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ORIGINAL ARTICLE

# Food sanitation of salad vending in the markets of Nay Pyi Taw, Myanmar

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**ABSTRACT**

This was a cross-sectional descriptive study conducted to determine knowledge and hygienic practices of street food vendors, attitude of customers toward vending practices and to find out the factors related to street food "Salad" safety in Nay Pyi Taw, Myanmar. Two structured questionnaires were used to interview 46 vendors and 250 customers, and a set of observational check-list was used for checking vending establishments' sanitation and vendors' practices. Coliforms SI-2 test kits were used to analyze microbial quality of salad from participating vendors. Descriptive results were presented in number and percentages. Chi-square tests and multiple logistic regressions were used to analyze the association between independent and outcome variables. The results revealed that vendor's knowledge was significantly associated with license status that influenced their hygienic practices. However their age was found to be the significant identical factor related to their practices. Further, the microbial test revealed that 69.9% of food samples analyzed was contaminated. The significant factor which had relationship with microbial quality was vendor' s environmental hygienic and food handling practices. From total vending cart observed, 60.9% of samples are poor sanitation establishment. Among the environmental hygienicand food handling practices, proper vending protection method was the factor that mostly influenced microbial quality (p-value <0.01). On the customers' side, both customers' perception on vending practices and awareness on foodborne illness could be predicted by their education level at p-value<0.05. Therefore, authority's administration and interventions should be strictly implemented. Also, food safety knowledge should be provided to unlicensed street food vendors. Awareness campaign especially on foodborne diseases, causes, and their consequences and personal hygienic practices must be conducted.

**Keywords:** food sanitation, salad vending, Myanmar

## INTRODUCTION

Food safety is an essential public health issue and crucial factor of food utilization in all countries. The World Health Organization stated that food borne illness is a major international health problem and an important cause of reduced economic growth.[1] Street food is a major concerned element of food safety issue. These foods are generally prepared under unhygienic conditions and sold at the sites with limited availability of sanitary services, safe water and garbage disposal facilities.[2] Hence, microbial contamination, inappropriate use of food additives and environmental contamination of street foods, stand with a high risk of food poisoning.[3]

"Street-vended foods" has been defined as foods and beverages prepared and sold by vendors in streets and other public places for immediate consumption or consumption at a later time without further processing or preparation.[4] This definition includes fresh fruits and vegetables which are sold in opened market areas as ready for consumption or later consumption. Street foods are widely popularized for their flavors, convenience, low cost and their cultural, traditional and social custom links. According to Food and Agricultural Organization (FAO), street food presents as an important section of food supply chain, as it can provide a vital need of the urban population.[5]

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.[6] A large variety of street food such as meals, drinks and snacks often reflect the local traditional culture in their ingredients, processing, vending methods and consumption. 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.[7,8]

Therefore, many microbiological studies in developing countries including Myanmar, have to explore about microbial quality of street food "Salad" as a high risk food not only for bare hand serving habit but also its uncooked items.[9,10] One pervious study in Myanmar food samples showed coliforms presented in 141 (56.2%) samples and fecal coliforms presented in 132 samples (52.8%) whereas *Escherichia coli* was isolated in 50 out of 250 samples (20%).[11] In this study, therefore the coliforms test was employed to analyze the food contamination together with the vendor resources like, knowledge, practice and vending establishment hygiene.

According to the literatures, food-borne diseases have widely concern with financial effects on individuals, food businesses and even economy of countries. One can lost a large proportions of income due to reduced productivity and expenditures on medical care.[12] Microbiological hazards and foodborne diseases caused an increasingly important global burden of disease of public health problem. World Health Organization reported that South-East Asia region had 150 million causes and 175,000 deaths associated with 22 different foodborne enteric diseases. Moreover, South-East Asia region had 50,000 deaths of children

under five each year and stand as second highest burden of foodborne disease. One person in three in industrialized countries may be affected by foodborne illness each year.[13] In Myanmar, diarrhea is a major cause of morbidity in under five children and stands as the fourth leading cause of morbidity.[14]

The common causal factors leading to poor microbial quality of street food in developing countries are lack of basic infrastructure, potable water, proper storage facilities and lack of knowledge of hygienic practices,[15] Moreover, the improper handling of food handlers 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.

From the consumer point of view, besides, customers could be an important cause for changing vendor's behavior that is the vector of various contaminations. For example, as poor hand washing practices of food handlers often contribute to food borne-illness and outbreaks, hands can be a major risk factor for transmitting microorganism to food and this improper practice can be corrected by awareness of customers as one of the influenced factor.[6] Therefore, a range of personal, social, and environmental factors influence the food handling practices of the sellers and these factors are needed to be addressed in order to change food sellers' behavior.[6]

Since the benefits such as convenience and low prices of street food attract to consumers, they may overlook the aspects of street food safety condition or may have lack of understanding of proper practices by sellers and the potential for foodborne illness.[16] Therefore, the role of consumer becomes predominant as a third partner after food sellers by comprising in risk communication of risk governance framework.[6,17]

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 potable water supplies, washing and waste disposal facilities; difficulty in controlling some street food vendors because of their mobile and temporary nature; insufficient training for inspection personnel; training given did not cover the large number of vendors with poor knowledge on basic food safety measures.[18,19] Therefore, studying about street food safety in Myanmar is essential for some beneficial interventions since a significant proportion of street food vendors still continue their business with a lack of some supervisions whilst most of the vendors with stationery food stalls have been licensed.

## METHODS

### *Data collection*

A cross-sectional study design was used to study microbial quality of "Salad", knowledge and hygienic practices of street food "Salad" vendors and customers' perception toward vending practices in Nay Pyi Taw, Myanmar. Salad called "Lat thoke" in Myanmar, is ready-to-eat food consisting of a mixture of small pieces of food, predominantly raw or cooked vegetables, typically served at room temperature or chilled, usually seasoned with oil, vinegar, or other dressing and sometimes accompanied by meat, fish, or other ingredients. Microbial quality in this study refers to assessment of sanitary quality of street food "Salad" by testing

coliforms bacteria in the salad samples. This study passed ethical approval by IPSR-International Review Board, Mahidol University (COA. No. 2018/02-056), and the Institutional Review Board of Defense Services Medical Research Center (IRB/2018/5). All participants were informed for consent and obtained their agreements. The vendors eligible for study were salad vendors who were 18 years old and above. The respondents who were eligible to respond their perception on vending practices were salad customers aged 18 years and above. Food samples which were included in this study were salads served by street food vendors who were interviewed.

The study area, Nay Pyi Taw is new administrative capital city and estimated total population is 1,160,242.[20] Zabuthri, Pyinmana and Lewe towships were selected to study in this research because these three township had more crowded populations, 540,155 (nearly 50% of the total population) and had biggest markets in the city.

Three townships were purposively selected due to higher population than the other townships. Myoma market and Thapyaykone market, Pyinmana Lan market and Lewe Myoma market were chosen. These four markets were purposively selected because they were the biggest and crowded markets in the city. 12 salad vendors each from Myoma and Thapyaykone markets and 11 salad vendors each from Pyinmana Lan and Lewe Myoma markets were randomly selected among all salad vendors (approximately 20 salad vendors in each market according to anterior observation by researcher). According to anterior observation and interview with salad vendors, approximately about 200-250 customers were coming to buy salad for 10 vendors and about 900-1150 customers were come out for 46 vendors. After that, proportional sampling was used for determining the percentages of selecting customers, 25% depending on the approximate total number of customers who came to buy salad per day. Customers were chosen by simple random sampling method to determine the actual proportion of participants. Thus, 125 customers from Zabuthiri township, 63 from Pyinmana township and 62 from Lewe township (total 250 customers) were interviewed. Salad food samples were selected from each salad vendor, as 46.

The pretest was conducted before data collection. The reliability of knowledge and practice questionnaires were tested by Kuder Richardson formula 20, 0.65 and Conbrach's Coefficient-Alpha, 0.80. All the data collectors are medical doctors from Department of Public Health, Ministry of Health and Sport, Myanmar.

***Data instruments***

This research has three part of studies; knowledge and hygienic practices of vendor, attitude of customer on vending practices and microbial quality of food samples. The respondents were asked general information about their age, gender, education, vending income, and individual income, access of food safety training (Licensed status) and access of food safety information.

Determination of vendors' knowledge level had 20 questions which was composed of knowledge about foodborne disease and their causes and knowledge about food handling practices. The knowledge questions were structured close ended questionnaire with "Yes", "I don't know" and "No" and the level was determined into poor and good by means of median. Vendors' food handling practice level and vending sanitation were

accessed by observing real situations while they were serving salad for customers. There was a set of observational check-list (17 items) to observe hygienic behaviors of vendors which consisted of environmental hygienic, personal hygienic and food handling practices. The level of vendors' hygienic practices was considered into poor and good by using median cut of point.

There were 18 items to study customers' perception on vending practices. The questionnaire was structured with multiple choice questions for customers' opinion on purchasing street food salad and awareness of foodborne illnesses and Likert's method for their attitude toward hygienic practices of food handlers. The negative questions were scored vice versa in Likert's Scale. The score was ranged from 34-170.

For the analysis of microbial quality of food sample, coliforms SI-2 test kit approved by Department of Health, Thailand was used. Yellow color changes within 24-48 hours were considered positive result, presenting unacceptable number of coliforms bacteria, whist the remained purple color was negative.

### *Data analysis*

The collected data was analyzed by using SPSS program version 21. The prevalence of preventive vending preparation situations, socio-economic characteristics and the level of knowledge, attitude and practices of the respondents was presented by using descriptive statistics. Chi square test was used to analysis the association between vendors' food safety knowledge, hygienic practices and microbial quality of food samples as well as customers' perception and their socio-economic factors. Simple logistic regression tests were used to find odd ratio with the considerable level, *p* value less than *0.05*.

## RESULTS

### *Investigation results of vendor perspective*

The social demographic factors of 46 vendors in this study can be summarized as following. Among of these vendors, 37% were ≤34 years old and 63% were older than 34. Among 46 vendors, most vendors were female and a few percent were male. About one-third of the participants were educated at high school level and the second-most distributed education level in this study was primary and middle school. Only a few percent were graduated. The rest two were uneducated, showing one was illiterate and another was just "read and write". About half of vendor had lower income (≤200000 kyats) and another approximately half had higher income (>200000 kyats). Among 46 salad vendors, only 17 have license which is educated and medical checked-up by authority. 29 vendors did not receive food safety training due to unlicensed food stalls which are not under the monitoring of authority.

About two third (65.2%) of the vendors was poor at overall knowledge level while knowledge about causing food contamination, hand washing practices and cleaning habits of food preparing tools, were good (Table 1).

Regarding to vendors' practice scores, there were two hygienic practices levels; (I) personal hygiene and (II) environmental, food preparation and storage hygiene (vending sanitations and food handling practices) as shown in Table 2. Nearly two third (63%) of participants was poor at total practices level whilst about one third (37%) was good. A small percent (26.1%) was poor at self-hygienic practices while most of all were good. 60.9% of participants were poor but 39.1% were good at food handling and vending practices.

**Table 1:** Percentage of vendors' knowledge for street food safety

| No | Knowledge of vendors | Total N=46 | Correct answer (%) |
|---|---|---|---|
| 1 | Dirty hands may cause food contamination | 42 | 91.3 |
| 2 | Contaminated water may cause food contamination | 44 | 95.7 |
| 3 | Contaminated raw food may causes food contamination | 38 | 82.6 |
| 4 | Contaminated surface where preparing food may causes food contamination | 43 | 93.5 |
| 5 | Food handlers with diseases cannot causes food contamination | 21 | 45.7 |
| 6 | Diarrhea is diseases which can caused by contaminated food | 45 | 97.8 |
| 7 | Dysentery is diseases which can be caused by contaminated food | 43 | 93.5 |
| 8 | Food poisoning is diseases which can be caused by contaminated food | 30 | 65.2 |
| 9 | Viral hepatitis A is diseases which can be caused by contaminated food | 25 | 54.3 |
| 10 | Typhoid is a disease which can be caused by contaminated food | 19 | 41.3 |
| 11 | There will be transmission of food-borne diseases via the fly | 45 | 97.8 |
| 12 | Hand washing is necessary before preparing food | 46 | 100.0 |

**Table 2**: Observation of vendors' hygienic practices and vending environment.

| No | Observational check-list factors | Yes | Percent (%) |
|---|---|---|---|
| | **Personal hygienic practices** | | |
| 1 | Neatly dressed hygiene | 33 | 71.7 |
| 2 | Well-kept finger nails | 40 | 87 |
| 3 | Hair restriction and covering | 31 | 67.4 |
| 4 | Wearing ornaments | 17 | 37 |
| 5 | Wearing apron | 3 | 6.5 |
| | **Environmental hygienic, food preparation and storage practices** | | |
| 6 | Vending protection from dust, wind, sun and fly | 20 | 43.5 |
| 7 | Good toilet facilities | 7 | 15.2 |
| 8 | Cleaning serving tables and surrounding | 15 | 32.6 |
| 9 | Good and adequate water supply | 19 | 41.3 |
| 10 | Having adequate sanitary conditions | 9 | 19.6 |
| 11 | Cleaning the surface of preparing food | 23 | 50 |
| 12 | Serving with bare hand | 43 | 93.5 |
| 13 | Cleaning utensils | 39 | 84.8 |
| 14 | Covering drinking water with lid | 43 | 93.5 |
| 15 | Enough bowls for washing raw foods and utensil | 17 | 37 |
| 16 | Protection of preparing food from flies and rodents | 19 | 41.3 |
| 17 | Protection of storage food from flies and rodents | 27 | 58.7 |

Table 3 shows that vendors' knowledge level was not significantly associated with their education level group (p-value= 0.057). However, odd ratio shows that lower education group was 3.333 times more likely to have poor knowledge level than those of higher education. Licensed status was found to be significantly associated with knowledge level of vendor (p-value= 0.009). Unlicensed food establishments were

5.476 times more likely to have poor food safety knowledge than licensed ones.

With respect to the practice levels, vendors' knowledge had significant relationship with environmental, food preparation and storage hygienic practice level (p-value= 0.018). Vendors with poor food safety knowledge, were 4.583 times more likely to have poor food handling practice than those of good.

Table 4 shows that male were 2.1 times more likely to perform poor practices than female. Age group and license status shows significant associations with vendors' hygienic practices (p-value= 0.007 and 0.003 respectively). Younger age group significantly performed 8.036 times poorer hygienic practices than older age group (>34 years old). According to licensed status, un-licensed food establishments were 7.028 times more likely to have poor practice than those of having license.

**Table 3**: Association between Independent variables and vendors' knowledge

| Independent variables | n | Knowledge level poor (%) | good (%) | Crude OR (95%CI) | | P-value |
|---|---|---|---|---|---|---|
| **Gender** | | | | | | 0.292 |
| Female | 34 | 70.6 | 29.4 | 2.4 | (0.622 -9.265) | |
| Male | 12 | 50.0 | 50.0 | 1 | | |
| **Age** | | | | | | 0.220 |
| ≤34 Years | 17 | 76.5 | 23.5 | 2.294 | (0.599 -8.782) | |
| >34 Years | 29 | 58.6 | 41.4 | 1 | | |
| **Education level** | | | | | | 0.057 |
| ≤ Middle school | 26 | 76.9 | 23.1 | 3.333 | (0.941 -11.812) | |
| ≥ High school | 20 | 50.0 | 50.0 | 1 | | |
| **Vending income** | | | | | | 0.515 |
| ≤200,000 Kyats | 26 | 69.2 | 30.8 | 1.5 | (0.442 -5.092) | |
| >200,000 Kyats | 20 | 60.0 | 40.0 | 1 | | |
| **License status** | | | | | | **0.009**** |
| No | 29 | 79.3 | 20.7 | 5.476 | (1.464 -20.483) | |
| Yes | 17 | 41.2 | 58.8 | 1 | | |
| **Environmental, food preparation and storage practices** | | | | | | **0.018*** |
| Poor | 28 | 78.6 | 21.4 | 4.583 | (1.254 -16.748) | |
| Good | 18 | 44.4 | 55.6 | 1 | | |
| **Personal hygienic practices** | | | | | | 0.292 |
| Poor | 12 | 50.0 | 50.0 | 1 | | |
| Good | 34 | 70.6 | 29.4 | 2.400 | (0.622 -9.265) | |

Knowledge level of vendor (event), *p-value < 0.05, **p-value<0.01

**Table 4** Association between independent variables and vendors' practices

| Independent variables | n | Practice level | | Crude OR (95%CI) | | | P-value |
|---|---|---|---|---|---|---|---|
| | | Poor (%) | Good (%) | | | | |
| **Gender** | | | | | | | 0.489 |
| Female | 34 | 58.8 | 41.2 | 1 | | | |
| Male | 12 | 75.0 | 25.0 | 2.1 | (0.481 | - 9.173) | |
| **Age** | | | | | | | **0.007**** |
| ≤34 Years | 17 | 88.2 | 11.8 | 8.036 | (1.550 | - 41.649) | |
| >34 Years | 29 | 48.3 | 51.7 | 1 | | | |
| **Education level** | | | | | | | 0.322 |
| ≤ Middle school | 26 | 69.2 | 30.8 | 1.841 | (0.548 | - 6.188) | |
| ≥ High school | 20 | 55.0 | 45.0 | 1 | | | |
| **Vending income** | | | | | | | 0.391 |
| ≤200,000 Kyats | 26 | 57.7 | 42.3 | 1 | | | |
| >200,000 Kyats | 20 | 70.0 | 30.0 | 1.711 | (0.499 | - 5.871) | |
| **License status** | | | | | | | **0.003**** |
| No | 29 | 79.3 | 20.7 | 7.028 | (1.839 | - 26.851) | |
| Yes | 17 | 35.3 | 64.7 | 1 | | | |
| **Knowledge level of vendor** | | | | | | | 0.181 |
| Poor | 30 | 70.0 | 30.0 | 2.333 | (0.666 | - 8.169) | |
| Good | 16 | 50.0 | 50.0 | 1 | | | |

Practice level of vendor (event), *p-value < 0.05, **p-value<0.01, ***p-value<0.001

***Microbial test to determine food contamination***

According to microbial quality of food samples, nearly two third (30.4%) of food samples was failed in microbial quality by changing the color, while only about one third (69.6%) did not change yellow.

Table 5 presents that gender was not significantly associated with bacterial result (p-value= 0.073). Odd ratio, however, showed that male were 6.81 times more likely to get positive result than female. In this study, vending sanitation and food handling practices was significantly associated with microbial quality (p-value= 0.021), odd ratio indicating that poor practice group was 4.6 times more likely to present positive result than those of good.

Among mishandling factors in street food vending sector, the most significant factor which may influence the growth of micro-organisms was "appropriate covering practice for food" as p-value shows 0.001. In this case, simple logistic regression interpreted that the vending establishment which did not cover properly, were 9.37 times more likely to be present positive bacterial result than well protecting food stalls.

According to observational check-list, only 20 street food stalls used glass containers to display and keep the foods but 26 were absent to protect food or used improper ways of covering. Consequently, among these 26 street food stalls, 23 of those get positive coliforms bacteria result when the food samples were tested by coliforms test kits. Like the result performed with vendor's knowledge level, microbial quality had no relationship with personal hygienic practices (p-value= 0.800).

**Table 5**: Association between independent variables and microbial quality result

| Independent variables | n | Coliforms result No (%) | Yes (%) | Crude OR (95%CI) | | P-value |
|---|---|---|---|---|---|---|
| **Gender** | | | | | | 0.073 |
| Female | 34 | 38.2 | 61.8 | 1 | | |
| Male | 12 | 8.3 | 91.7 | 6.81 | (0.785 - 59.094) | |
| **Age** | | | | | | 0.908 |
| ≤34 Years | 17 | 29.4 | 70.6 | 1.08 | (0.292 - 3.989) | |
| >34 Years | 29 | 31.0 | 69.0 | 1 | | |
| **Education level** | | | | | | 0.955 |
| Lower middle school | 26 | 30.8 | 69.2 | 1 | | |
| High school and graduate | 20 | 30.0 | 70.0 | 1.037 | (0.292 - 3.686) | |
| **Vending income** | | | | | | 0.482 |
| ≤200,000 Kyats | 26 | 34.6 | 65.4 | 1 | | |
| >200,000 Kyats | 20 | 25.0 | 75.0 | 1.588 | (0.435 - 5.799) | |
| **License status** | | | | | | 0.908 |
| No | 29 | 31.0 | 69.0 | 1 | | |
| Yes | 17 | 29.4 | 70.6 | 1.08 | (0.292 - 3.989) | |
| **Knowledge level of vendor** | | | | | | 0.189 |
| Good | 16 | 43.8 | 56.3 | 1 | | |
| Poor | 30 | 23.3 | 76.7 | 2.556 | (0.696 - 9.382) | |
| **Practice level of vendor** | | | | | | 0.225 |
| Poor | 29 | 24.1 | 75.9 | 2.556 | (0.696 - 9.382) | |
| Good | 17 | 41.2 | 58.8 | 1 | | |
| **Appropriate covering practices for vending** | | | | | | **0.001 **** |
| No | 26 | 11.5 | 88.5 | 9.37 | (2.109 - 41.625) | |
| Yes | 20 | 55.0 | 45.0 | 1 | | |
| **Environmental, food prepared and storage practices** | | | | | | **0.021*** |
| Poor | 28 | 17.9 | 82.1 | 4.600 | (1.207 - 17.524) | |
| Good | 18 | 50.0 | 50.0 | 1 | | |
| **Personal hygienic practices** | | | | | | 0.800 |
| Poor | 12 | 33.3 | 66.7 | 1 | | |
| Good | 34 | 29.4 | 70.6 | 1.2 | (0.293 - 4.909) | |

Microbial quality (event), *p-value < 0.05, **p-value<0.01, ***p-value<0.001

***Customers perception toward food safety***

The distribution of the youngest group (<25 years) of street food salad customer was 27.2% and the most distributed age range was 25-34 years old. The rest all were above 34 years old. Among 250 participants, female and male occupied 147 and 103 respectively. With respect to education, minority is the lowest educated group (read and write). However, majority of street food salad customers in this study was the highest educated group (graduated people). The rest of all were primary, middle and high school education. 53.6 % occupied lower income group (≤150,000 kyats) and 46.4 % occupied higher income group (>150,000 kyats). Among the participants, about half of them said that they never had food safety training or information from any source. Furthermore, a few respondents answered that they got the training and/or information once in a while and nearly half of them said they often received training and information.

Regarding the customers' perception scores, almost equal distribution of negative (51.6%) and positive (48.4%) attitude level were resulted. Table 6 shows that customers' education level had significant association with their perception of vending operation habits (p-value=0.008). Odd ratio shows that non-graduated people were 2.007 times more likely to lead negative attitude than graduated people in this study.

Table 6 shows three variables that were included in a full multiple regression model to determine predicting factors for public perception on vendors' practices. There was a significant association with customers' education level (p-value< 0.05). Nevertheless, customers' attitude was insignificantly associated with their income and safety awareness.

According to the Table 7, awareness of customers on foodborne illnesses was not significantly related with gender and age group (p-value= 0.739 and 0.364 respectively). customers' education level was significantly associated with their having awareness on cause of foodborne illness, odd ratio showing non-graduated people were 2.980 times more likely to have lack of awareness than educated people (p-value<0.001). Likewise, customers' income level was relevantly associated with their awareness that lower income group was 2.479 times more likely to have weak awareness than higher income group. Having food safety information was significantly associated with awareness of customers on food safety issue (p-value= 0.033). Salad customers who meet with food safety information once in a while, were 2.727 times more likely to have lack of awareness than those who frequently explored on that issue.

Table 8 shows five variables that were interpreted in multiple logistics regression and one variable, education level was significant (p-value= 0.019) associated with customers' awareness. Gender, age group, income and frequency of food safety training were not significant.

**Table 6**: Full model of multiple logistic regressions to determine predicting factors for public perception on vendors' practices

| Independent variables | Adj.OR | 95% C.I.for OR | | P-value |
|---|---|---|---|---|
| | | Lower | Upper | |
| **Education level** | | | | **0.043*** |
| Non-graduated people | 1.920 | 1.020 | 3.616 | |
| Graduated people | 1 | | | |
| **Awareness of unclean salad** | | | | 0.235 |
| No | 1.742 | 0.697 | 4.354 | |
| Yes | 1 | | | |
| **Individual income** | | | | |
| Lower income | 1.213 | 0.572 | 2.573 | 0.615 |
| Middle income | 1.461 | 0.782 | 2.733 | 0.235 |
| Higher income | 1 | | | |

*p-value < 0.05, **p-value<0.01, ***p-value<0.001

**Table 7**: Association between independent variables and awareness of customers on street food salad

| Independent variables | n | Awareness of street food | | Crude OR (95%CI) | | | P-value |
|---|---|---|---|---|---|---|---|
| | | No (%) | Yes (%) | | | | |
| **Gender** | | | | | | | 0.739 |
| Female | 147 | 32.0 | 68.0 | 1 | | | |
| Male | 103 | 34.0 | 66.0 | 1.095 | (0.641 - | 1.870) | |
| **Age** | | | | | | | 0.364 |
| Less than 25 years | 68 | 39.7 | 60.3 | 1.505 | (0.743 - | 3.050) | |
| 25 to 34 years | 113 | 30.1 | 69.9 | 0.984 | (0.513 - | 1.887) | |
| Above 34 years | 69 | 30.4 | 69.6 | 1 | | | |
| **Education level** | | | | | | | **< 0.001 *** ** |
| Non graduated people | 102 | 47.1 | 52.9 | 2.980 | (1.727 - | 5.144) | |
| Graduate people | 148 | 23.0 | 77.0 | 1 | | | |
| **Individual income** | | | | | | | **0.001**** |
| Lower income | 84 | 46.4 | 53.6 | 2.479 | (1.428 - | 4.304) | |
| Higher income | 166 | 25.9 | 74.1 | 1 | | | |
| **Food safety information** | | | | | | | **0.033*** |
| Never | 135 | 30.4 | 69.6 | 1.467 | (0.682 - | 3.158) | |
| Once in a while | 67 | 44.8 | 55.2 | 2.727 | (1.192 - | 6.240) | |
| Often | 48 | 22.9 | 77.1 | 1 | | | |

Customers' awareness (event), *p-value < 0.05, **p-value<0.01, ***p-value<0.001

**Table 8**: Full model of multiple logistic regressions variables to determine predicting factors for awareness of customer

| Independent variables | Adj.OR | 95% C.I.for OR | | P-value |
|---|---|---|---|---|
| | | Lower | Upper | |
| **Gender** | | | | |
| Female | 1 | | | |
| Male | 0.835 | 0.476 | 1.465 | 0.529 |
| **Age** | | | | |
| Less than 25 years | 0.906 | 0.403 | 2.038 | 0.812 |
| 25 to 34 years | 1.258 | 0.628 | 2.523 | 0.517 |
| Above 34 years | 1 | | | |
| **Education level** | | | | |
| Non graduated people | 2.310 | 1.150 | 4.638 | **0.019*** |
| Graduate people | 1 | | | |
| **Income** | | | | |
| Lower income | 0.605 | 0.765 | 3.366 | 0.211 |
| Higher income | 1 | | | |
| **Food safety information** | | | | |
| Never | 1.207 | 0.558 | 2.611 | 0.633 |
| Once in a while | 2.006 | 0.841 | 4.785 | 0.117 |
| Often | 1 | | | |

*p-value < 0.05, **p-value<0.01, ***p-value<0.001

## DISCUSSION

For vendors perspectives, the age group was categorized according to literature review studied about the risk factors of street food practices in developing countries which mentioned that a young age group within 20-35 years old were the most negligent group to the hazards of street foods because their occupations and lifestyles were cited as the major factors for this careless perception to food safety.[21] Further, most of the vendors were female in this study since food preparing and cooking were commonly performed by female, especially for salad preparation in Myanmar and the researcher had to ask the questions to the participant who actually handle the foods. The majority of the vendors in the study can be considered as primary, middle and high school level education and the scenario here is that under-graduated people in Myanmar can earn low salary as employees. Therefore, most of the under-graduated people operate self-employment at a low investment. Among 46 vendors, 6 have higher education as graduated people since a higher income can be earned from the own business than from employer in some developing countries including Myanmar. Having food safety training was considered as giving education twice a year and issuing license by Health Department of Nay Pyi Taw Development Committee and Food and Drug Administration.

In addition, food preparing situations of street food salad vendors was measured in terms of food preparing place and hours before vending. Most of them

prepares food at home before vending at the market and uses food preparation time more than 2 hours. This finding suggested that vendors' education can support their promotion in food safety knowledge. In the result done in Ho Chi Min City, Vietnam, education level of the vendors was determined to have significant influence on their food safety knowledge.[15] For more information, the research done in Shijiazhuang city, China showed that the vendors with lower education level were less receptive to new techniques and food sanitation knowledge, compared to those with higher education level.[22] One researcher, however, reported that education level of vendors in Guwahati, Assam, India had no significant impact on knowledge of food safety.[23] Therefore, KAP study for food sanitation is needed to be conducted in each country in order to access the most leading problem in that area based on different norms, natures and cultural features.

This research, however, presented that education and knowledge cannot support to correct vendors' self-hygienic practices as well as their food quality. Although most of the vendors had good knowledge level at self-hygiene, observation revealed that almost all of them did not perform self-hygiene such as wearing glove, apron and ornaments, in reality. Therefore, vendors' perception on personal hygiene such as wearing glove, apron and ornaments, should be promoted among street food vendors in Nay Pyi Taw. Nevertheless, the finding indicated that vendors' knowledge can correct to their food handling practices and these practices can also lead to their success in food quality. In comparison with the study done in Malaysia,[24] the researcher reported that food safety knowledge was considered as the most influential predictor in food hygienic practices. This study conducted among mobile food handlers in Malaysia, revealed that there was positive relationship between food safety knowledge and food hygienic practices. In contrast, unlike here, the result in Malaysia indicated that food safety knowledge was significantly correlated to personal hygiene.

According to license status, licensed food handlers were higher in both safety knowledge and hygienic practices than unlicensed food handlers. Likewise, in comparison with the research done in Ethiopia,[25] the author found that there was statistically significant difference between trained handlers and non-trained handlers with regard to food hygiene practices. The researcher discussed that food safety training had positive impact on practices of food handlers and thus training and motivation should be provided to the street food vendors. Here in this study, licensed status represented trained vendor and unlicensed status represented non-trained vendor. Licensed food stalls had fundamentally trained for food safety practices (personal hygiene and food handling hygiene) twice a year by authority in Nay Pyi Taw City. Nevertheless, unlicensed food stalls are still on the loose from the monitoring of authority, except limitation of vending period. Therefore, it can be assumed that the vendors who did not have food safety training were leading to poor knowledge and practice level than trained vendors. Street food vendor training should be prioritized to improve the safety of street food.[25]

Moreover, licensed food stalls had better sanitary conditions than unlicensed food stalls. A significant relationship was coming out with p-value< 0.001 and odd ratio indicate that un-licensed food stalls were 12.458 times more likely to have poor sanitary conditions than those with licenses. Likewise, in the study done in Ethiopia,[26] the results showed that there was statistically significant association between the sanitary conditions and

license status of the establishments. The researcher discussed that this difference between licensed and unlicensed food establishments was affected by the licensing criteria controlled by authority and thus legal inspections were crucial steps for sustaining good sanitary conditions of food establishments. In this study, sanitary conditions included five factors: "Appropriate protection of foods from sun, wind, fly and dust", "Well providing of clean wash hand basin/soap/towel", "Establishment of clean service tables and surrounding", "Adequate supply of water" and "Adequate sanitary services".

Nevertheless, some of the licensed food handlers could not success in microbial quality of their foods although they had good knowledge and practices. As unclean and unsanitary hands are undoubtedly a major cross-contamination of germs, the critical part of street food safety is the way in which vendor handles and serves the food for the customer.[26] Moreover, the surrounding sanitation is another critical deciding factor in the success or failure of a street food stall. Likewise, in this study, there may be many factors of exposures which can lead to failure of microbial quality, since all the street food establishments participated in this study were vending just beside the road. Therefore, this finding suggested that all the factors of exposures to food such as personal, food handling and environmental hygienic practices, safe water supply, garbage disposal method, etc., have to be concerned to address to the success in microbial quality.

If explored from the side of microbial quality of salads, the most important factor which might influence the success and failure in microbial quality, was vendors' food handling practices. Vendors' food handling practices consisted of environmental hygienic, food preparation and storage practices. Among vendors' food handling practices, the most significant influenced factor was proper way of vending protection from environmental exposures such as dust, sun, wind and fly. Vending protection method was measured in many studies explored about street food vending culture. One study conducted in Ghana[27] observed that only 8% of vendors had their station covered with a tent, while 26% displayed in the open air and 62% with a permanent shelter. They mentioned that vendors should have protection from dust which can hold microbes on the foods, thus becoming pathogenic.

However, as almost all street food stalls in this study including licensed and unlicensed status, displayed their foods in the open air, the researcher checked the vending protection practices by means of special glass container which can display as well as keep the food. The scenario here is that although most street food stalls had a tent or permanent shelter, they did not cover displayed items (salad's ingredients) in a proper way to be able to protect from dust and fly.

Therefore, this finding suggested that environmental hygienic, food preparation and storage practices have to be prioritized in the monitoring of microbial quality of street foods. Moreover, many evidences had been also pointed out that foodborne illnesses and outbreaks were appeared by the food contamination through the failure of self-hygiene. Therefore, food handlers' personal hygiene cannot be left behind the food safety issue. In conclusion, the finding revealed that vendor' knowledge can address to their practices and then these practices can also correct to microbial quality.

Finally, with regards to gender, males were poorer in hygienic practices and then also lead to positive coliforms bacteria results than females. Further, younger age group in this study were poorer in food safety hygienic practices than older age group.

In the customer side, the results revealed customers' perception to salad vending practices of street food establishments from which they were used to buy and eat. Customers' education was the most significant influencing factor upon their perception to vendors' practices. If discussed with the reviewed articles, income and education were more significantly affected by customers than vendors. Many studies identified that higher educated consumers were more aware of harmful health risks inherent in street food due to the information at their disposal whilst higher income group would rather purchase fast food outlets and supermarkets although more expensive.[21] In reviewing literatures reported in developing countries, by Alimi et al in Nigeria and Bekerroum in North Africa respectively, presented that income and education positively affected in the perception of customers on the hazards of street foods.[28] To the contrary for the customers in Haiti[29] and China[22] the researcher had reported that level of education did not present a significant effect ($p<0.05$) on the level of food safety knowledge. However, for the customers' attitude assessment, Haiti result showed statistically significant on the basis of their education level.

Moreover, education also influenced on customers' awareness on safety of street food salad and foodborne illnesses. Based on HACCP approach, consumers must firstly be have awareness on benefits of street foods and risk of foodborne diseases as well as their association with vendors. And the final crucial point is knowledge and attitude of customers to decide safe and unsafe food handling practices because, unfortunately, consumers often have less awareness of the natural concept of disease transmission between contaminated food and foodborne pathogen.[2,30]

Education level of people in Nay Pyi Taw is commonly related to their income since most of them are government employees. When compared with reviewing literatures reported in developing countries, the authors presented that income and education positively affected in the awareness of customers on the hazards of street foods.[28] According to percentage distribution, this study found that nearly half of the respondents had positive attitude to correct the food handlers' vending practices and two third had awareness on safety of street food salad.

Nevertheless, although most of the respondents were concern over street food vending practices and their safety consumption, they were ongoing their purchasing and thus street food vending are still standing as a popular business among urban population. The scenario here to point out the reason of this consumption pattern, is urbanization and population growth of Nay Pyi Taw city. Since people in this city are mostly government employees that can be mentioned as "people on the run", street foods provided convenient consumption to those in a busy life style. Therefore, these "ready-to-eat" food that we called street food, are consuming across all income and education groups with an easily accessible reason.

According to interview about customers' purchase decision on street food salad, majority (57.6%) of those responded that they purchased street food salads as they seem appetizing at a glance and 78% answered that they had to choose street foods as they were sold at an affordable price in order to access by all

socio-economic backgrounds. Consequently, therefore, street food is nowadays occupying an important role in food supply chain.[31,32]

Furthermore, customers have lack of perception of extent of the hazards that they considered that foodborne illnesses are easily curable.[7] According to interview about respondents' experiences of foodborne illnesses, 72 % reported that they were encountered with serious cases and commonly suffered illnesses were diarrhea and dysentery. Some of the respondents mentioned that they were hospitalized and some answered that they recovered from illness by self-administrated medication. On the other side, 28% responded that they experienced mild foodborne illnesses more than one time in their life and also easily treatable by themselves. Therefore, from this report, the finding suggested that people perception on the extent of foodborne diseases transmitted from unsafe food consumption, needs a cognition to the hazard level.

From the interview about consumers' awareness level, 90.8% reported that they had awareness on foodborne illnesses while purchasing street foods. Furthermore, 33.2% answered that they were very much concerned over food safety issue whilst 66.8% were still lesser concerned for it. Moreover, 60.8% responded that they were not satisfied with the street foods from safety perspective while 39.2% had satisfaction with. Thus, street food safety issue can be addressed to the population, starting from perception and awareness by the customers.

This study was carried out at four markets of three townships in Nay Pyi Taw City, Myanmar. In addition, the target street food of this study was only "Salad". Therefore, it might not generalize for the whole street foods and food vendors in Nay Pyi Taw. It cannot be represented for whole country results. And another factor was environmental condition because the duration of my study period was within winter to summer. Therefore, the environmental condition is quite pleasant than rainy season. Researchers could not see and access the worst environmental conditions such as flies/vector breeding area and drainage system. Moreover, checking waste disposal and sewage disposal practices might not be sufficient as data collecting team could not access the entire operation of whole day's disposal practices of vendors. The information about foodborne diseases also may not get exactly because of recall bias.

## CONCLUSION

This study's finding revealed that 29 out of 46 vendors were poor at their personal, food handling hygiene and environmental hygienic practices. Almost of the vendors served salad with bare hand and only about half of food establishments had well protection of food from dust, wind, sun and fly. There was statistically significant relationship between licensed status and the sanitary conditions of the establishments. When salad samples were tested by coliform test kit, more than two third of those was positive or contaminated. The most significant factors affecting microbial quality of street food salad were appropriate covering practices for vending establishment and vendors' environmental, food handling, preparation and storage practices. On the customers' side, about half of them had never accessed food safety training or information. According to opinion on purchasing street food salad, majority of the customers thought that street food salad was at an affordable price and looked

appetizing but home-cook foods were better taste than those bought from market. Most of respondent did not have good perception about storage and covering practices of prepared foods, cause of contamination due to hair or staple wire found in the food, cross contamination by bare hand serving, correct method of cleaning utensils, wearing jewelry habit of food handlers during serving foods and effectiveness of vendors' self-hygiene. The most influencing factors on the attitude of customers about food handlers' vending practices was customers' education level. Moreover, customers' education level was significantly related not only with their attitude level but also their awareness level on foodborne diseases and illnesses. From all results, the food sanitation program of this food establishments should be developed urgently to protect the people health.

## RECOMMENDATIONS

This study's result recommended that every food safety education program to both vendors and customers, 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. Unlicensed street food stalls in the night markets of Nay Pyi Taw should be provided by local authority with regard to safe water supply and adequate garbage collecting services. Like the action for licensed food stalls, annual checking for sanitation of unlicensed food stalls with a set of food safety education and training program, should be implemented to improve unlicensed food handlers' knowledge and practices. Special administration by authority according to proper protection of displayed food items from environmental exposures by the use of glass containers and according to personal hygiene such as wearing gloves, cap and aprons, should be launched among street food vending stalls. Monitoring of food quality should be additionally implemented together with annual checking activity for food stalls' sanitary condition and food handlers' health. To raising the awareness of vendors and protect the customer's health, the clean food label champagne could help the customer to recognize and vendor to think of safe food production. The motivation factors among vendors to enhance the sanitation of their food establishments should be explored. Quasi-experimental study is required to evaluate the microbial quality of food samples between trained food handlers and untrained food handlers. Not only salad but also diversity of street foods should be studied for both safety practices and microbial quality.

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