), a small landlocked country in South Asia, is characterized by its unique and diverse geography, ranging from the lowest altitude of 57 meters in the southern plains above sea level to the towering Himalayas in the north.

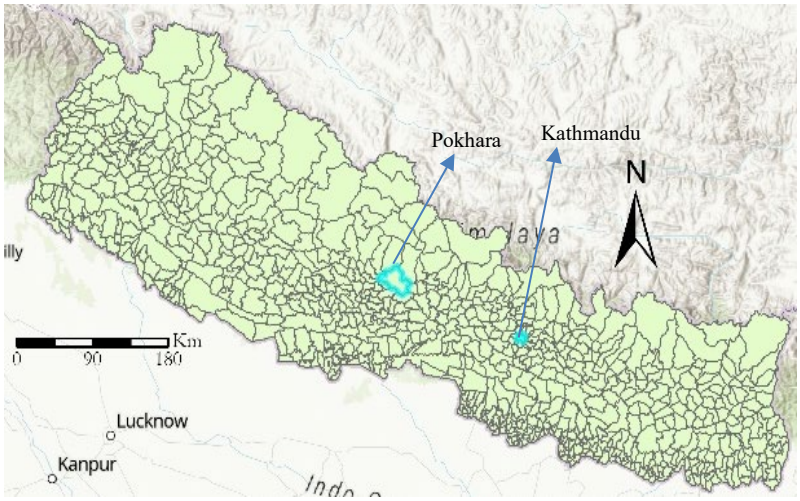


Figure 1 Geographical location of Nepal in the world map indicating study areas Kathmandu and Pokhara.

Nepal is home to a rich cultural heritage, shaped by its geographic and ethnic diversity, and a rapidly urbanizing population, particularly in cities like Kathmandu and Pokhara, where street food is an integral part of daily life. While growing urbanization has increased the popularity of street food, it has also introduced challenges in regulatory compliance and enforcement of sanitary regulations, raising significant concerns about food hygiene and public health. These factors make Nepal an ideal setting for studying food safety practices among street vendors.

Kathmandu (Figure 1) is the capital of Nepal and centre of country's most populated urban region. Geographically, Kathmandu is a bowl-shaped valley with three main cities (Kathmandu, Lalitpur and Bhaktapur) of oldest human settlements in the central Himalayas (Thapa, Murayama and Ale 2008). The city comprises vastly the metropolitan area, which interconnects and share minor socio-cultural differences. Positioned at geographic coordinates of 27°38′ north latitudes and 85°16′ east longitudes, Kathmandu is situated on a higher plateau at an altitude of 1350 meters above sea level. This elevation results in a sub-tropical to temperate climate, making the city attractive to a large population seeking to migrate for economic reasons.

Pokhara (Figure 1) is the second-largest city in Nepal, situated in the central mountain range of the country. It is recognized as a tourist destination due to its geographical features and proximity to the beautiful Annapurna Himalayan range. The city is located at an altitude of 825 meters above sea level and is surrounded by lakes such as Phewa, Begnas, and Rupa. Its geographical coordinates are 28° 16' 01" N and 83° 58' 60" E, and due to its location, a typical subtropical climate prevails in the city. Pokhara is one of the rainiest cities in Nepal, receiving about 5000 mm of precipitation annually.

In addition to its natural beauty, Pokhara is popular for its vibrant street food culture. The city is surrounded by hilly mountains, offering unique culinary practices with a variety of flavours that reflect the region's rich cultural diversity. Popular street foods include mo:mos (steamed dumplings), thukpa (noodle soup), spicy chatpate (a tangy puffed rice snack), and sel roti (a sweet, deep-fried rice bread), which highlights local traditions (figure 2).

Figure 2 Selected food items on sale in the street. Picture 1: Aaluko tarkari (Potato soup), Picture 2: Mo:Mo, Picture 3: Chowmin and Picture 4: Sweets.

2.2 Survey methods

In this study, a qualitative questionnaire survey is used, combined with direct observation, to obtain a deeper understanding of the answers and the current situation of street vendors. First, a desk study was performed to understand the relevance of published articles and research methods and to design suitable questionnaires. A checklist was prepared for observation. The questionnaire was developed based on field consultation and a pilot study conducted in the study area. The details of all methods are described below.

2.2.1 Desk review

The data collection and analysis methods directly address the specific objectives in this study. Initially, a comprehensive desk review was conducted to identify published data, including peer-reviewed literature, regulatory documents, unpublished data, national and regional surveys, and reports regarding food safety and hygiene practices in the study area. Data pertaining to food safety, hygiene, regulation, inspection, contamination, foodborne disease outbreaks, and food quality were systematically searched and collected. The gathered data were used as reference in the study.

2.2.2 Research design and sampling

A cross-sectional survey design and quantitative research approach was employed to collect primary data, involving two major components: direct

observations and interviews (Bethlehem 1999). The study was conducted in both Kathmandu and Pokhara metropolitan cities, where observations and interviews with street food vendors were also taken place. The statistical population under study was determined through a detailed desk review. A stratified sampling technique was applied in core part of both cities, dividing them into four different strata based on where street food vending occurs. After stratification, street food vending sites were randomly sampled in each stratum, utilizing the list of street food vendor sites. At each street food vending site, two different types of data were collected: direct observation and questionnaire survey.

2.2.3 Data collection: direct observation

The data collection instrument for direct observation is a checklist, carefully designed for this study after literature study in a desk review. A universal checklist was prepared for food vending sites. The status of food safety, hygiene, and sanitation practices at vending sites were also collected. The checklist was designed to collect data on sanitary compliance of streets, location of vending sites, and vending equipment. This checklist will also encompass information about food sources and acquisition procedures, cleanliness of cooking pots, waste management, and the transportation of materials from vendors' residences to the streets. The checklist is in Appendix 1.

2.2.4 Data collection: questionnaire survey

The cross-sectional survey carried out during the study focuses on the current vending practices and describes what people think about the issues and how they practice under the current conditions. Hence, using a questionnaire and observation techniques, data were collected from a group of street vending sites at one specific time, which was May–June 2024.

The data collection instrument was a questionnaire for the study. Questionnaire was developed based on recommended documents in the WHO guidelines for developing and implementing food safety policy and strategy (WHO 2022). The questionnaire was adapted to contain the specific information to the study area such as socio-demographics information of respondents, characteristics of the street food vending facilities, the food hygiene knowledge of street food vendors, personal hygiene, knowledge, microbial food safety awareness, knowledge of food borne bacteria and knowledge of cooking and holding temperature of foods.

Further, the questions about the monitoring and enforcement of food hygiene regulations and compliance of street food vending sites to sanitary requirements were also included. In addition, the provisions of inspection, trainings to the vendors, experiences, equipment and challenges were included in the question lists. When the questionnaire was ready and

consulted with experts, main supervisor and co-supervisor, it was tested with a pilot study (n=10) for reliability check and to establish questionnaire and checklists. Received feedback during pilot study were implemented in the questionnaire before commencing the data collection. The detail questionnaire used in the field survey is included in Appendix 2.

It was sought to get required permissions from the Kathmandu and Pokhara municipal authorities. Both municipality authorities provided informal clearance however did not need to get the official permissions to conduct the study. It was understood that such study is a normal practice in the municipalities. The formal clearance from the main supervisor and co-supervisor was received before the researcher visited the street food vending facilities. The individuals involved in street food vending were approached and all participants were informed about the purpose of the study and requested for oral consent to start the questionnaire survey. The participants were allowed of their right to withdraw from the study, at any time, if they wish to do so. In fact, total 3 participants withdraw from the interview. Data collection was carried out by means of a face-to-face interview which lasted approximately 40-50 minutes.

2.2.5 Data analysis

The total number of surveys was conducted with 80 participants (n=80), 40 from Kathmandu and 40 from Pokhara. All the data collected were recorded in the paper and later transferred to the Statistical Package for Social Sciences (SPSS) (version 25.0) for the analysis. Simple data analysis techniques such as population characteristics, cross tabulation, and population perception on various questions were used, while Chi-square test is used to test if there are differences in respondent's opinion on questions. These analyses will explain the data, display relationships among variables, and evaluate food safety knowledge and sanitary compliance based on responses collected during the observation and survey.

The perceptions of respondents were measured on a Likert scale from one to five, ranging from strongly agree to strongly disagree. Since the study was conducted in two different cities, the results on the demographic features of the vendors in these cities are also compared.

3. Results

The results from the questionnaire survey and observations at the vending sites are presented in this section. Firstly, the questions focused on general information about respondents, their education, socio-economic conditions, and the reasons they are engaged in street food vending businesses. Secondly, the questions aimed to gather information on respondents' views regarding sanitation, hygiene, and food safety practices. The study then explored the vendors' perceptions of sanitation, food, and hygiene knowledge, their compliance with public health safety standards, and the procedures they follow in their businesses. At the end of the study, they were asked questions about various types of bacteria, pathogens, and how they apply their knowledge and skills to prevent food contamination, as well as their adherence to different sanitary regulations. All relevant data are analysed and presented in different subsections.

3.1 Descriptive profile of respondents

The descriptive profile of respondents in this section summarises the key characteristics of such as demographic, educational and socioeconomic data of the respondents.

A general overview of the demography in terms of age and education level of the respondents was analysed using descriptive statistics and the Chart Builder in SPSS. The total number of respondents (n=80) is represented in the figure below (Figure 3).

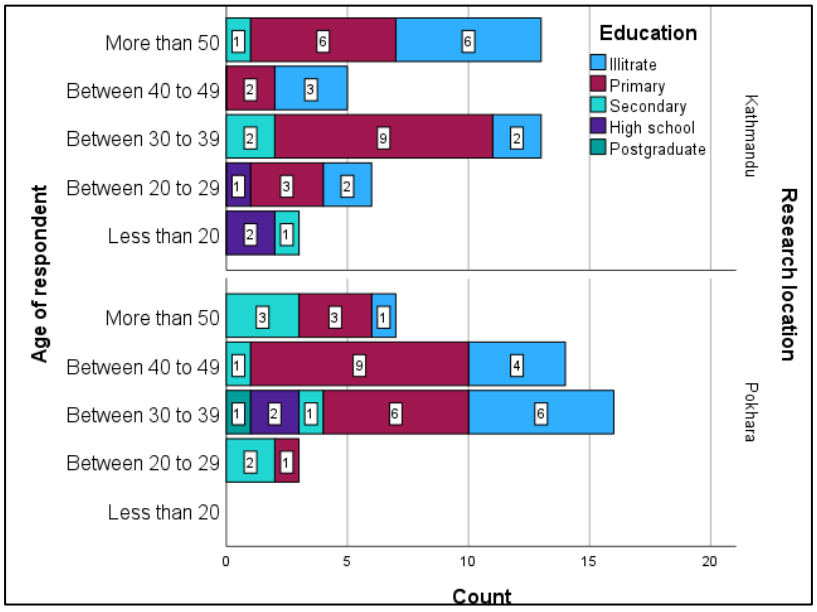


Figure 3 Age and education of the respondents in two study sites (Kathmandu and Pokhara).

The plotted data shows that 39 (49%) respondents had only primary-level education, while another 24 (30%) were illiterate. This may illustrate the overall understanding of hygiene and sanitation compliance among the vendors. The number of illiterate respondents was slightly higher in Kathmandu, while primary-educated respondents were similar in number in both sites. Evidence shows that some respondents were highly educated in both locations. Interestingly, Pokhara had no respondents below 20 years of age, while Kathmandu had three people in that age group. Additionally, Kathmandu had about twice the number of respondents over 50 years of age compared to Pokhara. The majority of the respondents were between the ages of 30 and 49 years.

One of the interesting parts of the study is to look deeper into the demographic characteristics of street vendors. Sometimes gender, marital status, and ethnic origin of respondents can influence their food preparation habits and techniques. To understand such characteristics of respondents, this study examined how the gender and marital status of respondents were distributed (Table 1).

Table 1 Gender and marital status of the respondents in two study sites

Description of respondents		Research location		Total
		Kathmandu	Pokhara	
Gender	Male	15	18	33
	Female	24	22	46
	Others	1	0	1
Marital status	Married	33	36	69
	Single	6	3	9
	Widow	1	1	2

Result showed that the majority of the respondents were female, 24 in Kathmandu and 22 in Pokhara (total n=80), which is about 58% of the total respondents. About marital status, majority were married, 33 in Kathmandu and 36 in Pokhara (total n=80) which corresponds to 86% of the total respondents.

Vendor experience is an important factor in maintaining business quality, particularly from the perspectives of food safety, hygiene, and sanitation. To assess the level of experience among street vendors, a question was designed to collect data on the number of years respondents had been operating their vending. The results are presented below in Table 2.

Table 2 Street vending experience (in years)

Research location	Experience of operation			Total
	<1	1 to 2	>2	
Kathmandu	14	13	13	40
Pokhara	7	13	20	40
Total	21	26	33	80

Most vendors in both cities had more than two years of experience. However, a significant number of vendors began their entrepreneurial activities this year. Another question asked, how many dependent family members the respondents had at home. The results showed that 52 respondents had 4 to 5 family members dependent on their vending business. However, there were two respondents from Kathmandu who had 7 and 8 family members depending on their vending business.

3.2 Skill development, time investment and income

The income from small businesses, such as street vending, depends on the skills and knowledge the entrepreneur has invested in and how much time they dedicate to operate the business. The general understanding is that working for a long time will provide enough income to sustain their families.

In the questionnaire survey, respondents were asked whether they have taken any formal training or participated in any knowledge development programs, and how many months per year they are active with their business. These questions were further cross analysed to determine if they have an effect on their income level. When it comes to training or any kind of development program, 87% of respondents reported that they have not received any training related to food preparation or vending businesses. Instead, 88% of respondents indicated that they are self-taught in entrepreneurship. At the same time, out of 80 respondents, 71 run their business year-round.

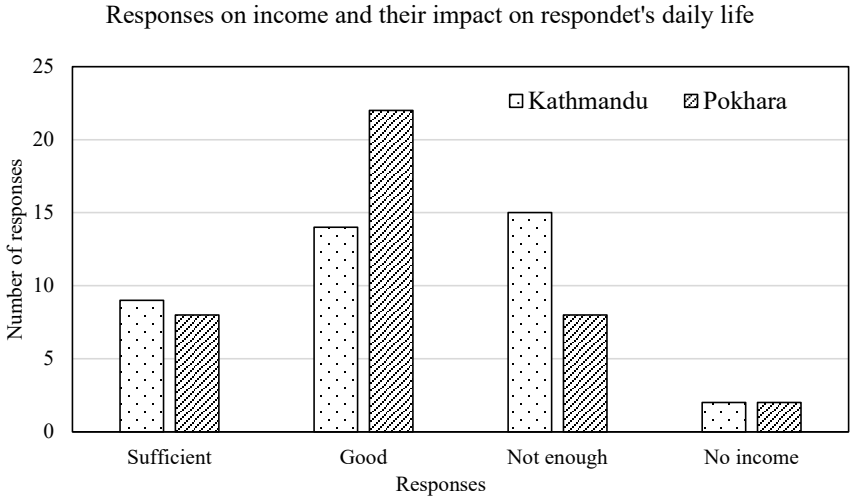


Figure 4 Responses on income levels from the street vendor's practice.

The responses regarding income levels and satisfaction were analysed, and the results show that 22% of the respondents in Pokhara reported their income as sufficient, and 35% as good. If we consider both 'sufficient and good' and positive response of the respondents, total 57% should be satisfied with their income. While in Kathmandu, 20% vendors indicated that their

income was sufficient (Figure 4) and 55% responded as ‘good’. This means total 75% vendors were satisfied with their income. Another question regarding income asked whether respondents had alternative sources of income in their daily activities, and 78% replied that they did have alternative income. This suggests that street vendors in the study areas often need to work additional hours or be engage in other activities to sustain their livelihoods.

3.3 Vendors response on sanitation, hygiene and food safety

There was a concern about whether street vendors' daily practices and activities follow the norms on hygiene and food safety. Hence, the questionnaire included simple questions that represent daily practices to understand how vendors manage hygiene and food safety.

Questions had four different answer options to represent the time or frequency. The representative answers were ‘every time,’ ‘continuously,’ ‘occasionally,’ and ‘never’ to scale the responses into a representative time period, explaining how often these norms or practices are followed by the vendors (Table 3).

Table 3 Vendor’s response on sanitation, hygiene and food safety practices
(ET= Every time, C= Continuously, OC= Occasionally, and N= Never)

Practices	**ET**	**C**	**OC**	**N**
Do you wash your hands regularly with soap and water?	26	46	8	-
Do you and your employees wear clean clothes and, if necessary, use gloves and caps?	14	41	24	1
Have you and your employees follow hygiene requirements as given in the trainings?	3	5	18	54
Do you use separate cutting boards and utensils for raw and cooked foods to prevent cross-contamination?	8	47	18	7
Do you clean and sanitize utensils and equipment?	20	58	2	-
Do you keep food preparation surfaces clean and sanitized regularly?	16	54	8	2
Would you mix containers that load raw food and those that load cooked food?	2	6	8	64
Do you use a food thermometer to check the internal temperature of cooked foods?	-	-	1	79
Do you have access to the clean water and proper sanitation facilities at home?	19	46	14	1
Do you and your employees have proper training regarding food safety and hygiene practices?	-	3	4	73
Do you take a health examination every year?	4	7	12	57

Questions had four different answer options to represent the time or frequency. The representative answers were ‘every time,’ ‘continuously,’ ‘occasionally,’ and ‘never’ to scale the responses into a representative time period, explaining how often these norms or practices are followed by the vendors (Table 3).

The results (Table 3) show the frequency of individual replies (total n=80) tabulated for ‘every time,’ ‘continuously,’ ‘occasionally,’ and ‘never.’ The response ‘every time’ indicates that the practices are followed consistently, ‘continuously’ suggests that the practices are regulated, ‘occasionally’ means they are not regularly followed, and ‘never’ indicates that they are not followed at all.

Respondents' replies showed that some routines were carefully followed, such as washing hands and sanitizing (every time n=26, continuously n=46); wearing clean clothes, gloves, and caps (every time n=14, continuously n=41); sanitizing utensils and equipment (every time n=20, continuously n=58); and using clean water and maintaining proper sanitation at home (every time n=19, continuously n=46). These responses represent more than 50% of the total replies, indicating that vendors are aware of cleaning norms, and the majority follow cleaning and food safety standards.

It was surprisingly strange that some replies fell under the categories ‘occasionally’ and ‘never,’ indicating that some practitioners do not follow regulatory practices in their daily business. It was unexpected to learn that the practitioners had not attended any hygiene or sanitary training sessions prior to or during their practice (Table 3). In addition, health examinations of practitioners also play an important role in maintaining clean vending practices. However, almost no one had undergone a health examination related to their practice (Table 3, n=57).

3.4 Vendor’s knowledge on sanitation, hygiene and food safety

The questionnaire survey focused to know the knowledge level of respondents on sanitation, hygiene and food safety. The responses were collected using a 5-point Likert scale (SA = Strongly Agree, A = Agree, IDK = I Do Not Know, D = Disagree, SD = Strongly Disagree). The findings show that respondents are aware about the practices. The frequency of answers shows that 91% of respondents (n=73 out of n=80) agreed or strongly agreed upon the statement keeping utensils and equipment in good condition is important for sanitation. While only 9% (n=7) disagreed or strongly disagreed (Table 4). This suggests that respondents have a high level of awareness about the importance of maintaining utensils and equipment for sanitation. This reflects strong fundamental knowledge in this aspect. Similarly, respondents seem aware about detergent use in washing utensils

and equipment (n=78). The awareness is there for microbes and cooking benefits regarding microbes in the food, and even for waste disposal (Table 4). Most of the responses are strongly agree and agree.

Table 4 Respondent's knowledge on sanitation and hygiene

(SA= Strongly agree, A= Agree, IDK= I do not know, D= disagreed, SD= Strongly disagree)

Utensils and equipment:	**SA**	**A**	**IDK**	**D**	**SD**
Keeping utensils and equipment in good condition is important for sanitation	24	49	4	2	1
Utensils and equipment can be used just after being washed	2	3	3	47	25
Washing utensils, equipment with detergent leaves them free of contamination	46	32	2	0	0
Personal hygiene:					
Microbes are in the skin, nose, and mouth	12	42	25	1	0
Using gloves while handling food reduces the risk of food contamination	3	14	62	1	0
Using a mask while handling food reduces the risk of food contamination	0	23	56	1	0
Proper cooking and temperature control:					
Well-cooked foods are free of contamination	20	56	4	0	0
Storing cooked food in room temperature does not contaminate	2	19	45	14	0
Mixing cooked food with raw leads to cross-contamination	5	37	31	7	0
Mixing vegetables with meat leads to cross-contamination	4	50	26	0	0
Packaging and serving					
It is important to change the gloves and sanitize hands after completing a packing	4	28	48	0	0
If the utensils are used for serving, it is very important to wash properly and sanitize before reusing it	31	42	7	0	0
Waste disposal:					
It is important to have proper waste disposal system in place to keep the area clean and avoid contamination	7	72	1	0	0

A one-sample *Chi-Square* test was conducted to determine whether respondents had an equal understanding of sanitation practices for utensils and equipment or to explain whether the distribution of responses differed

significantly from an equal distribution. The results (Table 5) showed significant differences in respondents' opinions across all hypotheses regarding the use of utensils and equipment (Table 4, Utensils and equipment). This indicates that the responses were not equally distributed, reflecting variability or consensus in their knowledge and practices regarding sanitation, hygiene, and equipment maintenance.

Table 5 One-sample Chi-square test results for survey responses (n=80)

Hypothesis	Test statistics	Degree of freedom	Critical value $\alpha = 0.05$	P-value Sig. (2-sided test)
Keeping utensil is important for sanitation	107.37	4	9.49	<0.001
Utensils used just after being washed	98.50	4	9.49	<0.001
Detergent leaves free of contamination	37.9	2	5.99	<0.001

The results were statistically significant, with Chi-square (χ^2) values of $(n=80, df=4) = 107.38$, $p < 0.001$ for the responses on *'Keeping utensils is important for sanitation'* and $\chi^2(n=80, df=4) = 98.50$ for the responses on *'Utensils used just after being washed'*. The critical Chi-square value at $\alpha = 0.05$ and $df = 4$ was 9.49 for both cases. Similarly, the results were significant, with $\chi^2(n=80, df=2) = 37.9$, $p < 0.001$, where the critical Chi-square value at $\alpha = 0.05$ and $df = 2$ was 5.99 for the response on *'Detergent leaves utensils free of contamination'*. This confirms that the observed frequencies significantly deviate from the expected values. Thus, the significant Chi-square result ($p < 0.001$) suggests that there are differences in respondents' opinions, and the distribution of responses is not uniform, indicating variability in respondents' knowledge regarding the hypothesis.

3.5 Vendor's 'perception' on sanitation, hygiene and safety of public health

A general understanding is that vendors should be aware of public health and ensure that their practices do not compromise public hygiene and safety while conducting their vending business. The questions were designed to

assess vendors' perceptions of public health and their commitment to safety through sanitation practices. The results are presented in Figure 5.

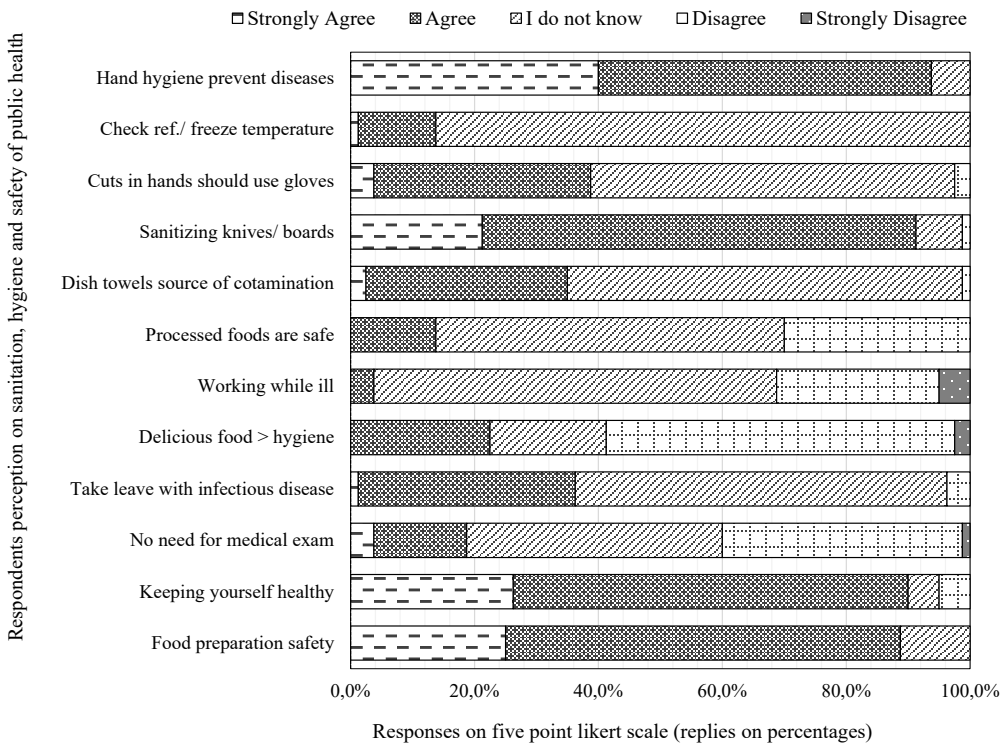


Figure 5 Perception' on sanitation, hygiene and safety of public health

The table shows that respondents recognize the importance of proper food preparation (89% strongly agree and agree) and acknowledge the need to maintain their health for the benefit of public health. There is a high level of agreement that sanitizing knives and cutting boards prevents cross-contamination (91% strongly agree and agree) (Figure 5).

However, respondents are uncertain about the necessity of medical check-ups related to public health, with 41% indicating "I do not know," suggesting a lack of awareness among vendors. Additionally, 61% of respondents replied "I do not know" for the question 'whether they need to take leave from work due to skin diseases', highlighting a significant knowledge gap regarding workplace health awareness and protocols. Furthermore, it was found that respondents are largely unaware of the importance of monitoring refrigerator temperatures, with 86% indicating "I do not know," which could impact public health.

Overall, the results show that respondents have a good understanding of fundamental food safety practices, such as hand hygiene and sanitization. However, results show knowledge gaps in the areas such as medical examinations, illness protocols, and temperature control, suggesting a need for targeted training and awareness programs among food handlers.

3.6 Respondent's compliance with sanitary requirements

Street vendors are one part of the urban society so they should comply with rules and regulations to ensure public health and safety. Non-compliance can lead to health issues in the society such as foodborne illnesses, parasite contamination, that can lead to legal consequences, which can affect both consumers and vendors. Compliance with hygiene and safety standards protects consumers, improves the quality of food, and promotes public trust.

Therefore, this study aimed to assess vendors' awareness and opinions on their sanitary compliance to understand real-world practices and identify gaps in knowledge or behaviour. The questions addressed whether respondents were updated with new sanitary rules and regulations, aware of sanitary requirements, what measures they took during their business, and what legal consequences they might face for non-compliance. Respondents were also asked if they had received any warnings in the past and whether they would support regular inspections of their facilities.

The data (Figure 6) shows a significant gap in respondents' compliance with sanitary requirements. Only 9% of respondents stay updated with food-related regulations, and just 17% are aware of sanitary requirements set by government authorities. Only 11% have taken measures to ensure compliance. These findings indicate that respondents lack awareness and action regarding legal obligations related to food safety. About 30% of respondents are aware of the legal consequences of non-compliance, 43% are not, and 6% are unsure, suggesting a limited understanding of potential penalties. Additionally, 4% of respondents reported receiving warnings or penalties for non-compliance (Figure 6).

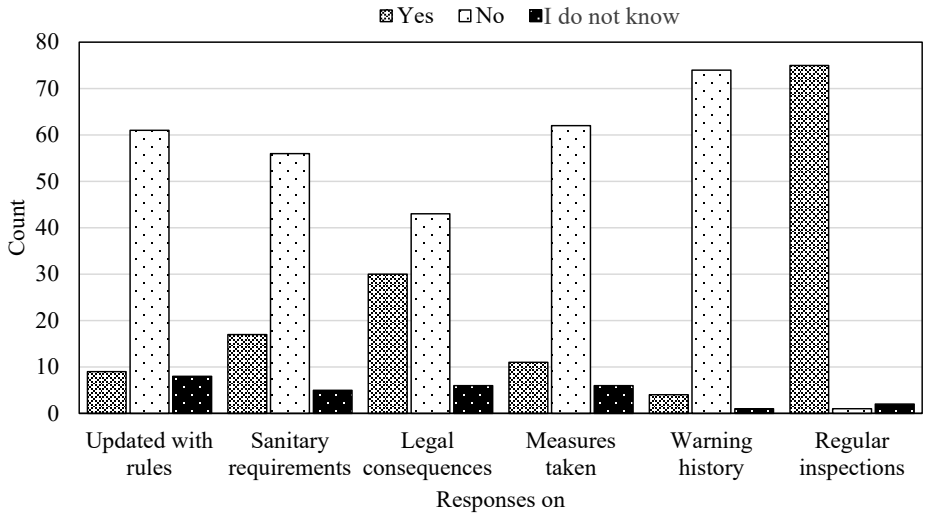


Figure 6 Respondent's compliance with sanitary requirements

However, 74% acknowledge the impact of food safety practices on public health, and 75% believe health authorities should conduct regular inspections. This shows a positive attitude towards public health but insufficient knowledge of regulatory requirements. This highlights a critical need for awareness, education, and regular inspections to reduce knowledge gaps and ensure compliance with food safety regulations among street vendors.

3.7 Other

The questionnaire included additional questions about pathogens and issues that were not covered in previous analyses. Key areas explored include vendors' understanding of pathogens such as *E. coli*, the frequency of hygiene practices, access to resources like clean water, and the economic impact of maintaining safety standards. Further, the study evaluated the vendors' confidence in their food safety practices, their satisfaction with current sanitary conditions, and their willingness to engage in further training to improve food safety measures. By addressing these issues, this analysis seeks to identify the strategies to enhance food safety among street food vendors and protect public health.

This part of the survey highlights critical insights into the food safety practices among street food vendors. It should be a very common that the vendors have awareness of pathogens such as *E. coli*. The results showed that only 4% of respondents were aware out the pathogen, which means there is a strong need of awareness in the area of food safety knowledge in the street vendor in Kathmandu and Pokhara (Figure 7).

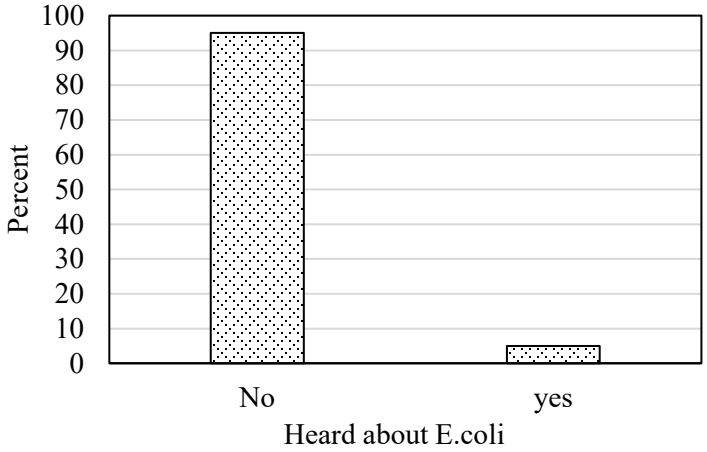


Figure 7 Respondent's awareness of pathogens

However, 72% respondents recognised that the importance of food safety knowledge is very important. Hygiene practices such as handwashing and cleaning utensils are commonly agreed replies where yet 70% of vendors

report never receiving training on food safety. Limited access to clean water and waste disposal impacts operations, with only 38% having full access. Encouragingly, 80% expressed interest in additional training, underlining a significant opportunity to enhance food safety practices through education and resources. The results reveal a highly positive attitude toward food safety knowledge among street food vendors or preparers, with 90% recognizing its importance. While a small minority views it as less important, this can be addressed with targeted education and practical interventions.

3.8 Observation checklist interpretation

The observations from the survey of street food vending sites revealed that respondents have mixed practices regarding compliance with sanitation and hygiene practices. While many vendors try to put their efforts to maintain cleanliness and food safety, these efforts were often constrained by inadequate facilities, supports from administration, available infrastructure and local surrounding challenges. Many vending sites were located near potential sources of contamination, such as dusts around due to running vehicles, some uncleaned areas with simple garbage (that the vendors may have produced), and often lacked proper waste disposal facilities. Streets near vending areas were not consistently free of litter, and adequate waste bins were not available, highlighting significant gaps in environmental sanitation and waste management support.

In terms of vending equipment and personal practices, vendors showed their utmost attempt to manage food safety using available resources. Food preparation surfaces and utensils were generally kept clean, and cooking pots were washed after use. Cleaning materials like soap and scrubbers were present, reflecting a basic level of hygiene awareness. However, critical elements like proper storage containers for raw and cooked food, such as refrigerators and separate tools for handling such items were inconsistently used. Vendors also faced challenges in maintaining personal hygiene, such as handwashing and using aprons. This inconsistency may be because of lack of proper training or resources. Despite these inconsistencies the use of clean utensils was observed, indicating an awareness of fundamental hygiene practices.

Waste management practices at vending sites were a significant area of concern. In many cases, waste collecting bins were not usually available, leading to the challenge to collect the garbage at the end of the day which may potentially increase the risk of scattered garbage around vending areas. Additionally, there was limited evidence of recycling or systematic separation of waste materials. Vendors did their best within these constraints, often attempting to manage waste manually, but the lack of regular garbage disposal services further intensified the issue. These observations emphasize the need for improved waste management infrastructure, targeted training

programs, and the provision of basic resources to empower vendors to uphold food safety and hygiene standards more effectively. The findings highlight both the resilience of street food vendors and the pressing need for systemic interventions to address gaps in sanitation and waste management.

4. Discussion and conclusion

During this study, it is well understood that there is dynamic interplay between urbanization, street food vending, and public health concerns in Nepal's rapidly growing urban centres, Kathmandu and Pokhara. Street food vendors are integral to the urban food ecosystem, serving as an affordable and accessible source of foods for diverse populations, from local workers to international tourists. However, the current nature of street vending shows that it is inconsistent to the food safety standards compliances.

The descriptive profile of respondents provides valuable insights into the demographic, educational, and socioeconomic characteristics of street vendors in Kathmandu and Pokhara. The data reveals that a significant proportion of respondents have low educational background, with 49% possessing only primary-level education and 30% being illiterate. This highlights potential challenges in understanding and implementing hygiene and sanitation practices. Despite some minor differences between the cities, the majority of respondents were middle-aged (30–49 years), a demographic group of publics that is well-positioned to benefit from targeted interventions, if it would come as a solution in any form in the future. Moreover, the gender and marital status distribution showed that these personal factors might influence food preparation habits. The large number of vendors with over two years of experience indicates a degree of stability in this occupation, which could serve as a foundation for skill enhancement and behavioural change initiatives.

When examining skill development, time investment, and income, the findings highlight the significance of training and consistent work in enhancing income stability. The majority of respondents (87%) reported a lack of formal training, suggesting a reliance on self-taught entrepreneurship. This deficiency in formal knowledge correlates with the varied levels of hygiene practices observed. While 71 of the respondents operate their businesses year-round, their income levels differ significantly between Kathmandu and Pokhara. Vendors in Pokhara are more likely to perceive their income as sufficient, whereas many in Kathmandu report financial struggles. These findings point to systematic differences and highlight the necessity of addressing educational gaps and offering structured training programs that can boost income and ensure compliance with safety standards.

The findings on sanitation, hygiene, and food safety reveal both strengths and gaps in current practices among street vendors. While many respondents reported regular handwashing, utensil sanitization, and proper cleaning of food preparation surfaces, there are notable gaps in critical areas, such as the use of food thermometers, access to clean water, and conducting health

examinations. The lack of training (noted by 73 out of 80 respondents) and awareness about regulatory compliance represents a significant barrier to achieving uniform standards of hygiene and safety. Furthermore, the study highlights a concerning lack of knowledge about pathogens like *E. coli*, with only 4% of respondents demonstrating awareness. This is in line with the study performed by Khanal et al. (2023). Despite these gaps, there is a strong willingness among vendors (80%) to participate in further training, presenting an opportunity to bridge knowledge deficits. Addressing these challenges with targeted interventions, such as workshops and access to resources, will be crucial in enhancing food safety practices and protecting public health.

Observational data from this study shows that the resilience and limitations of vendors in managing food safety amidst constrained resources and inadequate infrastructure. For instance, while vendors strive to maintain basic hygiene, structural challenges, such as a lack of waste management facilities and inadequate access to clean water, significantly hinder compliance with sanitation requirements. These findings align with Adhikari and Phil (2017) and Bhattarai and Pathak (2020), who emphasize the public health risks posed by inadequate food safety measures in urban street vending.

This study also highlights the broader socio-economic and cultural factors influencing food safety practices among street vendors. The occurrence of street vending in Kathmandu and Pokhara is rooted in urban migration, economic necessity, and the convenience it provides to urban populations (WHO 1999, Timalsina 2007, WHO 2023). Vendors' limited education and lack of formal training in food hygiene further increases the challenges of maintaining safe practices, as highlighted by Gautam (2015). Despite these constraints, many vendors demonstrate a proactive attitude, attempting to mitigate risks within their knowledge and resource limitations. The inconsistency in hygiene practices observed in this study as similar findings in other contexts (Bhandari et al. 2022), where systemic gaps in training, policy enforcement, and resource allocation combine further to risk in the public health.

To address these issues, this thesis compares its findings within the broader framework of sustainable urban development and public health goals. Effective interventions, such as targeted hygiene training, infrastructural improvements, and clearer municipal policies, are critical to improving food safety standards. As Bhattarai and Pathak (2020) and Saud et al. (2023) suggest, a multi-stakeholder approach involving municipal authorities, public health organizations, and the vendors themselves is essential. By increasing collaboration and providing the necessary resources and education, cities like Kathmandu and Pokhara can simultaneously

enhance food safety, safeguard public health, and support the livelihoods of street vendors.

The findings of this study highlight the critical role of street food vendors in achieving Sustainable Development Goals (SDGs), particularly SDG 3 (Good Health and Well-being) and SDG 11 (Sustainable Cities and Communities). The challenges of urbanization with limited educational backgrounds, and resource constraints among street vendors highlight the need for targeted interventions to promote food hygiene and sanitation practices. Enhancing the knowledge and practices of vendors through structured training programs can lead to safer food preparation methods, directly reducing public health risks and ensuring healthier urban populations. Furthermore, addressing infrastructural gaps such as waste disposal systems and access to clean water is essential to empower vendors to comply with hygiene regulations, promoting a safer urban food ecosystem that aligns with SDG targets for sustainable urban environments and equitable access to resources.

A multi-stakeholder approach is pivotal for creating sustainable and inclusive solutions to these challenges. Collaborating with municipal authorities, public health organizations, and community groups can facilitate the implementation of policies that support street vendors while safeguarding public health. For instance, providing training workshops, regular inspections, and financial support for sanitation infrastructure can build vendors' capacity to meet safety standards while sustaining their livelihoods. This aligns with SDG 8 (Decent Work and Economic Growth), as improving food safety and hygiene practices can enhance vendors' business stability and income. Ultimately, integrating food safety initiatives into broader urban development plans will not only improve public health outcomes but also support the socio-economic well-being of vulnerable populations, contributing to a more sustainable and inclusive urban future.

References

Adaku, A. A., Egyir, I. S., Gadegbeku, C., Kunadu, A. P. H., Amanor-Boadu, V., & Laar, A. (2024). Barriers to Ensuring and Sustaining Street Food Safety in a Developing Economy. *Heliyon* 10(11): e32190. https://doi.org/10.1016/j.heliyon.2024.e32190

Adhikari, D. B. (2017). Informal Street food trade: A source of income generation in urban Nepal. *Economic Journal of Development Issues*, 1-17. https://doi.org/10.3126/ejdi.v23i1-2.19062

Alimi, B. A. (2016). Risk factors in street food practices in developing countries: A review. *Food science and human wellness*, *5*(3), 141-148. https://doi.org/10.1016/j.fshw.2016.05.001

Bethlehem, J. (1999). Cross-Sectional Research. In Research Methodology in the Social, Behavioural and Life Sciences. Adèr, H. J. & Mellenbergh, G. J. (editor) London, England: Sage. ISBN 0-7619-5883-5.

Bhandari, R., Singh, A. K., Bhatt, P. R., Timalsina, A., Bhandari, R., Thapa, P., & Adhikari, N. (2022). Factors associated with meat hygiene-practices among meat-handlers in Metropolitan City of Kathmandu, Nepal. *PLOS Global Public Health*, *2*(11), e0001181. https://doi.org/10.1371/journal.pgph.0001181

Bhattarai, K., & Pathak, B. (2020). Street vending, income generation and poverty implication: The case of the Kathmandu Valley, Nepal. *Quest Journal of Management and Social Sciences*, *2*(2), 194-205. https://doi.org/10.3126/qjmss.v2i2.33269

FAO, U. (2019). The state of food and agriculture: Moving forward on food loss and waste reduction, FAO, Global Rome, Italy.

Gallo, M., Ferrara, L., Calogero, A., Montesano, D., & Naviglio, D. (2020). Relationships between food and diseases: What to know to ensure food safety. *Food Research International*, *137*, 109414. https://doi.org/10.1016/j.foodres.2020.109414

Gautam, O. (2015). *Food hygiene intervention to improve food hygiene behaviours, and reduce food contamination in Nepal: an exploratory trial* (Doctoral dissertation, London School of Hygiene & Tropical Medicine). https://doi.org/10.17037/PUBS.02531624

Gizaw, Z. (2019). Public health risks related to food safety issues in the food market: a systematic literature review. *Environmental health and preventive medicine*, *24*, 1-21. https://doi.org/10.1186/s12199-019-0825-5

Grace, D. (2015). Food safety in low and middle income countries. *International journal of environmental research and public health*, *12*(9), 10490-10507. https://doi.org/10.3390/ijerph120910490

Hazards, E. P. o. B. (2011). Scientific Opinion on the public health risks of bacterial strains producing extended-spectrum β-lactamases and/or AmpC β-lactamases in food and food-producing animals. *EFSA Journal*, *9*(8), 2322. https://doi.org/10.2903/j.efsa.2011.2322

Henson, S., & Jaffee, S. (2006). Food safety standards and trade: Enhancing competitiveness and avoiding exclusion of developing countries. *The European Journal of Development Research*, *18*, 593-621. https://doi.org/10.1080/09578810601070753

Kamboj, S., Gupta, N., Bandral, J. D., Gandotra, G., & Anjum, N. (2020). Food safety and hygiene: A review. *International journal of chemical studies*, *8*(2), 358-368. https://doi.org/10.22271/chemi.2020.v8.i2f.8794

Khanal, A. R., Timilsina, R. H., Sharma, B., Pokharel, B., & Aryal, R. (2024). Contaminated Water and an Indication of Risk: Examining Microbial Contamination in the Water Used by Consumers and Commercial Growers in Fresh Produce Systems in Nepal. *Journal of Food Protection*, *87*(3), 100228. https://www.emerald.com/insight/2044-0839.htm

Lamichhane, S. (2017). Livelihood Pattern of Street Food Vendors: A Sociological Study of New Road and Ratna Park Area of Kathmandu, Department of Sociology. Tribhuvan University Central Department of Sociology Kirtipur, Kathmandu, Nepal.

Paudel, U., & Pant, K. P. (2023). Understanding vitality of public space: A review with an example of capital city Kathmandu in Nepal. *Land Use Policy*, *133*, 106860. https://doi.org/10.1016/j.landusepol.2023.106860

Pradhan, B., Sharma, P., & Pradhan, P. K. (2020). Urban growth and environment and health hazards in Kathmandu Valley, Nepal. *Urban health risk and resilience in Asian cities*, 293-324. https://doi.org/10.1007/978-981-15-1205-6_17

Rahman, M., Alam, M. U., Luies, S. K., Kamal, A., Ferdous, S., Lin, A., & Ercumen, A. (2021). Contamination of fresh produce with antibiotic-resistant bacteria and associated risks to human health: A scoping review. *International journal of environmental research and public health*, *19*(1), 360. https://doi.org/10.3390/ijerph19010360

Saud, B., Devkota, P., Paudel, G., Amatya, N., & Shrestha, V. (2023). Is there a need for regular surveillance for bacterial contaminants in street foods of Kathmandu. *Clin Res Stud*, *2*, 2835-82. https://doi.org/10.31579/2835-2882/017

Scallan, E., Hoekstra, R. M., Angulo, F. J., Tauxe, R. V., Widdowson, M. A., Roy, S. L., & Griffin, P. M. (2011). Foodborne illness acquired in the United States—major pathogens. *Emerging infectious diseases*, *17*(1), 7. https://doi.org/10.3201/eid1701.P11101

Thapa, R. B., Murayama, Y., & Ale, S. (2008). Kathmandu. *Cities*, *25*(1), 45-57. https://doi.org/10.1016/j.cities.2007.10.001

Timalsina, K. P. (2007). *Rural urban migration and livelihood in the informal sector: A study of street vendors of Kathmandu Metropolitan City, Nepal* (Master's thesis, Geografisk institutt). NTNU, Norway. http://hdl.handle.net/11250/265207

Timilsina, R. H., Aryal, R., Poudel, S. R., & Khanal, A. R. (2024). Assessment of Food Safety Knowledge Among Fresh Produce Growers and Extension Workers Before and After Training in Nepal. *Agriculture Development Journal*, 1-9. https://doi.org/10.3126/adj.v17i1.67859

Uyttendaele, M., Franz, E., & Schlüter, O. (2016). Food safety, a global challenge. *International Journal of Environmental Research and Public Health*, *13*(1), 67. https://doi.org/10.3390/ijerph13010067

WHO (1999). Food safety. Regional committee for the Eastern and Mediterranean. Forty sixth session Agenda 9 (a), Technical Paper, EMlRC46/6, WHO.

WHO (2011). Tackling antibiotic resistance from a food safety perspective in Europe, World Health Organization. Regional Office for Europe. ISBN 978 92 890 1422 9 (ebook) World Health Organization 2011.

WHO (2022). *WHO global strategy for food safety 2022–2030. Towards stronger food safety systems and global cooperation*. World Health Organization. https://www.who.int/publications/i/item/9789240057685

WHO (2023). General Principles of Food Hygiene. 60p, Rome Italy. https://doi.org/10.4060/cc6125en

Wilson, A. M., Withall, E., Coveney, J., Meyer, S. B., Henderson, J., McCullum, D., ... & Ward, P. R. (2017). A model for (re) building consumer trust in the food system. *Health promotion international*, *32*(6), 988-1000. https://doi.org/10.1093/heapro/daw024

Popular science summary

Food hygiene for public health

Food hygiene is an essential foundation of public health, directly impacting the safety and quality of food consumed worldwide. In urban centres like Kathmandu and Pokhara in Nepal, street food vendors play a vital role in the food supply chain, providing accessible and affordable foods to diverse populations. However, inconsistent commitment to hygiene standards presents significant risks to public health, as contaminated food can lead to severe illness. Addressing these challenges is crucial for achieving global Sustainable Development Goals (SDGs), particularly SDG 3 (Good Health and Well-being) and SDG 11 (Sustainable Cities and Communities).

The study highlights systemic barriers, including low levels of formal education among vendors, with nearly half having only primary education and 30% being illiterate. This limited educational background often hinders the understanding and application of effective hygiene practices. Despite these challenges, there is an encouraging willingness among vendors—80% expressed interest in further training. Targeted interventions, such as workshops on food safety and structured skill development programs, offer a pathway to elevate hygiene standards. Additionally, addressing infrastructural limitations like inadequate water access and waste management systems can empower vendors to meet regulatory requirements. These initiatives not only enhance food safety but also support the livelihoods of vendors and enhance consumer confidence in street food.

To achieve these goals, municipal authorities, public health organizations, and community groups must collaborate to implement effective policies and provide resources for sanitation infrastructure. Training vendors in hazard analysis and critical control points (HACCP) can strengthen their ability to identify and manage risks. By integrating food safety into urban development frameworks, cities can safeguard public health, enhance the sustainability of food ecosystems, and improve the socio-economic well-being of vulnerable urban populations.

Thank you/ Acknowledgments

First and foremost, I would like to express my sincere thanks to my main supervisor, Monika Johansson, for her guidance and support throughout the course of this thesis. Her timely advice and acceptance have been instrumental in ensuring the success of this project.

I am equally grateful to my co-supervisor, Ram Hari Timilsina, from the Agriculture and Forestry University in Nepal, for his exceptional support and mentorship. His assistance in facilitating the field study and internship at his institution has been very valuable. I am also thankful for the opportunity to attend the conference he organized in Kathmandu, where I had the privilege to meet and interact with national and international experts in the field of food hygiene and safety practices.

My sincere appreciation also goes to Mattias Eriksson, program coordinator, for his dedicated help in preparing and providing all the necessary official documents required for my Erasmus Plus funding application. His all support ensured a smooth administrative process for my research.

I would like to extend my gratitude to all the staff of the Erasmus Plus program at SLU, whose assistance made it possible for me to travel and conduct this study in Kathmandu and Nepal. A special thanks to Erasmus Plus for providing the financial support that enabled this research to be realized.

Finally, I am thankful to all the participants who provided their valuable time and information to contribute to this thesis. This study would not have been possible without your presence, time and generosity.

Thank you all!

Sabita Sharma Poudel

Appendix 1: Check list for site observation

Checklist [Check ☑ for 'YES' OR check ☒ for NO]

---

1. General information

Location of vending site:

Date and time of survey:

---

2. Sanitary compliance of streets

☐ Site is not near any sources of contamination (e.g., garbage dumps, drains).

☐ Adequate distance from heavy traffic areas.

☐ Streets are free from visible litter and waste.

☐ No open sewage or stagnant water near the vending site.

☐ Adequate waste bins are available and used by the vendor.

---

3. Vending equipment

☐ Food preparation surfaces are clean and in good condition.

☐ Cooking utensils and equipment are properly cleaned and maintained.

☐ Adequate hand-washing facilities or alternatives available.

☐ Proper storage containers for raw and cooked food.

☐ Separate tools/equipment for raw and cooked food.

---

4. Cleanliness of cooking pots and utensils

☐ Cooking pots and utensils are washed after each use.

☐ Cleaning materials (soap, scrubbers, etc.) are available.

☐ No signs of rust, cracks, or damage on cooking equipment.

---

5. Personal hygiene of vendors

☐ Vendors wear clean clothing and maintain personal hygiene.

☐ Hand washing is practiced regularly, especially after handling money.

☐ Hair is properly covered or tied back.

☐ Gloves are used appropriately when handling food.

---

6. Food source and transportation

☐ Freshness and quality of raw materials are verified.

☐ Proper transportation methods are used to bring food to the site.

☐ Vehicles or carts used for transport are clean and well-maintained.

---

7. Waste management

☐ Waste is collected in proper bins and not scattered around.

☐ Garbage is disposed of regularly and not stored near food.

☐ Recycling and separation of waste materials are practiced.

Appendix 2: Questionnaire used for survey

Hello! I am Sabita Sharma Poudel, a master's student of food inspection. This survey is for academic purposes, and your participation is voluntary. If you agree to participate, I would like to proceed. Rest assured; I will only use this information for academic purposes. I would like to thank you in advance.

Section A: general information

Location:

1.What is your age?

2. What is your gender?

Male	Female	Others

3. How many years have you been operating this?

Less than 1 year	One to two years	More than 2 years

4. What is the primary type of food you sell?

Momo	Chowmin	Panipuri	Chatpate	Others

5. Which ethnicity do you come from?

Newar	Gurung	Magar	Brahmin	Chhetri	Other

6. What is your marital status?

Married	Unmarried/ single	Divorced	Widowed

7. How many family members do you have at home?

1	2	3	4	5	Other

8. What is your education level?

Illiterate	Primary education	Secondary education	Higher Secondary	Bachelor's degree	Postgra duate	Other

Section B: involvement and income

9. Do you operate this business year-round or seasonally?

Whole year	9 months	Less than 6 months	Occasionally

10: Does this business generate sufficient income to sustain your household?

Yes, sufficient	Good	Not enough	No, income	Other

11. Do you have any alternative source of income?

Selling online	Catering	Food delivery	Only this	Others

12. Have you taken food preparation training?

Yes	No

13. What kind of training have you taken?

Formal training	Self-taught	Hygiene training	No training	Others

14. Do you have your parents/ children with you? Do you need to give time for caregiving? If yes how many hours?

Less than 1 hr/day	1-2 hr/day	3-4 hr/ day	More than 4 h/ day	Others

15: Do you prepare food when you are sick? example (Fever, Coughing, Diarrhea)

Yes	Sometimes	Rarely	No

16. Do you have access to the internet? What kind of information generally you find in it?

Food preparation	Food storage	Water	Other

Section C: Vendor's response on sanitation, hygiene and food safety practices

(ET= Every time, C= constantly, OC= occasionally, and N= never)

Practices	**ET**	**C**	**OC**	**N**
Do you wash your hands regularly with soap and water?				
Do you and your employees wear clean clothes and, if necessary, use gloves and caps?				
Are you and your employees trained in personal hygiene practices?				
Do you use separate cutting boards and utensils for raw and cooked foods to prevent cross-contamination?				
Do you clean and sanitize utensils and equipment regularly?				
Are food preparation surfaces kept clean and sanitized regularly?				
Would you mix containers that load raw food and those that load cooked food?				
Do you use a food thermometer to check the internal temperature of cooked foods?				

Do you have access to the clean water and proper sanitation facilities at home?				
Have you and your employees received proper training regarding food safety and hygiene practices?				
Do you take a physical examination every year?				

Section D: Respondents' knowledge on sanitation, hygiene and food safety):

(SA= Strongly agree, A= Agree, IDK= I do not know, D= disagreed, SD= Strongly disagree)

Utensils and equipment:	**SA**	**A**	**IDK**	**D**	**SD**
Keeping utensils and equipment in good condition is important for sanitation					
Utensils and equipment can be used just after being washed					
Washing utensils, equipment with detergent leaves them free of contamination					
Personal hygiene:					
Microbes are in the skin, nose, and mouth					
Using gloves while handling food reduces the risk of food contamination					
Using a mask while handling food reduces the risk of food contamination					
Proper Cooking and Temperature Control:					
Well-cooked foods are free of contamination					
Storing cooked food in room temperature does not contaminate					
Mixing cooked food with raw leads to cross-contamination					
Mixing vegetables with meat leads to cross-contamination					
Packaging and serving					
It is important to change the gloves and sanitize hands after completing a packing					
If the utensils are used for serving, it is very important to wash properly and sanitize before reusing it					
Waste disposal:					
It is important to have proper waste disposal system in place to keep the area clean and avoid contamination					
I have a plan in place to deal with emergencies (waste, contamination)					

Respondent's 'perception' on sanitation, hygiene and safety of public health

(SD= Strongly agree, A= agree, IDK= I do not know, D= disagree, SD= Strongly disagree)

Perception	SA	A	IDK	D	SD
It is very important to understand how to prepare food for the safety of customers					
It is important to keep yourself healthy considering customer's health					
There is no need to go for a medical examination because I am healthy					
While having an infectious disease of the skin, it is necessary to take leave from work					
It is only important to prepare delicious food than the hygiene					
It is no problem to work when you are ill?					
Processed foods are free from pathogenic bacterial contamination					
Dish towels can be a source of food contamination.					
Knives and cutting boards should be properly sanitized to prevent cross contamination.					
Food handlers who have abrasions or cuts on their hands should not touch foods without gloves.					
It is necessary to check the temperature of refrigerators/freezers periodically to reduce the risk of food contamination.					
Proper hand hygiene can prevent foodborne diseases.					

Respondent's compliance with sanitary requirements

Legal compliance with sanitary requirement	Yes	No	I do not know
Do you keep updated with the rules and regulations regarding selling food in your area?			
Are you aware of sanitary requirements set by local authorities?			
Are you aware of the legal consequences of non-compliance with sanitary requirements?			
Have you taken the measures to ensure compliance with these requirements?			
Have you had any history of warnings or penalties for not meeting sanitary requirements?			

Are you aware the impact of food safety and hygiene practices on public health?			
Health authorities should conduct regular inspections to ensure compliance with food safety standards.			

Other:

a: Have you heard about *E. coli* or other types of pathogens?

b. What are the control measures that you implement to control this pathogen?

c. How important do you consider food safety knowledge in the preparation of street
food?

V. Important	Less Important	Not important	Other

d. On a scale of 1 to 5, how confident are you in your knowledge of food safety practices?

e. Do you believe maintaining hygiene in street food preparation impacts customer satisfaction?

Strongly agree	Agree	Neutral	Disagree	Strongly disagree

f. Can you list three critical food safety practices you adhere to while preparing street food?

Handwashing	Proper cooking	Cleaning utensils	Fresh ingredients	Other

g. How often do you receive training or education on food safety and hygiene practices?

Regularly	Occasionally	Rarely	Never

h. Do you have access to resources to maintain hygiene in your vending site? (e.g., clean water, proper waste disposal)

Yes	Partially	No	N/A

i. Do you have a valid permit or license to operate as a street food vendor?

Yes	No

j. How frequently do you clean and sanitize your utensils and cooking equipment?

After every use	Once a day	Few times a week	Rarely	Never

k. Have you ever received warnings or penalties for not complying with sanitary requirements?

Yes	No

l. How do you think your food handling practices impact public health?

V. positively	Positively	Neutral	Negatively

m. What measures do you take to ensure the shelf-life of your food products?

Storage	Exp. dates	Preservatives	Packing	other

n. Have you noticed any economic impacts resulting from your food safety and hygiene practices?

Customer Satisfaction	Reduced waste and cost	Increased business	Not applicable

o. On a scale of 1 to 5, how confident are you that your food safety practices maintain consumer confidence?

p. How satisfied are you with the current hygiene and sanitation status of your shop?

Very satisfied	Satisfied	Neutral	Dissatisfied

q. What improvements do you think could be made to enhance food safety practices among street food vendors in Kathmandu?

More trainings	Better hygiene supplies	Work with health officials	Safety rules	others

r. Would you be interested in receiving additional training or resources to improve your food safety and hygiene practices?

Yes	No

Publishing and archiving

Approved students' theses at SLU can be published online. As a student you own the copyright to your work and in such cases, you need to approve the publication. In connection with your approval of publication, SLU will process your personal data (name) to make the work searchable on the internet. You can revoke your consent at any time by contacting the library.

Even if you choose not to publish the work or if you revoke your approval, the thesis will be archived digitally according to archive legislation.

You will find links to SLU's publication agreement and SLU's processing of personal data and your rights on this page:

- https://libanswers.slu.se/en/faq/228318

☒ YES, I, Sabita Sharma Poudel, have read and agree to the agreement for publication and the personal data processing that takes place in connection with this

☒ YES, I, Sabita Sharma Poudel, have read and agree to the agreement for publication and the personal data processing that takes place in connection with this.

☐ NO, I/we do not give my/our permission to publish the full text of this work. However, the work will be uploaded for archiving and the metadata and summary will be visible and searchable.