

Factors Associated with Food Safety Knowledge and Practice
among Street Food Vendors in Taunggyi Township, Myanmar:
A Cross-sectional Study

Mr. Tin Aung Soe Htway



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By	Mr. Tin Aung Soe Htway
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Thesis Advisor	KRAIWUTH KALLAWICHA, Ph.D.

Accepted by the COLLEGE OF PUBLIC HEALTH
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Requirement for the Master of Public Health

..... Dean of the COLLEGE OF
PUBLIC HEALTH
SCIENCES
(Professor SATHIRAKORN PONGPANICH,
Ph.D.)

THESIS COMMITTEE

..... Chairman
(Professor SATHIRAKORN PONGPANICH,
Ph.D.)

..... Thesis Advisor
(KRAIWUTH KALLAWICHA, Ph.D.)

..... External Examiner
(Napaphan Viriyautsahakul, M.D.)

ติน อ่อง โช ทเร :

ปัจจัยที่เกี่ยวข้องกับความรู้และการปฏิบัติด้านความปลอดภัยทางอาหารในกลุ่มผู้จำหน่ายอาหารบนบาทวิถีในเขตเมืองตอง
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ความปลอดภัยทางอาหารเป็นปัญหาด้านสาธารณสุขที่ได้รับความสนใจเพิ่มมากขึ้นทั่วโลกอาหารบนบาทวิถีเป็นองค์ประกอบหลักของความกังวลด้านความปลอดภัยทางอาหารเนื่องจากโดยเฉพาะอย่างยิ่งในประเทศกำลังพัฒนาซึ่งอาหารบนบาทวิถีเป็นส่วนสำคัญของวัฒนธรรมที่นำเสนออาหารที่เข้าถึงได้ง่ายในราคาที่เหมาะสมดังนั้นความรู้ด้านความปลอดภัยของอาหารและการปฏิบัติของผู้ขายอาหารข้างทางจึงมีความสำคัญอย่างยิ่งเพื่อให้แน่ใจว่าอาหารปลอดภัยและป้องกันการแพร่ระบาดของโรคที่เกิดจากอาหาร ในการศึกษาภาคตัดขวางนี้ได้ศึกษาระดับความรู้และแนวปฏิบัติด้านความปลอดภัยทางอาหารตลอดจนปัจจัยเชื่อมโยงระหว่างผู้ขายอาหารบนบาทวิถีเมืองตองจิประเทศเมียนมาร์ในการศึกษานี้ใช้แบบสอบถามที่มีโครงสร้างที่ผ่านการตรวจสอบแล้วเพื่อสัมภาษณ์ผู้ขายอาหารบนบาทวิถีจำนวน 158 รายและมีการใช้ชุดตรวจสอบเชิงสังเกตเพื่อตรวจสอบสภาพสุขอนามัยของสถานที่จำหน่ายและการปฏิบัติด้านสุขอนามัยอาหารของผู้ขาย การศึกษานี้ได้ใช้ Chi-Square เพื่อหาความสัมพันธ์ระหว่างความรู้และแนวปฏิบัติด้านความปลอดภัยของอาหาร ผลการวิจัยของเราพบว่าผู้ขายส่วนใหญ่มีความรู้ระดับสูงและ 58.9% ของผู้เข้าร่วมได้คะแนนเท่ากับหรือต่ำกว่าค่ามัธยฐานในแนวทางปฏิบัติด้านความปลอดภัยของอาหาร ในขณะที่ 41.1% ได้คะแนนมากกว่าค่ามัธยฐานเพศและระดับการศึกษา มีความสัมพันธ์อย่างมีนัยสำคัญกับความรู้ของผู้เข้าร่วมในเรื่องความปลอดภัยของอาหาร ($p < 0.001$) ในทำนองเดียวกันการศึกษาเชื้อชาติและรายได้ต่อเดือนมีความสัมพันธ์อย่างมีนัยสำคัญกับแนวปฏิบัติด้านความปลอดภัยของอาหาร ($p < 0.001$) ในขณะที่การเข้าร่วมการฝึกอบรมด้านความปลอดภัยของอาหาร ไม่มีความสัมพันธ์กับนอกจากนี้ผู้เข้าร่วมที่มีคะแนนความรู้ดีกว่ามีแนวโน้มที่จะมีคะแนนการปฏิบัติที่ดีขึ้นดังนั้นการฝึกอบรมด้านความปลอดภัยของอาหารที่มอบให้กับผู้จัดการอาหารควรมีรายละเอียดมากขึ้นและเป็นไปตามแนวทางมาตรฐาน โดยเฉพาะอย่างยิ่งเกี่ยวกับแนวปฏิบัติด้านความปลอดภัยของอาหารบนบาทวิถี



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ปีการศึกษา 2562

ลายมือชื่อนิสิต
ลายมือชื่อ อ.ที่ปรึกษาหลัก

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Food safety is a growing public health concern worldwide. Street food is a major element of food safety concerns since, especially in developing countries, it is where street food is an integral part of the culture offering easy access to food with affordable price. Food safety knowledge and practices of street food vendors is, therefore, essential to ensure safe food and prevent food borne disease outbreaks. This cross-sectional study investigated the level of food safety knowledge and practices as well as their associate factors among street food vendors in Taunggyi Township, Myanmar. Validated structured questionnaires were used to interview 158 street food vendors, and a set of observational checklists was used to inspect sanitary conditions of vending sites and food hygiene practices of vendors. The association between food safety knowledge and practices was tested using Chi-square. Our results revealed that most vendors had high level of knowledge and that 58.9% of participants scored equal to or lower than the median in food safety practices while 41.1% scored greater than the median. Gender and education level were significantly associated with knowledge of participants on food safety ($p < 0.001$). Similarly, education, race and monthly income were significantly associated with food safety practices ($p < 0.001$) while food safety training attendance had no association. Additionally, participants with better knowledge score were more likely to have better practice score. Therefore, food safety training given to food handlers should be more detailed and comply with standard guidelines, especially about street food safety practices.

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CHULALONGKORN UNIVERSITY

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Student's Signature

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Tin Aung Soe Htway

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CHAPTER I

INTRODUCTION

1.1 Background and Rationale

Food safety is an important issue of public health and a key factor for the use of food in every country. The World Health Organization has reported the food causing illness is a major international health issue and a major course of declining economic growth (WHO, 1983). Street food is a major element of food safety issue concern. Such foods are generally able to prepare under unhygienic conditions and sold at sites where sanitation services safe water and garbage disposal facilities are limited in availability (WHO, 2003). Consequently, microbial contamination, misuse of food additives and environmental contamination of street foods present a high risk of food poisoning (Dittrich, 2017).

"Street foods" has been defined as foods and beverages ready and sold by street stalls and other public areas for immediate consumption or consumption without further processing or preparation at a later time (WHO, 1996).

In the food supply chain, street food industry plays an important role, feeding "people on the go" (Waiyeelinn, 2016). In many developing countries, street food vending is a concurrence of growing trade and attraction of cities as well. Consequently, street food consumption becomes an important consumption pattern associated with urban life because nowadays busy life style encourages people from all socioeconomic backgrounds, more preferable to street food consumption. Street foods are a customer snip when taking into account the time and cost demands of food, fuel, cooking equipment and transportation (Samapundo et al., 2015).

Since Myanmar is also exhibited as rapid growth of socioeconomic changes, urbanization and population, street food corresponds to the informal sector as a public health concern. The most significant influenced factors on street food consumption in Myanmar from socioeconomic point of view are that street food are easily accessible with a saving time and available at affordable prices by low-income group, followed by appetizing and knowing the vendor socially. The noodles salad, for example, which is the second-most popular street food among Myanmar people, is commonly

served with bare hand because bare hand serving culture makes local people appetizing. Even Mohinga, the top popular traditional street food in Myanmar, made by fermentation of rice which may be the source of contamination of diseases, unlike salad, is a kind of soup. Therefore, many microbiological studies have explored about microbial quality of street food “Salad” as high-risk food not only for bare hand serving habit but also its uncooked items (Mensah et al., 2002, Adjrah et al., 2013, Soncy et al., 2015).

In Myanmar, a total of 250 food samples (e.g monhin-gha, lat-thoke (various salads), processed meat, milk, milk product and pickles) from Mingalar Taung Nyunt and Tha Ke Ta Township, Yangon, were studied for bacterial contamination. In that study, coliform presented in 141 (56.2%) samples and fecal coliform presented in 132 samples (52.8%). Further, *Escherichia coli* was isolated in 50 out of 250 samples (20%) (Myint, 2006). In addition, a total of 45 food samples (fried rice) and water (1 liter) from respective street food shops from Latha, Yankin and new Dagon Township, Yangon, were studied for bacterial contamination. Coliform presented in 32 (71.11%) samples and fecal coliform presented in 15 samples (33.33%) and enteropathogenic *Escherichia coli* presented in 29 samples (64.44%) (Mya et al., 2006).

According to the literatures, food-borne diseases have widely concern with financial effects on individuals, food businesses and even economy of countries. One in three persons in industrialized countries may be affected by food-borne illness each year (Bizikova et al., 2014). In Myanmar, diarrhea is a main root of morbidity in children under five years and stands as the fourth leading cause of morbidity (Department of population, 2014).

The causal factors that lead to low microbial quality of street food in developing countries are lack of basic infrastructure, lack of drinking water, proper storage facilities and lack of knowledge of hygienic practices (Samapundo et al., 2015). Moreover, the improper handling of food by vendors had been confirmed as major cause of food-borne illness. The three main reasons of improper food handling are (a) lack of knowledge about food-borne diseases, their sources of causes,

symptoms and implications (b) lack of perception of extent of the hazards and (c) lack of knowledge how to change their behavior. All these weaknesses of street food vending operations and contamination prevention practices, can be addressed by providing education program about food-borne diseases, their cause, impact on human and societal development and actions to avoid them (Waiyeelinn, 2016)

In addition, knowledge can influence the practice through attitude. However, attitude may not necessarily translate into good practice as the evidence from previous studies. A study conducted in Italy indicated that although most of street food vendors have positive attitude towards food borne disease control and preventive measures, the attitude was not supported into good practice because only 20.8% used gloves and washed their hands (Angelillo et al., 2000). Another study about food safety knowledge, attitude and practice of street food vendors in Ilala Municipality during 2018, despite the vendors had positive attitude on food safety including hand washing, it was found that more than half (59.2%) did not have hand washing facilities, only 28.1% accessed to portable water and 43% did not wash their hands after visiting toilet (Mlay, 2018). During 2018 in Bandung, Indonesia, the attitude about food safety of street food vendors was adequate but practice was poor on basic food hygiene and also found that there was no correlation between attitude and practice about food safety of street food vendors ($p=0.106$) (Allanswers, 2018). A study conducted in a Philippines university campus also claimed that street food vendors didn't have too much knowledge in terms of food legislation and waste management and a significant gap between knowledge and practice on these topics was established (Patricia V. Azanza, 2000). In 1995, Food and Agricultural Organization (FAO) of the United Nations recorded that the presence of microbial contamination of food sold by vendors is mainly due to poor food safety knowledge and practices in food handling (FAO, 1995).

In Myanmar, some of the successes in intervention for street food safety are a promotion in awareness of personal hygienic practices on the part of trained vendors. Nevertheless, the constraints that may inhibit safe establishing of street food stalls include: limitation of infrastructure such as water supplies, waste disposal facilities, difficulty in controlling some street food vendors because of their mobile and

temporary nature, insufficient training for inspection personnel, given training did not cover the large number of vendors with poor knowledge on basic food safety measures (WHO, 2012, Latt et al., 2016). Therefore, the research in Myanmar may emphasize on street food vending as street food vendors still continue their business with a lack of some supervisions whilst most of them with stationery food stalls have been licensed.

Food and hospitality are inextricably linked and eating is a physical necessity for each tourist producing large amounts of income (Abdullah, 2015). Myanmar is well recognized for its vibrant and diverse ethnicity groups and tourist attraction sites such as Taunggyi, the fourth capital of Myanmar where considerable socio-economic status societies live. It has many places to visit and eat, both local and international travelers. Moreover, there are plenty of famous street food stalls with traditional food with bad hygienic condition and local and international tourists usually like to eat in these street food stalls. Because of its rapid urbanization, it also has growing economic growth, industrial zones, and construction sites which have many internal migrant workers. These groups of population usually rely on street food which offering easy access to food with cheap price. Moreover, the hygienic and food safety condition of street food in Taunggyi Township are really worsen than other food such as from restaurants and homes for many reasons include lack of infrastructure, limited regulation and enforcement, poor food safety knowledge of street food vendors, and etc. Therefore, according to food and drink establishments, the role of street foods and their hygienic activities is essential not only for tourist attraction but also for food hygiene concerns.

In the current situation, legislation, regulation and enforcement on street food stall are still restricted. Government institutions like municipal and Food and Drug Administration (FDA) departments are attempting to adjust those gaps. Even though the issue of food safety is significant, the study conducted to explore the street food safety knowledge and practice of people from street food stall in Taunggyi Township is still limited.

Food poisoning and diarrheal diseases ranked third and fourth on the list of national disease outbreaks in Myanmar during 2018. Total 37 food poisoning events with 1320 cases and 17 diarrheal events with 567 cases have been reported. One death from food poisoning and 11 from diarrheal diseases in all those incidents were recorded (Central Epidemiology Unit, 2018). Moreover, according to Taunggyi's 2017 health profile, 2342 diarrheal cases with five deaths and 263 dysentery cases ranked first and fourth in five leading causes of morbidity and mortality and also 42 cases of food poisoning had been recorded (Department of Public Health, 2017).

With regards to the above-mentioned problems, issues of foodborne disease and lack of food safety hygiene are extremely important. In order to avoid these emerging issues, the characteristics and baseline knowledge regarding the food safety among the street food vendors should be assessed. Consequently, the appropriate intervention and strategies can be implemented to fill the regulatory gap. Additionally, the developing of sustainable guidelines, directions and training on street food safety are also possible.

1.2 Research Questions

- What are the levels of food safety knowledge and food safety practice of street food vendors in Taunggyi Township, Myanmar?
- Is there any association between socioeconomic status and food safety knowledge and practice of street food vendors in Taunggyi Township, Myanmar?
- Is there any association between food safety training and food safety knowledge and practice of street food vendors in Taunggyi Township, Myanmar?
- Is there any association between food safety knowledge and food safety practice of street food vendors in Taunggyi Township, Myanmar?

1.3 Research objectives

General objective

- To identify the factors associated with food safety knowledge and practice of street food vendors in Taunggyi Township, Myanmar

Specific objectives

- To investigate the socioeconomic status and food safety training information among street food vendors in Taunggyi Township, Myanmar
- To investigate the vending environment condition of street food vendors in Taunggyi Township, Myanmar
- To investigate the level of food safety knowledge and food safety practice of street food vendors in Taunggyi Township, Myanmar
- To identify the association between socioeconomic status, and food safety knowledge and practice of street food vendors in Taunggyi Township, Myanmar
- To identify the association between food safety training, and food safety knowledge and practice of street food vendors in Taunggyi Township, Myanmar

1.4 Research Hypothesis

1. There is an association between the socioeconomic status, and food safety knowledge and practices among street food vendors in Taunggyi Township, Myanmar.
2. There is an association between food safety knowledge and practice of street food vendors in Taunggyi Township, Myanmar.
3. There is difference in knowledge regarding food safety practice between trained and untrained street food vendors in Taunggyi Township, Myanmar.

1.5 Conceptual framework

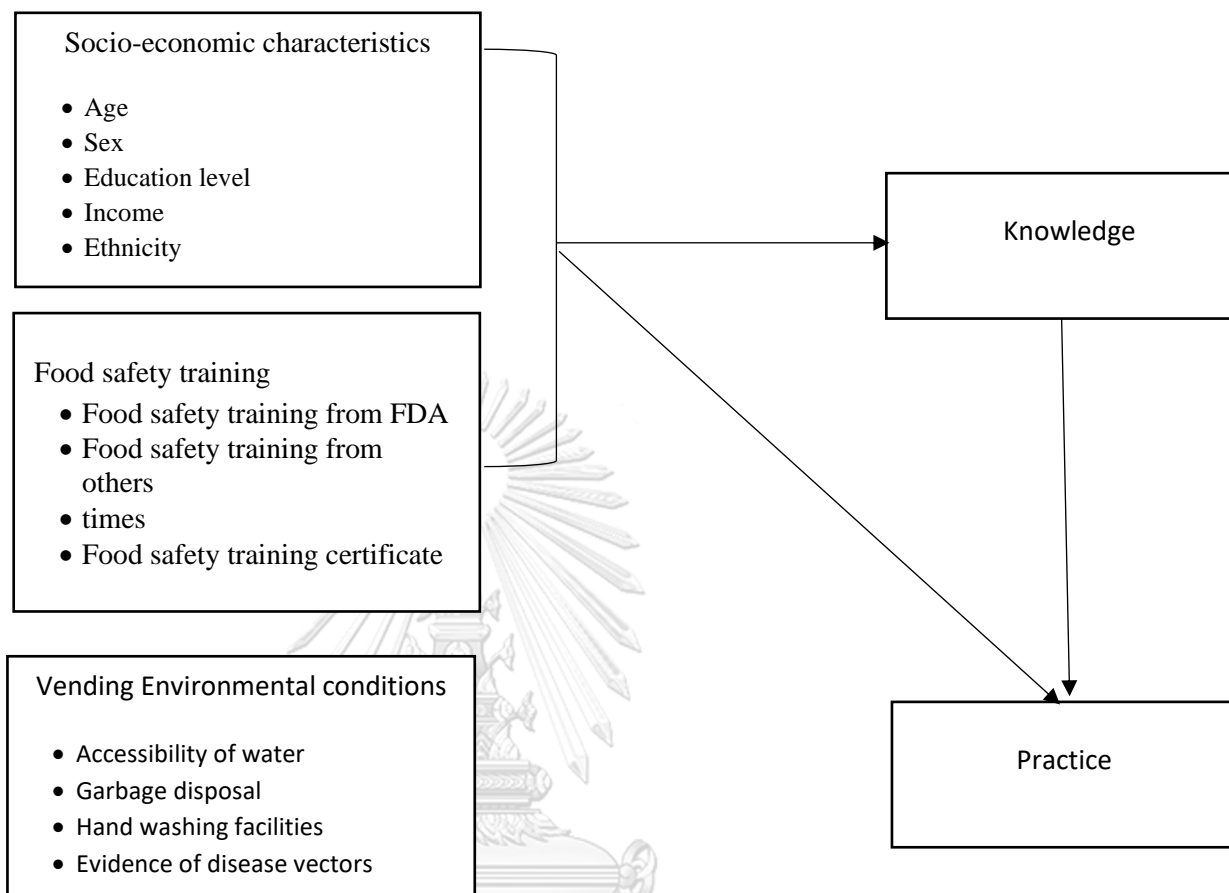


Figure 1 Conceptual framework

1.6 Operational definition

Terms	Definition
Street food	Street food is defined as food and drinks prepared and sold by vendors in street and other public places for immediate consumption or consumption at a later time without further processing or preparation.
Food safety	Food safety refers to all measures to ensure that, when prepared and/or eaten according to its intended use, food will not cause harm to the consumer.
Hygienic quality	<p>Hygienic quality of street food includes cleanliness and avoidance of dirt and diseases by vendors. All official recommendations for hygienic practices are based on scientific micro-biological explanations. WHO guided the five recommendations for producing safe food. These five keys to safer food are</p> <ol style="list-style-type: none"> 1. Keep clean 2. Separate raw and cooked 3. Cook thoroughly 4. Keep food at safe temperatures and 5. Use safe water and raw materials (Campbell, 2011)
Diarrhea	Diarrhea refers to WHO definition (Solaro, 2006); gastrointestinal is defined as three times or more watery or loose stools or any passage of mucous and/or bloody stool within 24 hours.

Street food vendor	Street food vendor is an entrepreneur who sells ready-to-eat food and drinks (street food) and must register in Taunggyi Municipal department.
Age	Age is a complete age of respondent on the interview day and will be above 18 years.
Sex	Sex represents gender of the respondent that is male or female.
Income	Income refers to the average vending income per month of every vendor.
Education level	Education level is the highest education that respondents obtained and will be categorized into six levels; non-school, primary school (grade 1-4), secondary school (grade 5-8), high school (grade 9-10), university education and others.
Food safety training	Food safety training refers to teaching scientific discipline, including a number of routines that should be followed to avoid potential health hazards and describing personal hygiene, handling, preparation, and storage of food in ways that prevent foodborne illness.
Food hygiene	Food hygiene refers to a scientific discipline describing handling, preparation and storage of food in ways that prevent food-borne illness.
Food safety knowledge	The ability of memorable and the level of understanding of human in food sanitation as well as health risk resulting from poor or good personal hygiene, handling of food and exposure of

	hazards during operation of vending unit.
Food safety practice	The habitual activity of street food vendors or performing repeatedly or regularly on awareness of personal, food preparation, storage and environmental hygiene during operation of vending unit.
Vending Environmental condition	Vending Environmental condition refers to authority's water supply and garbage disposal service access by establishments and vendors' practices deals with proper vending protection, presence of clean wash hand basin/soap/towel and having clean service tables and surrounding.
Garbage disposal	Garbage disposal means a collection, removal and treatment of waste materials and availability of waste disposal service during the operation of vending unit.
Food Contamination	Food Contamination refers to the presence of an impure and detrimental component that spoils and infects or makes poorer state of a food, natural environment, workplace, etc.
Establishment's protection and sanitation	Establishment's protection and sanitation refers to basic infrastructures of street food stalls such as shelter protected from sunlight, dust, rainfall and etc. Additionally, service table setting and cleaning will also include.
Accessibility of water	Accessibility of water refers to the water availability from the service of Taunggyi Municipal Department and easy to assess the any water source.

Hand washing facilities	Hand washing facilities mean presence of basin/soap/towel or tissue.
Evidence of disease vectors	Evidence of disease vectors mean presence of vectors such as fly, mouse, cockroach, etc in premises?



CHAPTER II

LITERATURE REVIEW

2.1 Personal hygiene of street food vendors

The personal appearance of vendors is the first area of hygienic practices with the proper characteristics of wear, observing by the buyer. Wearing apron, covering the hair and using gloves by vendors are the first requirements at a glance of the customers in the preparation and serving their foods. A study carried out in Trinidad, West Indies investigated the hygienic practices of street food "Doubles" vendors and the public perception of sales practices. The organized questionnaire and observational checklist were utilized for this survey on 120 street vendors. Based on the observation, the result indicated that 55% of the vendors appeared 'outwardly clean' during the operation of their vending and 99.2% of the vendors well dressed with covering hair and wearing apron. This study presented that the "double" vendors in Trinidad have awareness of the importance of personal hygienic appearance since the well-dressed vendors can influence the customers' purchase decision and their perception of street food safety (Benny-Olliviera and Badrie, 2007).

In comparison to the research evaluating the food safety dimension of mobile street-selling in downtown Florianopolis, Santa Catarina, Brazil, however. 43 street vendors were interviewed and checked their personal hygiene with observational checklist. The result showed 91% did not have hair covering and 46% did not wear appropriate uniform. This result indicates that the vendors in this survey may have lower rate of attitude towards the importance of their physical appearance to customers' purchase decision (Cortese et al., 2016).

2.2 Food handling and serving practices

Another critical part of the health of street food is how vendors treat and serve customers with the food. Unhygienic and unsanitary hands are certainly a significant cross-contamination of pathogens produced by germs and foods (Warner, 2016). A report done in Florianopolis, Brazil on the street food safety prepared by 43 street

food vendors which was checked via observation showed that 67% washed their hands usually 4 times per day, in which 33% didn't wash hands during working. 24% reported they used water only for washing their hands. Another wrong handling practice is that optical brighteners were only used for sanitizing utensils, reported by 21% vendors although detergent it is not a sanitizer (Cortese et al., 2016). FAO stated that money is unclean and one of the reasons to cause contamination of food. It is seen during observation of this survey that 95% of the sellers handled money and food without washing their hands (Muinde and Kuria, 2005).

This finding is in line with the observations made in Vietnam with 70% of money being exchanged during handling food and going to serve (Samapundo et al., 2015). In contrast to the food handling practices of food handlers categorized by 3 groups (group 1; restaurants in major hotels, group 2; fast food type and group 3; food hawkers, gardens and open-space cafeterias) in Nigeria, 84% of respondents reported washing their hands with water and soap each time they prepared food. Restaurants' hand washing practices culminated in group 1, 100%, (group 2) 92%, (group 3) 60%. The respondents offered various methods for handling vegetables, such as flooding raw vegetables under running water (60%) and soaking them in vinegar and salt water (40%) (Pepple, 2017).

In a cross sectional study conducted in Kuching City, Sarawak of Malaysia to assess the level of knowledge, attitude and practice of food safety among the 361 street food vendors and to determine the factors affecting them, it showed that had poor knowledge (20.5%), attitude (17.2%), practice (16.9%) and however, average attitude (62.9%), food safety practice (71.5%) was high compared to knowledge (41.6%), but the good attitude (19.1%) and practice (10.8%) were low compared to knowledge (36.8%). Concerning with the factors influencing knowledge, attitude and practice of food safety, age, knowledge and attitude were significantly related to food safety practice, the duration of food vending had inverse relation with food practice ($p < 0.05$). This indicated that short duration of food vending maintained better food safety practice. It indicates that the knowledge of vendors in this study positively influences attitude formation, and the recipient's comprehension of health facts. Moreover, there is no statistically significant association between knowledge score

and socio-demographic characteristics except for age, race and marital status ($p < 0.05$) that is overall, young food vendors have less than optimal levels of food safety knowledge and safe food handling best practices and also a positive correlation with food hygiene practice and knowledge of food safety ($p < 0.05$) that revealed as 4.039 times higher with good practice and 2.834 times higher with average practice of food safety among respondents with history of food safety training (Rahman et al., 2012).

2.3 Food storage practices

Storage as another unsuitable food handling practices by vendors is an element that vendors need to ensure product safety. In a study, on hazard analysis of street-selling foods in developing countries, the researcher stated that the products become a contributor to food poisoning outbreaks when they are kept at high ambient temperatures for long periods of time. This can result greater public health consequences with an outbreak of food poisoning (Rane, 2011). Another study of the safety practices of vendors, hygienic knowledge of 50 street food vendors in Accra, Ghana, the observation found that only 8% of vendors had their station covered with a tent, while 26% had a permanent shelter in the open air and 62%. They stated that vendors should be protected against dust that can carry microbes on the food and thus become pathogenic (Warner, 2016).

2.4 Street food vending environment

The sanitation of surrounding is another important deciding factor in the risk level of a street food stall. In an experimental study conducted in Trinidad, West Indies, of food safety practices by street vendors and microbial quality of Hamburger beef patties, the immediate surroundings were generally clean and waste disposal practices seemed appropriate with the provision of garbage bins. Nevertheless, stray dogs were seen in the vending areas (Badrie et al., 2004). Characteristically, in research conducted in three Uganda districts, garbage receptacles were either seen inside the prep area or outside the stall immediately. The vendors did not cover the

garbage bin, attracting flies and other insets which are the sources of cooked food contamination. However, with regard to the waste water drainage system, food isotopes were disposed of in the drainage trench near the vending sites in particular those that collected in the wash water by washing the dishes. This study shows that receptacles are not properly managed as a result of overflowing garbage in the gutter, raising concerns about public health (Muyanja et al., 2011).

According to the license status and the form of establishment, in the cross-sectional analysis of the unhygienic conditions of licensed and unlicensed food service establishments in Ethiopia, the result was interpreted as good sanitary conditions for licensed food establishments and a substantial correlation existed between the sanitary conditions and the type of establishments ($p=0.01$) (Kibret and Abera, 2012).

2.5 Association between socio-demographic factors of vendors

Attitude, perception, and awareness about sanitation practices and risks in street foods are often influenced by their level of education, employment, food safety, age, and sex. Theology reported varied effects of these factors also from vendors on the understanding and disposition of the street food sanitation.

2.6 Age

Some studies surveyed in India and Bangladesh revealed that after the rickshaw pulling, street selling is considered to be the second most favorable job and it is an opportunity with an investment of mites especially for young and middle-aged men (Ahmed et al., 2017).

According to surveys, street food vendors' age ranged from 18 to 60 years, indicating rarely significant association with age groups. For example, in the study carried out in Uganda, there was no significant difference ($p=0.901$) between vendors by age. However, a significant difference ($p<0.05$) was observed in the study done in Vietnam (Samapundo et al., 2015).

2.7 Gender

One of the benefits of street food enterprise is the gender that can deliver to a large percentage of the population, especially women, who can combine street food sales with family life demands (FAO, 1995, WHO, 1996, Da Silva et al., 2014). The usual population was occupied commonly with females, with the consistently results of other studies which indicate that a female involved more on the street food and family demands (Mensah et al., 2002, Donkor et al., 2009, Chukuezi, 2010, Muyanja et al., 2011). However, previous reports with the conflicting results were also presented in West Indies and India (Muinde and Kuria, 2005, Benny-Ollivierra and Badrie, 2007, Choudhury et al., 2011).

In an evaluated article investigated about the hazard factors in street foods rehearses in developing nations, the author referenced that male young adults age between 20-35 years old were the most careless group resulting to the risks of street food. This result may due to fact that their occupations and life style, as well as the lack of concerning on sanitation of their food (Alimi, 2016). In the cross-sectional study done in Florianopolis, Brazil, the result showed no correlation among genders of vendors which in agreement with the surveys conducted in Vietnam (Samapundo et al., 2015, Cortese et al., 2016).

2.8 Income and education

According to the articles examined, vendors ' level of education was calculated to have a significant impact on their knowledge of food safety ($p=0.001$), as shown in the data in Ho Chi Min City, Vietnam (Samapundo et al., 2015). In more information, the research done in Shijiazhuang city, China showed the vendors with lower education level were less open to new techniques and experience of food sanitation, compared to higher education (Liu et al., 2014). Nevertheless, one researcher recorded that the educational level of vendors in Guwahati, Assam, India had no material impact on the awareness and approach to food safety activities such as fresh

food procurement, food adulteration, and leftover food management (Choudhury et al., 2011).

2.9 Receiving food sanitation training program

According to exposure to food hygienic instruction, there was a notable difference in food hygienic practices ($p<0.05$) between qualified handlers and non-trained handlers in the cross-sectional analysis of the skills and practices of food safety employees as well as health conditions of food service establishments in Bahir Dar Region, Ethiopia. In more detail, in the investigation of food street information, attitude and practices of street food sellers and clients in Ho Chi Minh city, Vietnam, noteworthy extraordinary ($p=0.04$) happened between sanitation information level of prepared merchants and undeveloped merchants with accomplishing lower scores (36 ± 12 =poor food handling information level) contrasted with prepared merchants (67 ± 23 =adequate food handling information level) (Samapundo et al., 2015).

2.10 Studies in Myanmar

With Myanmar's increasing population and urbanization, there are many street food vendors in urban areas of the cities. Among them, some have hygienic practices and some may not. Upon considering later, food safety training on proper handling and preparation of foods, secure display and safe storage management was presumed to be given as highly necessary intervention. One study was conducted on street food vendors in Latha and Kyauktada Township, Yangon, aiming for raising food safety through food safety training program. Quasi-experimental study was conducted and 81 vendors in each area with 81 controls participate in this study. Tested food samples were cold beverages and fruits, with or without ice, salads, and grilled pork-on-stick.

As a result, there was no difference between study and control group as to the habit of seeking health food information such as reading literatures, attending health talks and watching health or food TV program ($p>0.05$). The results after the food

hygiene training course showed that mean knowledge, attitude and practice scores in the research group were improved in more detail, and these findings were statistically significant ($p < 0.05$). About the fecal coliform count measured in the research field food collection, the number of counts decreased significantly after intervention ($p = 0.0004$) while those of control area did not decrease ($p = 0.5566$).

As indicated by this study, the analysts demonstrated that season of distributing experience was discovered that was not related with level of sanitation information, individual and nourishment slow down cleanliness albeit most merchants have deal understanding of over ten years. In this manner, paying little heed to deal years all vendors ought to be given education program on sanitation (Maung et al., 2017).

In a case study surveyed by Wai Yee Lin in Yangon, Myanmar, 72 vendors are interviewed to investigate vendors' knowledge of health and personal hygiene, and to identify constraints that prevent vendors from following proper handling practice. Nearly a quarter of the respondents (47.2%) had no awareness that after handling money, hand washing is required (Waiyeelinn and Yamao, 2014). Most of vendors (86%) had understood hair covering and more than 72% had a positive aspect of wearing apron while (50%) knew that jewelry was a source of contamination, particularly rings (Waiyeelinn and Yamao, 2014). This result was same with the outcome (60%) that perceived in Ghana (Ackah et al., 2011).

Observations show that the constraints cited by the vendors are high mobility (54.25%), absence of access to clean toilet facilities (58.3%), lack of clean water sources (66.7%), lack of market competence (58.35%), lack of timely help for garbage disposal systems (55.8 %) and unfavorable food practices situation (63.9%). The researcher suggested by this survey that the majority of the vendors involved in the study have a good understanding of health and personal hygiene, but their knowledge needs to fit into practices (Waiyeelinn and Yamao, 2014).

2.11 Guidelines for street food safety

In 1996, WHO recommended the standard essential safety requirements for street foods including:

1. The vending unit should have license, prior medical examination of food handlers as general requirements,
2. Raw materials should be free from physical and chemical hazards and also should be stored separately from other raw materials and non-food materials. Water and ice used for drinking should be safe and sanitary and water use for washing should be running water or should be emptied the bucket after each time used
3. Formulation of food should be in edible condition and thus taste, appearance, texture, odour, pH, water activity, etc should be monitored regularly.
4. If the food is cooked, the temperature should be at least 70°C and if the food is eaten at raw state, it should be cleaned carefully with safe and running water.
5. The vehicle used for transportation of food should be clean and should not carry animals and toxic substances.
6. If the food needs to store, the temperature should be at less 10°C.
7. Utensils and containers should not be made of toxic materials such as copper, lead, cadmium etc.
8. Food handlers should be free from any infection such as diarrhea, jaundice, hepatitis A, skin lesions. They should wear cap, mask, apron, gloves and also should wash their hand every time after they doing any activity. They should also avoid the unhygienic behaviours such as betel chewing, tobacco smoking, spitting, sneezing.
9. Food should be protected from sunlight, dust, wind and rain and also should be away from toilet, waste bin, animals including pets and insects.
10. All liquid and solid wastes should be disposed not to be contaminated to food and water and the environment (WHO, 1996).

Moreover, in 2010, WHO and International Food Safety Authorities Network (INFOSAN) adopted WHO 5 keys into basic steps to improve safety of street-vended food. These are:

- i. Keep clean
- ii. Raw and cooked food should be separated
- iii. Destroy hazard if possible
- iv. Keep food from microorganism growing
- v. Use safe water and raw materials (WHO, 2010)

In addition, Codex Alimentarius provided the guideline as regional code of hygienic practice for street vended foods in Asia for all sectors including regulators, street food stakeholders and customers. In this guideline, the requirements and standards are more detail and modified for the countries in Asia (Alimentarius, 2017). In which as a general requirement, it contains rules and regulations and registrations/licensing of street food vendors. Regarding with the personal hygiene of Street Food Vendors, wearing clean clothes and gloves, covering the hair, keeping the finger nails short, washing hand before and after handling food, after toileting and avoiding wearing ornaments are necessary. Moreover, bad behaviors such as betel chewing, spitting, smoking, sneezing and coughing should be avoided. Street food vendors should be free from any sign like jaundice, diarrhea, skin lesions, vomiting, fever and sore throat etc.

For the street food stall, it should be in clean, non-polluted area together with waste bins and storage spaces should be separate for raw and cooked food. Water should be safe and enough for many tasks with the hand washing facilities. It should be also provided suitable containers in sufficient area for solid waste disposal and proper drainage system for waste water disposal with free from flies and other pests.

To avoid cross-contamination, cutting boards and knives should be washed after every used. Food should be served within two hours after thoroughly cooking of food. Raw and cooked food should be separately stored in hygienic place protecting against dust, sun, wind. Leftover food should be disposed properly.

CHAPTER III

RESEARCH METHODOLOGY

3.1 Study design

A cross-sectional study design was used in this study.

3.2 Study area

The study area was the fourth capital of Myanmar, Taunggyi Township, principal of Shan State which is the biggest state in Myanmar have large population of 386,917 with diverse socio-economic status. Taunggyi Township is located in southern part of Shan State which is eastern part of Myanmar at elevation of 4,712 feet above the sea level with the area of 2007 square kilometer together with hills and mountains. Many kinds of ethnicity with different religions are living in Taunggyi Township but mostly are Shan and Burma ethnicity in believing Buddha (Department of population, 2014). In addition , there are four towns in Taunggyi Township: Taunggyi, Ayetharyar, Shwenyaung and Kyauktalonegyi and also the many villages and wards. It has many beautiful and popular places to visit and eat, such as Inle Lake, Pindaya Caves and so many Buddhist temples.

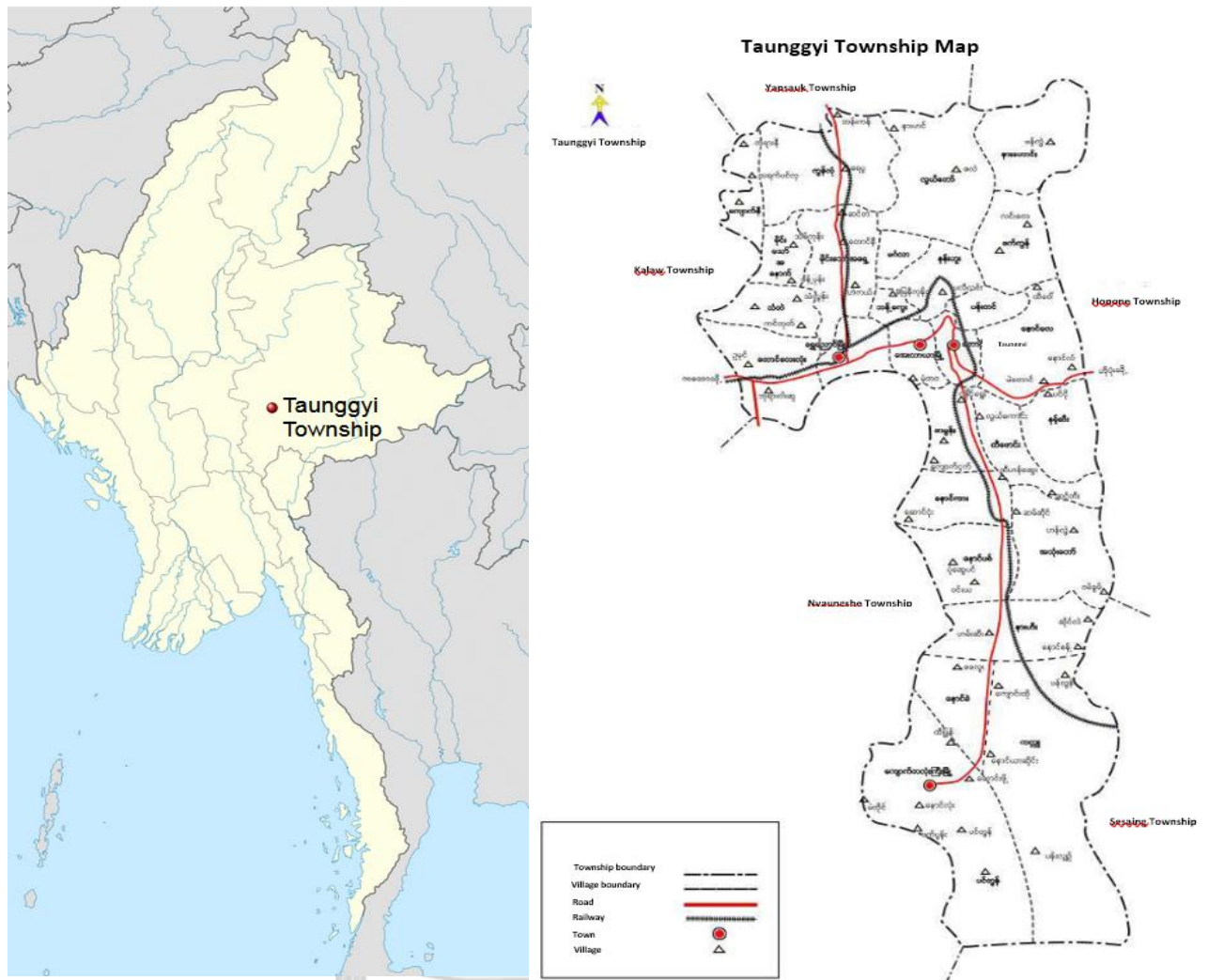


Figure 2 Taunggyi Township map

3.3 Study population

As capital city of Shan State which is economic developing area for many businesses such as tourism, construction, industry and agriculture, people living in Taunggyi are mostly internal migrant workers and they tend to prefer eating outside home for the reason of saving time and easily accessible. On the other hand, as a tourist attractive place, local and foreign tourists usually go to street food stall for local and traditional food. Even among developing countries, by United Nations standards, Myanmar is one of the least developed nations (Hlaing et al., 2016, United Nation, 2020). The water infrastructure for that country needs to be developed. The use of water in the vending operation in this study area is poor and lack of available of

source and service from local authority. The registered street food vendors in Taunggyi township were chosen. According to data of Taunggyi Municipal Department, there were 158 registered street food shops and unknown number of unregistered street food shops in Taunggyi Township. All registered street food stores were eligible to participate in this study. Unregistered street food stores were excluded to avoid missing subject because they are mobile stores and moving around the town.

3.4 Duration of the Study

The data was collected within July 2020.

3.5 Measurement tools

Validated structured questionnaire and observational check-list were used for data collection. These questionnaires were modified from previous study (Khine Hsu Wai, 2018), the standard essential safety requirements of street foods by WHO (1996), basic steps to improve safety of street-vended food by WHO and FAO (2010) and regional code of hygienic practice for street vended foods in Asia by Codex Alimentarius (2017) (WHO, 1996, WHO, 2010, Alimentarius, 2017).

For structured questionnaires, it contained 3 parts:

1. General characteristics
2. Food safety training information
3. Knowledge related to food safety

1.General characteristics

General characteristics of the sampling group contained 5 questions: age, sex, education, ethnicity, monthly income.

2.Food safety training

This section contained 5 questions: FDA training, other training, times, date of last training, certificate.

3. Knowledge related to food safety

This section contained 3 parts with 21 questions with “yes” and “no” answers. There were 11 questions for knowledge about foodborne disease and the cause of foodborne diseases and comprised.

And there were 6 questions for Knowledge about personal hygiene and 4 for food preparation and storage hygiene of vendor which might be the cross-contaminated process by means of host, agent and environment.

For structured close ended questionnaire were with “yes” and “no” in knowledge questions. The score was categorized as “1” for correct answer and “0” for incorrect answer. After the survey, correct answers of these knowledge related to food safety have been given to the participants. Score of each question has been summed up for total score and vary from 0 to 21. Bloom’s cut off point was used for classification of knowledge score into 3 levels as follow.

- Poor food safety knowledge (0%-59%): Score 0 – 12
- Moderate food safety knowledge (60% - 80%): Score 13 – 17
- Good food safety knowledge (81% - 100%): Score 18 – 21

For Observational checklist:

This observational checklist adopted from previous study, WHO guidelines and Codex Alimentarius 2017 guideline for street food. This checklist was mainly structured for checking environmental sanitary conditions, and food handlers’ hygienic practices. It contained three parts:

1. Environmental hygiene
2. Personal hygiene
3. Food handling, storage and preparing hygiene

1. Environmental hygiene

The vending environmental sanitary conditions were observed by part I with 9 checklists of observational checklist. Detail included the accessibility of water, garbage disposal management, and vending establishment's sanitation.

2. Personal hygiene of food handlers

This section (part II) contained 5 checklists: well-kept finger nails, wearing cooking cap and apron, wearing ornaments, presence of skin lesion.

3. Food handling, storage and preparing hygiene

This section (part III) contained 9 checklists about how the vendors practice on food handling, storage and preparing hygiene.

The practice was observed by the part I, II and III of observational checklist with 23 checklists: 9 checklists for environmental hygiene, 5 checklists for personal hygiene and 9 checklists for food handling, storage and preparing hygiene.

For structured and validated observational checklist was with yes and no practices questions. The score was categorized as "1" for correct answer and "0" for incorrect answer. After the survey, correct answers of these vending practices of food handlers were checked by the participants

Score of each checklist was summed up for total score and vary from 0 to 23. Food safety practice level was categorized into two levels as lower or equal to the median and greater than the median.

3.6 Sample size

All 158 registered street food stalls of Municipal department of Taunggyi Township were included in this study.

Inclusion and exclusion criteria

Inclusion criteria

- Street food stores registered to Taunggyi Municipal Department
- Subjects were main cook who prepare the food most in the store
- Both genders with age ≥ 18 years old at the time of data collection and willing to participate
- Agreed to participate with a signed inform consent
- Subjects who able to communicate in Myanmar language

Exclusion criteria

- The vendors who were hawkers and do not sell in Taunggyi Township.

3.7 Sampling Technique

Taunggyi Township was chosen as the study location according to the high rank of food borne-diseases and diarrheal diseases in Myanmar. In this study, all registered street food stores in Taunggyi Municipal Department were selected to avoid missing subjects because all of these stores were permanently operated around the markets. The unregistered stores were excluded according to their characteristics that moving around within the Township.

Sampling Frame

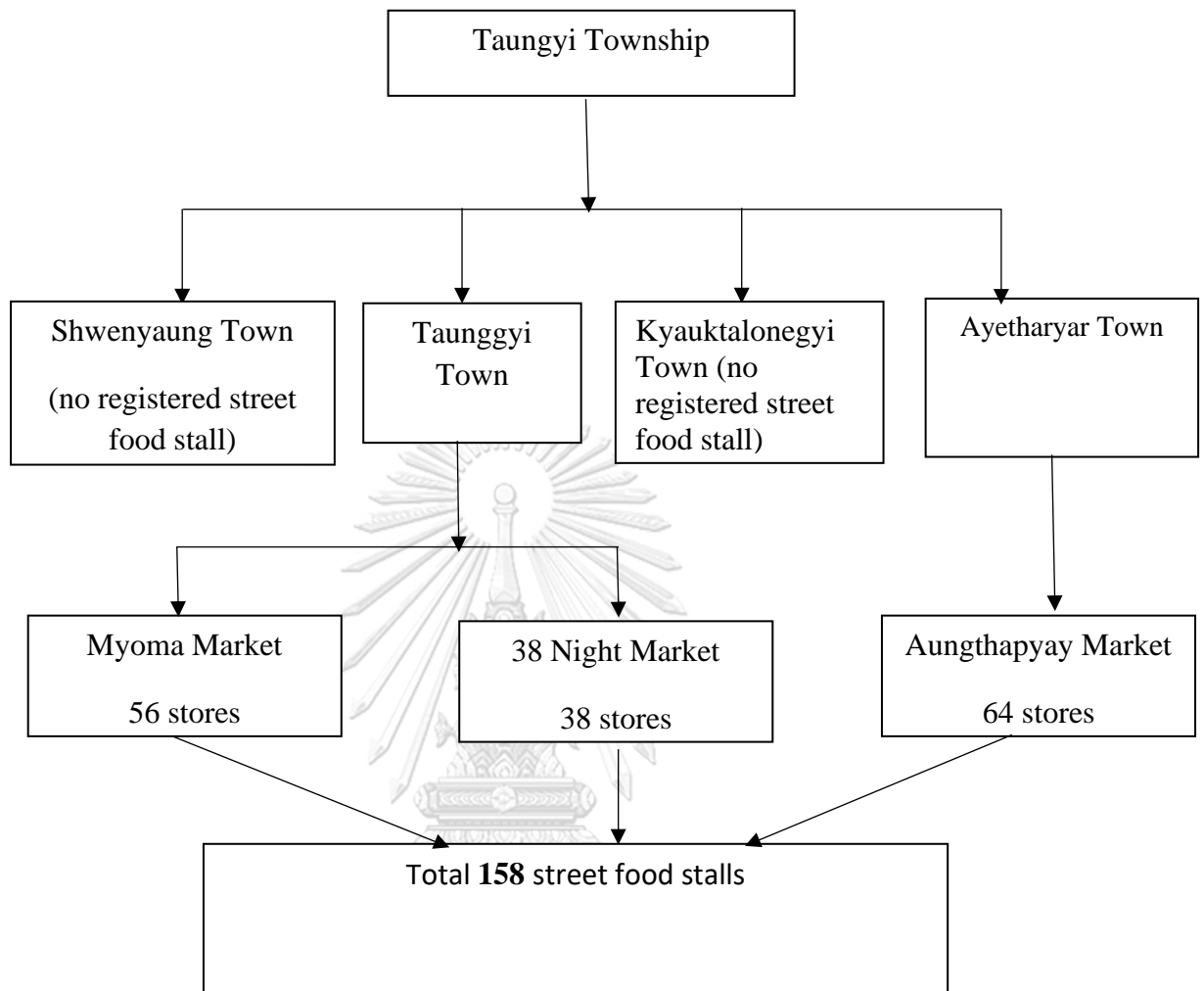


Figure 3 Sampling process

All registered street food stores in Taunggyi Municipal Department were selected purposely. One vendor from one registered street food stall who cooked and prepared mainly were selected for this study. The selected vendors must be at least 18 years old.

3.8 Validity and reliability test of the study tools

In the process of designing the items, at first concept of theory, knowledge and practices with regard to the personal hygiene, food handling hygiene of food handlers

and environmental hygiene of vending site were explored from the previous related research, report and document.

Validity

The structured questionnaires in English was produced and reviewed for content validity by College of Public Health Science, Chulalongkorn and scored for each question (+1/0/-1). The Index of Item-Objective Congruence (IOC) was conducted. The questions with score equal or less than 0.5 were revised or deleted accordingly. After the revision, the questions were requested to review by three food safety experts (Drs Anchalee Prasansuklarb, Ph.D., Wandee Sirichokchatchawan, Ph.D., MPH, and Pokkate Wongsasuluck, Ph.D, MPH) again for confirmation. The validated questionnaires were translated into Myanmar language.

Pretest and reliability

Prior to actual data collection, a pretest was conducted in 30 samples (not from selected markets) in Taunggyi township with similar characteristics. By using SPSS ver.22, reliability of knowledge questions was tested by Kudar-Richardson formula 20.

3.9 Data Collection

For the data collecting team, the researcher was tried to get assistant interviewers from Taunggyi Township who know well about local street food culture and the researcher gave the training about questionnaire and checklist.

Phase 1: Data collection procedure was started from July.

Phase 2: The researcher, corresponding food safety experts from Chulalongkorn University (Drs Anchalee Prasansuklarb, Ph.D., Wandee Sirichokchatchawan, Ph.D., MPH, and Pokkate Wongsasuluck, Ph.D, MPH) prepared the measurement tools such as questionnaires all together with participants ID, consent form and checklist before the data collection period.

Phase 3: Before face to face interview, the working behaviors and condition of working sites were also observed by the researcher and assistants using observational checklist. The observation was carried out by researcher and assistants.

Phase 4: At the time of data collection period, the researcher and three assistants from local explained the purpose and process of this study to the participants and ensured that participant information will be kept confidentially. And then, distributed information sheets and inform consent to participants who meet the inclusion criteria. Then, the researcher and assistants conducted face to face interview to the participants by using validated questionnaires.

3.10 Data entry and analysis

The questionnaires completed were labelled, coded, and analyzed using SPSS. Descriptive statistics: To examine the participants' socio-demographic characteristics and explain their working actions and condition, their knowledge and experience of food safety in the streets.

Descriptive statistics were used to describe all participants' socio-demographic characteristics and to explain their working activities, working conditions, food safety knowledge and experiences in street food safety.

To determine the level of food safety knowledge and practices of street food vendors, knowledge level was categorized according to Bloom's cut-off point into 3 levels: low (<60%), medium (60-80%), high (>80) (Rahman et al., 2012). Food safety practice level was categorized into two levels as lower or equal to the median and greater than the median.

The association between knowledge and practices of food safety and other variables were evaluated using Chi-square and Fisher's exact test. Statistical significance was at $p < 0.05$. Moreover, the significant independent variables in Chi-square test were examined with multiple logistic regression in order to describe the predictor variables for dependent variables with 95% confidence intervals for adjusted

odd ratios. All statistical analyses were performed using IBM SPSS Statistics for Windows, version 25 (IBM Corp., Armonk, NY, USA).

3.11 Ethical consideration

The study protocol was approved by the University of Public Health-Institutional Review Board (UPH-IRB) which is one of the major research centers of Myanmar. The researcher also passed the permission of Taunggyi Municipal Department and FDA department to conduct the study in the Taunggyi Township area. The anonymity and confidentiality of respondent were maintained. The respondents were informed that they can refuse to participate in the study at any time. Each respondent provided signed informed consent to participate in this study.



CHAPTER IV

RESULTS

This cross-sectional study was done in the markets that have registered in the Taunggyi Municipal Department within Taunggyi Township. These markets were Myoma market, 38-night market, and Aungthapyay market. In total, 158 street food stalls were observed by observational checklist and 158 vendors from these street food stalls were face-to-face interviewed using validated structured questionnaires.

4.1 Demographic characteristics

The characteristics of street food vendors are described in Table 1. The age group was divided into 3 categories includes young adults (18-35 years), middle-aged adults (36-55 years), and older adults (≥ 56 years). The mean age was 36.8 ± 7 (mean \pm SD) with the minimum age of 19 years old and maximum age of 52 years old. Most participants are the middle-aged adults between 36 to 55 years (68.4%). More than half of participants in this study are male ($n = 96$, 60.8%).

We divided the educational attainment into 4 categories. The largest component of participants attained high school education (32.9%), while the smallest group is the middle school level (19.6%). In Taunggyi Township, population are mixed with different ethnic groups. Majority of participant in our study are Burma (39.2%), and Shan (34.2%), and the rest are the combination of other ethnic group (26.6%). Among the participants, almost 90% of the vendors earned more than 400,000 MMK (approximately 288 USD\$) while only 7% earned between 200,001 and 300,000 MMK (approximately between 133 USD\$ and 200 USD\$), and about 6.3% earned between 300,001 and 400,000 MMK (approximately between 20 USD\$ and 266 USD\$). Detail information and characteristics of participants are listed in Table 4.1.

Table 1 Socio-economic status of participants (N = 158)

Characteristics	n (%)
Age	
Young Adults (18-35 yrs)	50 (31.6)
Middle-aged Adults (36-55 yrs)	108 (68.4)
Mean \pm SD [Min-Max]	36.8 \pm 7.1 [19-52]
Sex	
Male	96 (60.8)
Female	62 (39.2)
Education	
Middle School	31 (19.6)
High School	52 (32.9)
College	32 (20.3)
Graduated	43 (27.2)
Ethnic	
Burma	62 (39.2)
Shan	54 (34.2)
Others	42 (26.6)
Monthly Income (1 US\$ = 1500 Kyat)	
200,001 – 300,000 Kyat	11 (7.0)
300,001 – 400,000 Kyat	10 (6.3)
> 400,000 Kyat	137 (86.7)

4.2 Food safety training

Among the participants, most of the participants had never attended any food safety training (81%) and only 30 participants attended food safety training. Among the participants who attended the food safety training, all got training from (FDA) (19%). Among them, 10 participants also attended the training by other organization

so that they got the food safety training for two times. Furthermore, 10 (6.3%) participants completed the last training in 2020 and 20 (12.7%) participants in 2019. In which, only 10 participants had the certificate of food safety training (6.3%). More detail information is listed in Table 2.

Table 2 Food safety training of the participants

Food safety training	n (%)
Attended the food safety training by FDA	
Yes	30 (19.0)
No	128 (81.0)
Attended the food safety training by other organization	
Yes	10 (6.3)
No	148 (93.7)
Times of getting food safety training	
0 time	128 (81.0)
1 time	20 (12.7)
2 times	10 (6.3)
Year of last training	
N/A	128 (81.0)
2019	20 (12.7)
2020	10 (6.3)
Having food safety training certificate	
Yes	10 (6.3)
No	148 (93.7)

4.3 Level of food safety knowledge and food safety practice

There were two measurements for street food safety in this study. Validated structured questionnaires for face to face interview were used to study the food safe knowledge of street food vendors and vendors' food safety practice was checked by observing with observational checklist. Food safety knowledge and food safety practice scores of the participants are described in Table 3.

There were 21 items to assess the food safety knowledge of the participants. The knowledge score of participants ranged from 16 to 21 and the mean knowledge score of the participants was 19.9 ± 1.4 (mean \pm SD).

Regarding the food safety practice level, there were 23 items to assess the food safety practice of the participants (total score = 23). The practice score ranged from 10 to 21 with the median score of 15.

Table 3 Food safety knowledge and food safety practice scores of the participants

Variables	Mean \pm SD	Minimum Score	Maximum Score
Knowledge	19.9 ± 1.4	16	21
Practice	15.3 ± 2.8	10	21

Food safety knowledge of the participants was categorized into three groups; poor (0-12), moderate (13-17) and good (18-21) by Bloom's cutoff points. Majority of participant had good knowledge (93.7%) about foodborne disease and the cause of foodborne disease, personal hygienic practice, food handling, preparation and storage practice. Among the 158 participants, only 10 (6.3%) participants had moderate knowledge, while there was no participant had poor knowledge as shown in Figure 4.

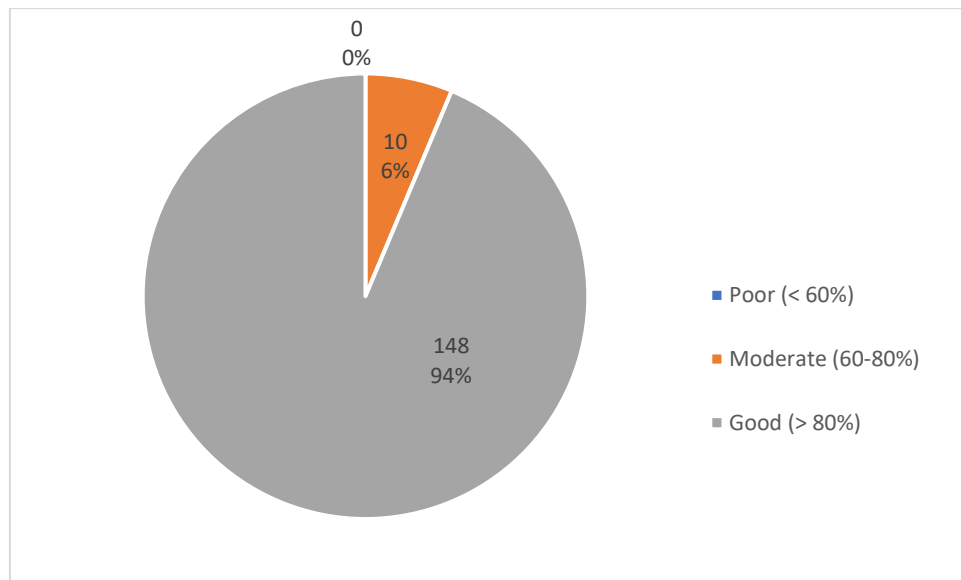


Figure 4 Level of food safety knowledge of the participants

Food safety practice score of the participants was categorized into two groups i.e. less than or equal to median score and greater than median score. There were 93 (58.9%) participants had practice score less than or equal to median and 65 (41.1%) participants had score greater than median as shown in Figure 5.

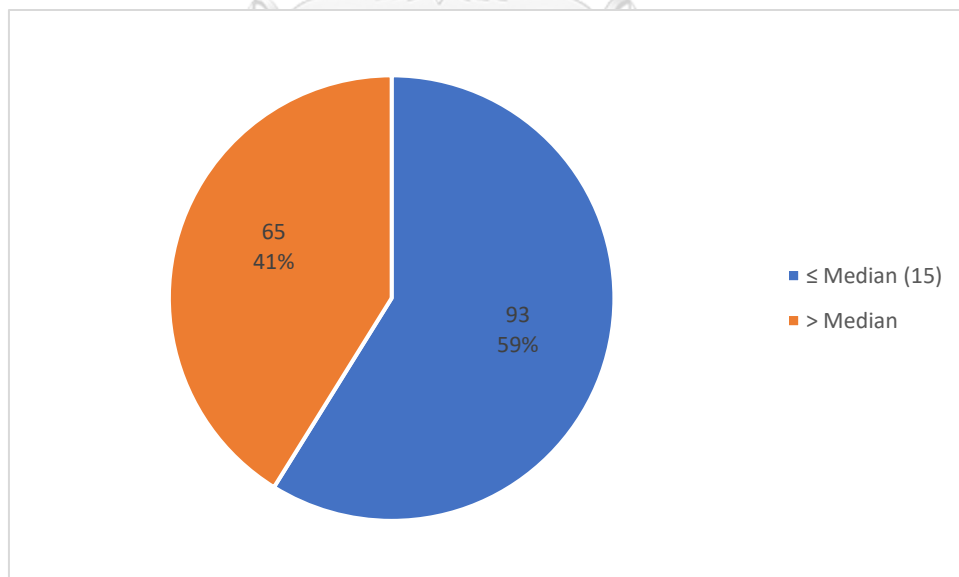


Figure 5 Level of food safety practice of the participants

4.4 Knowledge related to Food safety

This section consisted of three parts;

- (A) Knowledge about foodborne disease and the cause of foodborne disease
- (B) Questions related to personal hygienic practice of street food vendors
- (C) Questions related to food handling, preparation and storage practices

(A) Knowledge about foodborne disease and the cause of foodborne disease

Knowledge about foodborne disease and the cause of foodborne disease is composed of 11 items of assessment. It was found that all participants correctly answered that food contamination might be caused by the dirty hands, by using contaminated water, by using contaminated raw ingredients, by the contamination on the surface for food preparation and by the food handlers with foodborne diseases. Moreover, all of them correctly identified that diarrhea could be caused by consuming contaminated food. The vast majority of the respondents (93.7%) knew that dysentery could be caused by consuming contaminated food. Almost three fourths of the respondents (74.7%) correctly answered that food poisoning could be caused by consuming contaminated food. More than 80% of the respondents correctly knew that viral hepatitis A and typhoid could be caused by consuming contaminated food, while 86.7% of them answered that food-borne diseases could be transmitted by the fly. Therefore, almost all of questions related to the knowledge about foodborne disease and the cause of foodborne disease answered correctly by the participants as shown in Table 4.

Table 4 Knowledge about foodborne disease and the cause of foodborne disease

	Items	Correct Answer n (%)	Incorrect Answer n (%)
1	The dirty hands may cause food contamination.	158 (100%)	0 (0%)
2	Food contamination may be caused by using contaminated water.	158 (100%)	0 (0%)
3	Food contamination may be caused by use of contaminated raw ingredients.	158 (100%)	0 (0%)
4	Food contamination may cause from the contamination on the surface for food preparation.	158 (100%)	0 (0%)
5	Food handlers with foodborne diseases such as diarrhea, jaundice, hepatitis A, skin lesions may cause food contamination	158 (100%)	0 (0%)
6	Diarrhea is a disease which can caused by consuming contaminated food.	158 (100%)	0 (0%)
7	Dysentery is a disease which can be caused by consuming contaminated food.	148 (93.7%)	10 (6.3%)
8	Food poisoning is a disease which can be caused by consuming contaminated food.	118 (74.7%)	40 (25.3%)
9	Viral hepatitis A is a disease which can be caused by consuming contaminated food.	128 (81%)	30 (19%)
10	Typhoid is a disease which can be caused by consuming contaminated food.	127 (80.4%)	31 (19.6%)
11	Food-borne diseases can be transmitted by the fly.	137 (86.7%)	21 (13.3%)

(B) Questions related to personal hygienic practice of street food vendors

Table 5 describes the knowledge related to personal hygienic practice of street food vendors by 6 items of assessment including about hand washing, gloves wearing and using hand towel. All participants knew that hand washing is necessary before preparing food, after coming back from toilet, and after moving refuse. Likewise, they all knew that hand washing with soap could only prevent transmission of disease from hand to food. The vast majority of the respondents (93.7%) knew that the gloves should be removed after one time used, while all of them answered that the hand towel should be washed every day.

Table 5 Knowledge related to personal hygienic practice of street food vendors

	Item	Correct Answer n (%)	Incorrect Answer n (%)
1	Hand washing is necessary before preparing food.	158 (100%)	0 (0%)
2	Hand washing is necessary after coming back from toilet.	158 (100%)	0 (0%)
3	Hand washing is necessary after moving refuse.	158 (100%)	0 (0%)
4	Hand washing with soap can only prevent transmission of disease from hand to food.	158 (100%)	0 (0%)
5	The gloves should be removed after one time used.	148 (93.7%)	10 (6.3%)
6	The hand towel should be washed every day.	158 (100%)	0 (0%)

(C) Questions related to food handling, preparation and storage practices

Knowledge related to food handling, preparation and storage practices of the participants assessed by 4 items are described in Table 6. It was found that only 22 respondents (86.1%) answered incorrectly that meat and vegetables could be stored together. All participants knew that cooked meat/vegetables and raw meat/vegetables should be stored separately, and surface of cutting board had to be washed before and after using it.

Table 6 Knowledge related to food handling, preparation and storage practices

	Items	Correct Answer n (%)	Incorrect Answer n (%)
1	Meat and vegetables can be stored together.	136 (86.1%)	22 (13.9%)
2	Cooked meat/vegetables and raw meat/vegetables should be stored separately.	158 (100%)	0 (0%)
3	Washing the surface of cutting board before cutting the food is necessary.	158 (100%)	0 (0%)
4	Washing the surface of cutting board after cutting the food is necessary.	158 (100%)	0 (0%)

4.5 Food Safety practice

The food safety practice of the respondents was assessed by using the observational check-lists containing three parts namely;

- (I) Environmental hygiene
- (II) Personal hygiene
- (III) Food handling, storage and preparing hygiene

(I) Environmental hygiene

The environmental hygienic practices of the respondents were observed by the check-list consisting of 9 items as presented in Table 7. This study found that 72.2% of the vending stalls were not protected from sun, wind and dust distinctly. Although the environment around the vending sites of all respondents were not near from dump site or toilet facilities, only a few numbers (6.3%) of vending stalls had basin, soap or towel. Additionally, more than half (53.8%) of the vending stalls had clean service table and surrounding. Most of the vending stalls (87.3%) didn't have evidence of disease vectors in premises, while 79.7% of them had access to potable water or tap water supply and 54.4% of vendors didn't reuse the water to clean utensils or other purpose. Regarding the garbage disposal, 106 street food stalls didn't have garbage container with lid (67.1%), while all vendors disposed the garbage at the particular site.

Table 7 Environmental hygiene

	Items	Correct n (%)	Incorrect n (%)
1	Is vending stall protected from sun, wind and dust? (All criteria need to be met)	44 (27.8%)	114 (72.2%)
2	Is the environment around the vending site near from dump site or toilet facilities? (Can smell or see means near)	158 (100%)	0 (0%)
3	Is vending stall presence of basin/soap/towel? (All criteria need to be met)	10 (6.3%)	148 (93.7%)
4	Does vending stall have clean service table and surrounding?	85 (53.8%)	73 (46.2%)
5	Does vending stall have evidence of disease vectors such as fly, mouse, cockroach, etc in premises?	138 (87.3%)	20 (12.7%)

	Items	Correct n (%)	Incorrect n (%)
6	Does vending stall have access to water supply such as potable water or tap water for activities like cleaning, washing utensils and etc?	126 (79.7%)	32 (20.3%)
7	Does vendor reuse the water to clean utensils or other purpose?	86 (54.4%)	72 (45.6%)
8	Does vending stall have garbage container with lid?	52 (32.9%)	106 (67.1%)
9	Does vendor dispose the garbage at the particular site?	158 (100%)	0 (0%)

(II) Personal hygiene

The personal hygienic practices of the respondents were observed by the check-lists consisting of 5 items including well-kept fingernails, covering the hair with cooking cap, wearing the ornaments and apron, and having undressed skin lesions. Detail information is presented in Table 8. In this study, although all the respondents had well-kept fingernails, only more than half (53.8%) of the respondents covered the hair with cooking cap. Moreover, the vast majority (93%) of the respondents didn't wear ornaments and (93.7%) of them didn't have undressed skin lesion. Moreover, almost three fourths (74.1%) of the respondents wore apron.

Table 8 Personal hygiene

	Items	Correct n (%)	Incorrect n (%)
1	Does vendor have well-kept fingernails?	158 (100%)	0 (0%)
2	Is vendor covering the hair with cooking cap?	85 (53.8%)	73 (46.2%)
3	Does vendor wear ornaments?	147 (93%)	11 (7%)
4	Does vendor wear apron?	117 (74.1%)	41 (25.9%)
5	Does vendor have undressed skin lesion?	148 (93.7%)	10 (6.3%)

(III) Food handling, storage and preparing hygiene

Food handling, storage and preparing practices of the respondents were observed by the check-lists containing 9 items as presented in Table 9. This study found that despite 60.1% of the vendors cleaned the surface before preparing food, 53.8% of them served with bare hands. Moreover, 66.5% of total participants handled money while serving food and 80.4% of them cleaned the utensils. Although 74.1% of the vendors stored drinking water with lid, 58.9% of them didn't cover leftover foods with lid. Additionally, about one third of them (32.3%) didn't protect the cooked and displayed foods from flies and rodents. As a good fact, all of the vendors protected the storage of food from flies and rodents. But, over one fifth of the vendors (26.6%) used the mouth to blow air into polythene bags.

Table 9 Food handling, storage and preparing hygiene

	Items	Correct n (%)	Incorrect n (%)
1	Does vendor clean the surface before preparing food?	95 (60.1%)	63 (39.9%)
2	Does vendor serve with bare hands?	73 (46.2%)	85 (53.8%)
3	Is vendor handling money while serving foods?	53 (33.5%)	105 (66.5%)
4	Does vendor clean the utensils?	127 (80.4%)	31 (19.6%)
5	Does vendor store drinking water with lid?	117 (74.1%)	41 (25.9%)
6	Does vendor cover leftover foods with lid??	65 (41.1%)	93 (58.9%)
7	Are cooked and displayed food protected from flies and rodents as mouse, cockroach, and etc?	107 (67.7%)	51 (32.3%)
8	Is storage of food protected from flies and rodents such as mouse, cockroach, etc?	158 (100%)	0 (0%)
9	Does vendor use mouth to blow air into polythene bags?	116 (73.4%)	42 (26.6%)

4.6 Association between socioeconomic status and knowledge related to food safety of the respondents

Outcomes variables and independent variables were analyzed with Chi square test to find out the association between them. The association between food safety knowledge and socioeconomic status of the participants were analyzed as shown in Table 10. The knowledge levels were recategorized to two groups as $\leq 80\%$ and $> 80\%$ because there was no participant in poor knowledge category. There were 10 (6.3%) participants in knowledge score of $\leq 80\%$ group and 148 (93.7%) in $> 80\%$ group.

The analysis revealed that male respondents were likely to have better knowledge score than female ($p < 0.001$).

Moreover, education was significantly associated with food safety knowledge of the participants ($p < 0.001$).

Furthermore, there was a significant association between ethnic and knowledge of the participants ($p < 0.001$). The result revealed that Shan people were likely to have better knowledge score than Burma and other people. However, there was no association between age, monthly income and knowledge of the participants.

Table 10 Association between food safety knowledge and demographic characteristics and socioeconomic status

Characteristics	Knowledge		χ^2	df	p value
	≤ 80%, n (%)	> 80%, n (%)			
Age					
Young Adults	2 (20.0)	48 (32.4)	0.669	1	0.506
Middle-aged Adults	8 (80.0)	100 (67.6)			
Sex					
Male	0 (0)	96 (64.9)	16.530	1	< 0.001
Female	10 (100)	52 (35.1)			
Education					
Middle School	0 (0)	31 (20.9)	21.762	3	< 0.001
High School	10 (100)	42 (28.4)			
College	0 (0)	32 (21.6)			
Graduated	0 (0)	43 (29.1)			
Ethnic					
Burma	10 (100)	52 (35.1)	16.530	2	< 0.001
Shan	0 (0)	54 (36.5)			
Others	0 (0)	42 (28.4)			
Monthly Income (1 US\$ = 1500 Kyat)					
200,001 – 300,000 Kyat	0 (0)	11 (7.4)	1.636	2	1.000
300,001 – 400,000 Kyat	0 (0)	10 (6.8)			
> 400,000 Kyat	10 (100)	127 (85.8)			

Note: Fisher's exact test with significant level $p < 0.05$

4.7 Association between socio-economic status and food safety practice of the respondents

Table 11 shows the association between food safety practice and demographic characteristics and socio-economic status. The results revealed that education was associated food safety practice ($p < 0.001$).

The association between ethnic and practice of the participants was also significant with ($p < 0.001$).

Additionally, monthly income was significantly associated with food safety practice of the participants ($p < 0.001$). However, there was no association between age, sex and food hygienic practice of the participants.

Table 11 Association between food safety practice and demographic characteristics and socioeconomic status

Characteristics	Practice		χ^2	df	p value
	≤ Median, n (%)	> Median, n (%)			
Age					
Young Adults	27 (29.0)	23 (35.4)	0.714	1	0.398 ^a
Middle-aged Adults	66 (71.0)	42 (64.6)			
Sex					
Male	52 (55.9)	44 (67.7)	2.226	1	0.136 ^a
Female	41 (44.1)	21 (32.3)			
Education					
Middle School	20 (21.5)	11 (16.9)	42.471	3	< 0.001 ^b
High School	30 (32.3)	22 (33.8)			
College	32 (34.4)	0 (0)			
Graduated	11 (11.8)	32 (49.2)			
Ethnic					
Burma	51 (54.8)	11 (16.9)	50.931	2	< 0.001 ^a
Shan	11 (11.8)	43 (66.2)			
Others	31 (33.3)	11 (16.9)			
Monthly Income (1 US\$ = 1500 Kyat)					
200,001 – 300,000 Kyat	11 (11.8)	0 (0)	13.452	2	< 0.001 ^b
300,001 – 400,000 Kyat	9 (9.7)	1 (1.5)			
> 400,000 Kyat	73 (78.5)	64 (98.5)			

Note: a = Chi square test, b = Fisher's exact test, significant level $p < 0.05$

4.8 Association between food safety training and knowledge related to food safety of the respondents

There were no association between food safety training and food safety knowledge of the respondents as described in Table 12.

Table 12 Association between food safety knowledge and food safety training

Food Safety Training	Knowledge		χ^2	df	p value
	$\leq 80\%$, n (%)	$> 80\%$, n (%)			
FDA Training					
Yes	0 (0)	30 (20.3)	2.502	1	0.210
No	10 (100)	118 (79.7)			
Other Training					
Yes	0 (0)	10 (6.8)	0.721	1	1.000
No	10 (100)	138 (93.2)			

Note: Fisher's exact test with significant level $p < 0.05$

4.9 Association between food safety training and food hygienic practice of the respondents

Table 13 shows association between food safety training and food safety practice of the respondents. The results revealed that there was no association.

Table 13 Association between food safety practice and food safety training

Food Safety Training	Practice		χ^2	df	p value
	≤ Median, n (%)	> Median, n (%)			
FDA Training					
Yes	18 (19.4)	12 (18.5)	0.020	1	0.888 ^a
No	75 (80.6)	53 (81.5)			
Other Training					
Yes	4 (4.3)	6 (9.2)	1.568	1	0.320 ^b
No	89 (95.7)	59 (90.8)			

Note: a = Chi square test, b = Fisher's exact test, significant level $p < 0.05$

4.10 Association between knowledge related to food safety and food hygienic practice of the respondents

Table 14 shows the association between knowledge related to food safety and food safety practice of the respondents. The result revealed that there was a significant association between knowledge and practice of the respondents ($p \leq 0.05$).

Table 14 Association between knowledge and practice

Variables	Practice		χ^2	df	p value
	≤ Median, n (%)	> Median, n (%)			
Knowledge					
≤ 80%	10 (10.8)	0 (0)	7.461	1	0.006
> 80%	83 (89.2)	65 (100)			

Note: Fisher's exact test with significant level $p < 0.05$

Additionally, although multiple logistic regression test was performed, we didn't find any association.

CHAPTER V

Discussion

A cross-sectional study was conducted among all street food vendors that were registered with Taunggyi Municipal Department within Taunggyi Township, Myanmar in 2020. We successfully conducted face-to-face interview all street food vendors (N=158) using validated structured questionnaires to study their food safety knowledge. Additionally, the observational check-list was used to check their food safety practice.

In this study, we observed that the middle-aged adults between 36 to 55 years was the dominant group (68.4%). The age distributions of the street food vendors varied among studies conducted in different countries. Our observation was similar to the studies done in Nay Pyi Taw, Myanmar (Khine Hsu Wai, 2018) and South Africa where middle-aged adults more considered street food vending as a suitable job (Campbell, 2011).

Male street food vendors were exceeded than female in Taunggyi Township which is quite similar to the study of Muinde and Kuri that studied hygienic and sanitary practice of street food vendors during 2005 in Nairobi (Muinde and Kuria, 2005) and also the studies of Benny-Olliviera and Badrie and Choudhury (Benny-Olliviera and Badrie, 2007, Choudhury et al., 2011). Moreover, the previous research that studied profile of street food vendors in Asian countries explained that men were likely to be more dominant in food selling industry in Asia (Bhat and Waghray, 2000). However, the opposite result was found in the study done by Khine Hsu Wai in Nay Pyi Taw, Myanmar which reported that female vendors were more occupied in street food vending also in other studies (Mensah et al., 2002, Donkor et al., 2009, Chukuezi, 2010, Muyanja et al., 2011, Khine Hsu Wai, 2018).

Regarding to the education of participants, we found that high school level is the common educational level attained among the street food vendors. Similar observation also found in the previous study conducted in Nay Pyi Taw, Myanmar which reported that 30% of vendors educated from high school (Khine Hsu Wai,

2018) and a study in Phillipine which claimed that 44.5% of the participants attained secondary school (Patricia V. Azanza, 2000). In our study, there was no participant under the middle school education and thus all of the participants were appropriate educated. This result was different with a study conducted in Nay Pyi Taw that reported 30.5% of vendors had education under middle school level. Many participants attained the higher educational level maybe because of this group of people have more opportunity to do own private business than in the company, government organization which earn lower income than own business in Myanmar (MyJob, 2018). The educational levels of street food vendors were found differently among countries which may results from the economic status and basic educational requirement of those countries (Muinde and Kuria, 2005, Omemu and Aderoju, 2008, Campbell, 2011).

This study found that the vast majority (81%) of the street food vendors had never attended any food safety training. Similarly, most of the vendors in Nay Pyi Taw, Myanmar didn't attend any food safety training (Khine Hsu Wai, 2018). The percentage of untrained vendors in this study was much higher than the finding of Sihombing in Indonesia during 2018 and Campbell in South Africa during 2011 where 52.6% and 48.5% of untrained respondents respectively (Campbell, 2011, Sihombing et al., 2018). In Myanmar, having food safety training was considered as giving education twice a year and issuing license by Health Department of City Development Committee (CDCs) and (FDA) (Khine Hsu Wai, 2018). Nevertheless, these food safety training are not mandatory to attend for getting license. A case study about street food control in Myanmar stated that according to the interview, restaurants and school food stalls are under supervision of CDCs, FDA and regional health department, with regards to licensing, health certificate and food safety training for food handlers. However, street food stalls were still excluded from these issues, though CDCs are responsible for sanitary control of street foods, according to the City Development Committee Management By-law (1999) (Waiyeelinn and Yamao, 2014). Therefore, although street food stalls were registered, they were not mandatory to have food safety training certificate or medical certificate and they were just listed in street food authority. This finding pointed out the need for relevant food safety

training among food processing personnel in Taunggyi Township not only from FDA but also from other organizations. Moreover, the registration process of street food stalls should be improved with essential requirements such as food safety training certificate, medical certificate and basic infrastructure of vending unit.

Although Taunggyi is the hometown of Shan people, 62 participants were claimed as Burma race (39.2%), and 54 participants were Shan people (34.2%). This could be due to internal migration for job opportunity in Myanmar (MIMU, 2019).

With regards to the vending income, almost all of the vendors (86.7%) in this study showed their income more than 400,000 MMK (approximately 288 USD\$) per month which is over than the average basic income rate of individual in Myanmar, since Taunggyi city is one of the tourist interested city in Myanmar due to its famous Shan's style foods and Tan Saung Taing festival, playing a crucial role of street food vending (MyJob, 2018).

Mean score for knowledge was 19.9 ± 1.4 (max score was 21), indicating that the respondents had an acceptable level of knowledge on food safety. As a strange and distinct part of this study, nearly all of participants had good level of food safety knowledge and we did not find any participants with poor knowledge. This is possible due to Covid-19 pandemic condition in which the government gave the massive health education program including personal hygiene and that might lead to some influence on vendors' knowledge. Likewise, previous study conducted in Myanmar in 2014 showed similar statement that most of the vendors surveyed in Yangon City possessed a good knowledge of health and personal hygiene, though there was a need to put their knowledge into practice (Waiyeelinn and Yamao, 2014). In contrast, the finding of this study was different from the study done in Nay Pyi Taw, Myanmar which reported that about one third of the respondents had low level of knowledge (Khin Hsu Wai, 2018). The inconsistent finding was also revealed in the study during 2012 in Malaysia for 36.8% of respondents had good knowledge (Rahman et al., 2012). By comparing results, our street food vendors generally had good level of food safety knowledge which might be due to well access to education programs and good advocacy via the medias such as online, TV, radio, etc.

Although most of the vendors had overall good knowledge level, the most incorrect answers were the questions about the foodborne disease. Some participants did not think including food poisoning and dysentery are diseases which can be caused by consuming contaminated food and 20% of vendors did not know viral hepatitis A and typhoid are diseases which can be caused by consuming contaminated food. A few participants thought food-borne diseases cannot be transmitted by the fly and the gloves should not be removed after one time used because they might think about the cost of using gloves only for one time. This research finding is very similar with another study of Khine Hsu Wai in Myanmar during 2018 except all participants have well known about using of gloves to remove after one time used (Khine Hsu Wai, 2018). Another almost similar finding was in the study in Ilala Municipality (Mlay, 2018). These findings indicated that although the participants well know basic food safety knowledge, most of them had poor knowledge in food borne illnesses. Therefore, public education about food borne diseases should be focused to institutional food handlers and increased their awareness in seriousness of food borne diseases (Al-Shabib et al., 2016). As distinct and strange finding for which 21 participants thought the flies cannot transmitted foodborne diseases, the socioeconomic status of all these respondents was very low such as their education level was middle school and most of them were old age above 50 years. This indicated that public food safety education programs may need more improvement for all levels of socioeconomic status.

Regarding food safety practice, our participants achieved the median score of 15 out of 23, and 41% of them had lower score than the rest of participants. It is possible that this poorer score arises from investment or financial decision of individuals as profit incentive might be greater than good practices. Another factor contributing to poor score for food safety practices could be caused by lax regulation of the authority. Although food safety training was implemented and encouraged, the number of vendors who attend the training was very low and food safety inspection and regulations were inadequate. The FDA or local authorities did not closely monitor street food vendors to ensure that they followed practice guidelines. Nearly similar percent of practice level was found in another study done in Myanmar which revealed

that 63% of vendors had poor practice (Khine Hsu Wai, 2018). Nevertheless, considering those pitfalls, most participants in our study still scored higher than average compared to other studies (Rahman et al., 2012, Sihombing et al., 2018).

The researcher checked the environmental, personal and food handling hygiene by means of observation. The sanitation of the vending environment in Myanmar is mostly influenced by sorts of the street food, basic infrastructure, cultural factors and government's support. Although the characteristic of the stall is defined as the compartment enclosed by three sides for the sale of goods in a market or large covered area, most of the stalls in the night markets in this study, were constructed only by the top shelter (Tinker, 1997). Some stalls however openly displayed their vending without covering anything from sun, wind and dust. This finding indicated that they invested as less as possible in their business for their profit.

As the target places in this study were the night markets, there are particular damp sites and toilets in the market area. Therefore, all street food vending stalls in this study were situated in a particular area where was quite far from the dump sites and toilets. Almost all vending stalls were absent of basin/soap/towel for wash by consumer. The absence of these facilities was mainly influenced by the poor basic infrastructure such as lack of adequate water supply by the authority, narrow space of vending, etc. Moreover, almost half of the street food stalls in this study were not cleaning their service tables and surrounding.

Almost all of the vendors had good practices for protection their foods from disease vectors such as fly, mouse, cockroach, etc., by the use of insecticide sticker panel, candle light and grilles cover while few are still neglected. More than two third of the street food stalls in this study had access to water by means of potable supply which is bringing from home or receiving from resources nearby. However, some stalls are still trading with unacceptable amount of water for the process of cleaning vegetables and utensils.

As the researcher has already mentioned above, the scenario here is that tap water is not supplied by the street food authority and therefore the availability of clean

water is not quite plentiful in this sector. Therefore, almost half of the vendors in this research were reusing their bringing water to clean utensil or other purposes. Furthermore, more than half of the vending did not provide the garbage container with lid. The vendors placed their garbage in the open containers and finally carried to the particular dump sites in the market area at the end of the vending time. Therefore, street food infrastructure should be improved and regular inspection should be performed by street food authority from Taunggyi Township.

With regards to the personal hygiene of the vendors, the researcher observed five practices such as having well-kept fingernails, covering hair with cooking cap, wearing ornaments and apron, and having undressed skin lesion. All vendors were observed cutting their nails well whilst only half of them were covering their hair. Besides, few vendors were wearing ornaments which is the risk factor of food contamination, while almost one third are not wearing apron. However, only 10 out of 158 were observed with undressed skin lesion.

This research also explored about the vendors' handing behaviors during their vending operation. Firstly, they were observed that more than two third of them were handling money while serving and preparation food. Secondly, more than one third of them were not properly cleaning the surface before preparing food. Moreover, more than half of the vendors performed food handing with their bare hand without using gloves. Almost one third of total vendor in this study did not store drinking water for customers by covering with lid and a few numbers did not properly clean the utensils. More than half of the vendors were not covering leftover foods with lid and 32.3% of vendors didn't protect cooked or displayed food from flies and rodents as mouse, cockroach, and etc. although all of them were well keeping their storage foods in the closed or grilles containers in order to protect from disease vectors. Finally, a significant number of vendors (42 out of 158) were still using their mouths to blow air into the polythene bags before packaging the ordered foods. Factors contributing to this could be the lack of training and poor inspection by authority. These findings were almost nearly agreed to the studies of Aung et al., and Khine Hsu Wai in Myanmar (Khine Hsu Wai, 2018, Aung et al., 2019). Therefore, although after some time, we found that there wasn't significant change in food safety practice in

Myanmar. In Addition, similar findings were found in the studies of food safety practice in Parkistan and in Ilala Municipality (Ahmed et al., 2017, Mlay, 2018). Therefore, this study can suggest that vendors' practice on street food safety environmental hygiene, personal hygiene and food handling and storage practice should be promoted among street food vendors in Taunggyi.

Our study reveals that gender, education level and race of the participants were significantly associated with food safety knowledge. However, different results were found in another study done in Myanmar which revealed gender and education were not associated to food safety knowledge (Khine Hsu Wai, 2018). Similar results were also observed in Rahman (2012), who found that Malays people had better knowledge about food safety than Non-Malays and that food safety knowledge score is associated with vendors' education level (Rahman et al., 2012). Likewise, a study in Ho Chi Min city, Vietnam, observed a significant association between educational level and food safety knowledge (Samapundo et al., 2016). In support of this notion, street food vendors in China with lower education level appeared to be less receptive to new hygienic techniques and food sanitation knowledge (Liu et al., 2014). However, there are some inconsistent findings among studies in other geographical areas. A study conducted in Guwahati, Assam, India, reported that education level of vendors had no significant impact on knowledge of food safety (Choudhury et al., 2011). Therefore, region-specific studies are needed to better understand food safety problems based on different norms, natures, and cultural features.

Besides education level, our study also showed that ethnic group as well as monthly income of the participants were also significantly associated with food safety practices. However, different findings were seen in another study in Myanmar which reported that education level and monthly income of vendors were not associated with their practice (Khine Hsu Wai, 2018). This study findings are similar to those from studies conducted in Pakistan and Indonesia which reported that the association between education level of the participants and levels of food safety practices (Ahmed et al., 2017, Sihombing et al., 2018). In contrast, monthly income of food vendors was not associated with their practice in the study done in Ethiopia (Dagne et al., 2019).

Food safety knowledge of the respondents showed a significant association with food safety practices in this study in which street food vendors with high level of food safety knowledge were likely to apply their knowledge to hygienic practices of street food vending. Similar findings were shown by Rahman (2012) and Sihombing (2018). Moreover, Ismail et al., 2016 reported that, in Malaysia, food safety knowledge was the most influential factor that contributed to better hygienic practices of street food vendors (Ismail et al., 2016). The finding indicated that vendors' knowledge can correct to their food handling practices and these practices can also lead to their success in food safety.

Originally, we hypothesized that the training experience should be associated with food safety knowledge and practices. However, we did not observe any association between the two in this study. This might be due to the fact that a high number of street food vendors (81%) had never attended any food safety training. The percentage of untrained vendors in our study was much higher than the finding of Sihombing (2018) in Indonesia and Campbell (2011) in South Africa where 52.6% and 48.5% of respondents were untrained, respectively (Campbell, 2011, Sihombing et al., 2018). Additionally, it is possible that the training might not have provided enough information on food safety practices which consequently resulted in low knowledge and practices scores. Our study was consistent with the study of Rahman and a study in Zimbabwe (Rahman et al., 2012, Ncube et al., 2020). Similarly, among the literatures studied in Myanmar, one Quasi-experimental research for street food in Yangon, revealed that food safety training program as their present intervention, did not increase in actual food safety practice and hygiene, although their knowledge and attitude scores were increased after intervention. The researchers of that study discussed that the vendors did not fully obey the instructions for safety practice from their knowledge (Maung et al., 2017).

Additionally, although further test, multiple logistic regression was performed, we didn't find any association. This may be due to the subject in each category or parameter estimation in two different methods as Chi-square and logistic regression.

Our cross-sectional study was successfully conducted with all street food vendors in Taunggyi Township. As a result, this study can be used as a model to reflect the actual situation of food safety knowledge and practices of the vendors which can provide useful information for local government and community for improvement of street food safety knowledge and practices and sanitary conditions through suitable intervention programs. It will also be informative for lawmakers, legislators, and implementing entities who want to develop realistic strategies to increase the level of compliance with best hygienic practices among street food stalls in the country. From our point of view, one approach would be to close the regulatory gaps and establish new laws and regulations on street food safety, such as standards, guidelines, training.

Although our study reflects current street food safety situation in Taunggyi Township, it should be noted here that this study has some limitations. First, this study was being conducted during the Covid-19 pandemic, and as a result, some safety precautions against Covid-19, such as an increase in government-funded public health education on good hygiene practices, might have influenced the findings in our study. Second, as this study was conducted specifically in Taunggyi Township, Shan State Principal Myanmar, results from this study might not reflect food safety knowledge and practices of street food vendors in other parts of the country where geography and culture are different. Third, although the street food vending experience of vendors can influence their food safety knowledge and practice as a portion, we had to fail to collect this information. Finally, we did not perform the microbial inspection in the food sample, and, therefore, we could not correlate food safety practices to food hygiene.

Recommendation

Health education program of primary health care system should be implemented at the community level to improve street food vendors' knowledge as well as practices. Accessibility of food safety information should be improved by means of easier accessible ways and by drawing their interests with the competitions such as the level of awards and badges of street food vendors according to their hygiene. Additionally, by implementing of such campaigns through the media, not only community level but also national level can be attracted to access food safety information by the consumers. For every food safety education program to vendors, knowledge should be strengthened with more important key messages, especially emphasizing on foodborne diseases, causes and consequences of foodborne illnesses and effectiveness and important of personal hygiene.

Moreover, environmental sanitation also should be promoted to control and prevent food contamination and foodborne outbreaks. Safe water supply and adequate garbage collecting services should be provided by local authority. With a lack of such basic infrastructures, it will be difficult to promote street food vending pattern from the hygienic behaviors to the safety consumption.

Registration process of street food stalls in local authority should be improved including mandatory requirements such as current food safety training certificate, medical certificate and basic infrastructures, etc. Moreover, regulation program should be established such as monthly checking or surprise checking to maintain their food safety status.

Additionally, food safety training by authorities such as FDA and Municipal Department should be implemented and improved together with the specialized course not only by the teaching program but also by practice program like work shop including evaluation test. Moreover, the given food safety training certificate should need to renew every year for registered street food vendors.

Monitoring with laboratory tests to street food sample as microbial surveillance should be additionally implemented together with annual checking

activity for food stalls' sanitary condition and food handlers' health. Quasi-experimental study is required to evaluate the microbial quality of food samples between trained food handlers and untrained food handlers.

Conclusion

This study demonstrated that most of street food vendors Taunggyi Township had good food safety knowledge with less practices. Among sociodemographic factors, gender, education level, and ethnic group of the participants were significantly associated with food safety knowledge while education level, race, and monthly income were significantly associated with food safety practices. Additionally, food safety knowledge of the participants had a significant association with food safety practices.

Food safety practices is essential for guaranteed delivery of hygienic foods to consumers as improper food handling is a major cause of foodborne illness. Our study found that most vendors had good food safety knowledge, but their hygienic practices need an improvement. Therefore, food safety training with specialized courses according to the guidelines is essential for the street food vendors. Regular monitoring and microbial surveillance of street food should also be enforced to increase food hygiene in the food vending industry. Moreover, motivational campaign and food safety advocacy among street food vendors to enhance hygienic practices should be explored and encouraged.

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จุฬาลงกรณ์มหาวิทยาลัย
CHULALONGKORN UNIVERSITY

VITA

NAME Tin Aung Soe Htway
DATE OF BIRTH 20 February 1992
PLACE OF BIRTH Yangon, Myanmar
INSTITUTIONS ATTENDED University of Medicine(2), Yangon
HOME ADDRESS No.1, (D+E), Mingalar Street 1, Shwehninsi Quarter, Mingalardon Township, Yangon



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CHULALONGKORN UNIVERSITY