

KNOWLEDGE, ATTITUDE AND PRACTICE TOWARDS WATER, SANITATION AND HYGIENE AMONG STREET FOOD VENDORS IN SERDANG, SELANGOR

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ABSTRACT

Objective: This study was conducted to determine the level of knowledge, attitude and practice (KAP) towards water, sanitation and hygiene (WASH) among Serdang's street food vendors and determine the KAP level association with sociodemographic characteristics and the food handling course attendance. **Method:** A pre-tested questionnaire adapted from United Nations Human Settlement Programme containing open-ended questions and a 5-score Likert scale was used and distributed to 85 street food vendors in Serdang, Selangor. **Results:** The highest frequency (percentage) of Serdang street food vendors were vendors around age 18-35 years old, 61 (71.8%), male, 55 (64.7%), local 77 (90.6%) and had completed secondary education 45 (52.9%). The mean percentage of score (SD) obtained for knowledge was 76.4% (n=14), attitude 84.4% (n=15), and practice 96.6% (n=13). Out of 85 respondents, 82 (96.5%) had good knowledge, 83 (97.6%) had a good attitude, and 84 (98.8%) had good practice towards WASH. Furthermore, Chi-square analysis found an association between citizenship and level of knowledge. There was no association between food handling course attendance with the level of knowledge, attitude and practice. **Conclusion:** The majority of street food vendors had scored a good level of knowledge, attitude and practice towards WASH. However, they can further improve their current knowledge, attitude and practice towards WASH from the help of the government in providing better education and more facilities towards the goal of clean water and sanitation. Doing so would help in reducing the prevalence of food and water-related diseases cases in our country.

Keywords: *Environmental, water, sanitation, hygiene, street food vendors*

1. Introduction

In early history, many of the diseases are related to water. Poor sanitation contributes to the spread of diseases like cholera, diarrhoea, dysentery, hepatitis A, typhoid, and polio and exacerbates stunting. The United Nations General Assembly declared safe and clean drinking water and sanitation to be a human right in 2010 and asked for international assistance to help countries provide safe, clean, accessible, and affordable drinking water and sanitation (WHO, 2021a). Moreover,

universal access to safe drinking water, sanitation, and good hygiene (WASH) services are critical for population, health, welfare, and development (WHO, 2021b).

In the Western Pacific Region, preventable water-related diseases take the lives of tens of thousands of people. More than 14 000 people die each year in the region from diarrhoea due to contaminated drinking water, poor sanitation, and poor hygiene (WHO, 2021c). Drinking water that is sufficient, inexpensive, and safely managed, as

well as improved hygiene behaviours, can drastically reduce this number. From 1990 to 2018, most of the nations in the area achieved significant progress in meeting global drinking water and sanitation standards (WHO, 2021c).

Malaysia is listed under United Nations Development Program, UNDP Sustainable Development, committed to achieving Goal 6: Clean water and sanitation. By 2030, the country must invest in enough infrastructure, sanitation facilities, and hygiene promotion to ensure that everyone has access to safe and inexpensive drinking water (Goal 6: Clean Water and Sanitation, 2021).

Safe drinking water, sanitation, and hygiene are not limited to households in an urban or rural area; it is also related to the food business in any country, such as street food vendors. In both developed and developing countries, street food vending is a common and distinct aspect of a massive informal industry (Mizanur et al., 2012). The term "street food" refers to a wide range of ready-to-eat foods and beverages sold and occasionally made in public spaces. It is possible to eat street food right where it is purchased, take it home, or eat it somewhere (WHO, 1996). It is widespread in public spaces, especially in cities, and it is unique in that it meets an essential requirement for city dwellers. Due to urban people's expanding and changing food demands searching for cheaper food amid a tough economy, this sector is booming (Muzaffar et al., 2009).

There are various sorts of food vending sites, such as mobile stalls, various pushcarts, roadside stands, and hawkers, depending on the individual's resourcefulness, available resources, type of food sold, and other amenities (FAO, 1990). On the other hand, several foodborne disease outbreaks have been linked to inadequate personal cleanliness among food workers. Foodborne infections are rising in both developed and developing countries (Hoffmann & Scallan, 2017). The seller and the buyer will become the impacted groups for any unprecedented foodborne outbreaks from poor sanitation at the stall. These buyers may come from the nearby community, visitors, or even tourists from other countries.

The general objective of this study was to determine the level of knowledge attitude and practice towards water, sanitation and hygiene. The spe-

cific objectives were to describe the sociodemographic of the respondents. Other than was to determine the association between socio-demographic and food handling course attendance towards the level of knowledge attitude and practice towards WASH.

2. Materials and Method

This was a qualitative study with a cross-sectional design and was conducted around Serdang town in Selangor Darul Ehsan, the most developed state in Malaysia. The study population was Serdang's street food vendors. The sampling method used was simple random sampling, whereby any street food vendors in the Serdang area have the probability of becoming the respondents.

2.2 Sample Size

The sample size was based on the single proportion formula. The following shows the overall score percentages based on previous KAP studies conducted to street food vendors (the value for p used in this study was 37%) knowledge, 37%, attitude 19% and practice, 11% towards among street food handlers (Rahman et al., 2016). Standard values that could be used in this formula to calculate sample size might be either larger or smaller of a better estimate of p . This procedure should be used when someone is unable to arrive at a better estimation of p (Wesson, 2006). Therefore, this study's required minimum sample size was 69 with 10% relative precision and after considering 10% non-response rate into account.

2.3 Questionnaire

A questionnaire was used to collect relevant information based on study objectives, especially concerning knowledge, attitudes and practices. The questionnaire was adapted from a study by United Nations Human Settlements Programme (2015) and was modified according to the targeted population. This questionnaire was scored using a percentage score from true or false for knowledge and from 5 points Likert scale for attitude and practice.

There were a few inclusion and exclusion criteria for choosing or accepting respondents' responses in this study. Those related to street food vendors (owner, staff), street food stalls located in Serdang town, local or foreign workers who understood the Malay language and were more than 18 years old

were included and invited to partake in this study. The exclusion criteria were those not related to street food vendors (customer) or street food stalls located more than 10 km from the borderline of the Serdang area, unidentified immigrants, or those below 18 years old. Those who have any of these criteria were not invited to participate in this study, and already filled questionnaires were discarded.

2.3.1 Quality Assurance and Quality Control of Questionnaire

A pre-test questionnaire session was conducted before data collection. The population surveyed in this pre-test was street food vendors in Bangi, Selangor. The questionnaire was tested for its reliability using IBM SPSS Version 22, whereby the Cronbach alpha value was obtained to indicate its internal consistency. The Cronbach alpha for each Likert scale question was determined using the choice of answer from the pre-test respondent. All the Cronbach Alphas were more than 0.7, Knowledge items; $\alpha=0.859$, Attitude items; $\alpha=0.73$, Practice items; $\alpha=0.87$ which were acceptable for its' internal consistency. In addition, the questionnaire was marked only with a unique respondent code for the issue of confidentiality.

3. Results

This study was conducted with street food vendors located in Serdang, Selangor. The response rate was 86.7%, where 98 respondents were identified and approached; 85 individuals agreed to participate in the survey.

3.1 Sociodemographic Data

Most of the respondents came from the young age group, which at 61 (71.8%), followed by 22 (25.9%) respondents from the middle age group and 2 (2.4%) respondents from the elderly age group. They were 77 (90.6%) local and 8 (9.4%) non-local respondents. They were 55 (64.7%) male street food vendors compared to 30 (35.3%) female street food vendors involved in this study. There were 45 (52.9%) respondents currently in or did not finish their secondary education, which was the majority in this study. The next to follow

was tertiary education. They were 29 (34.1%) respondents at this level. They were also 6 (7.1%) respondents who only finished primary education and 5 (5.9%) respondents who did not go to school. The result is presented in Table 1.

Table 1. Sociodemographic characteristics of street food vendors in Serdang

Sociodemographic characteristics	N (%)
Age group (years)	
Young (18-35)	61 (71.8)
Middle age (36-55)	22 (25.9)
Elderly	2 (2.4)
Gender	
Male	55 (64.7)
Female	30 (35.3)
Nationality	
Local	77 (90.6)
Foreigner	8 (9.4)
Level of Education	
No education	5 (5.9)
Primary Education	6 (7.1)
Secondary Education	45 (52.9)
Tertiary Education	29 (34.1)

3.2 Knowledge towards WASH

The percentage of vendors having good knowledge towards WASH for street food vendors in Serdang town, Selangor was high at 96.5% (n=82). Despite the high percentage on good knowledge level, there are some items of the questions that most did not know or failed to answer correctly (Table 2).

3.2.1 Source of water

Of 85 respondents, 49 (57.6%) did not know that tube well/ borehole use is also one of the safe sources of drinking water in Malaysia and some regions in other countries. Also, 67 (21.2) had the idea that rainwater is a safe source of drinking water. However, 40 (47.1%) respondents believed rainwater could be used for kitchen and other uses.

3.2.2 Water treatment

Water treatment is a crucial process to make the source of water safe for humans. In Serdang street food vendor sets, 68 (80.0%) chose to boil as an effective water treatment method. However,

more respondents, 77 (90.6%), answered that filtration using ceramic, sand, composite is an effective water treatment method. On the other hand, 11 (12.9%) showed poor knowledge by having the idea that filtration using cloth, and 8 (9.4%) chose to let the water stand and let the sediments settle will make the water safe to drink.

3.2.3 Water parameters

Most respondents knew well about the parameters of safe and clean water. On that note, 69 (81.2%) answered that safe water is colourless, and 68 (80.0%) answered that safe water is also odourless. Other than that, 32 (37.6%) answered that water with sediments is also safe water. These were the three physical water parameters assessed in the questionnaire. Other than that, 73 (85.9%) answered that safe water should also be free from germs.

3.2.4 Waterborne diseases

Many waterborne diseases can occur from the use of unsafe and untreated water. A total of 71 (83.5%) respondents answered that they knew about diarrhoea, and 70 (82.4%) knew that stomach pain could also be caused by drinking unsafe water. However, 57 (67.1%) respondents failed to recognise cholera and typhoid as food and waterborne diseases, and 59 (69.4%) failed to recognise dysentery as the disease related to consuming contaminated or unsafe water. Apart from that, one of the highest percentages of poor knowledge in this study was 62 (72.9) respondents who did not recognise tapeworm as a parasitic disease related to unsafe water.

3.2.5 Water contamination

A total of 78 (91.8%) respondents knew that disposing trash near the water storage, 81 (95.3%) knew that if trash fell into the water, and 70 (82.4%) knew that if contaminated water combines with safe and clean water, while not considering the amount, will surely contaminate the water inside. As for contamination during storing, 81(95.3%) knew using a dirty container or unwashed container, and 78 (91.8%) knew that if larvae were found inside the water storage, the water inside was contaminated and not safe to be used. In addition, 76 (89.4%) respondents knew that stored water should be tightly closed all the time, and 71

(83.5%) knew that water containers should be wash daily or weekly, depending on their usage.

Water contamination can occur while a person handles the water. Most respondents (n=78, 91.8%) knew that using contaminated or unclean pot/bucket/handling cup, 68 (80.0%) knew that handling water using dirty hands, and 54 (63.5%) knew that putting hands or fingers inside the water will contaminate the water. Other than that, 51 (60.0%) respondents knew that using piped water containers can reduce the risk of contamination, and 49 (57.6%) knew that pouring rather than using a handling cup can reduce the risk of contamination.

3.2.6 Sanitation

Sanitation of street food vendors was mainly performed at the toilet. They were 68 (80.0%) respondents who knew that using clean and proper toilets will reduce the risk of contamination at the stall and 53 (62.4%) respondents knew that toilets experiencing water supply cuts or disruptions could not be used since it is the same service toilet.

3.2.7 Personal hygiene

As for the personal hygiene of the food handlers, all of them (n=85,100.0%) knew that hands need to be washed before preparing foods or drinks. In addition, 81 (95.3%) respondents knew that hands are supposed to be washed anytime when dirty; however, although it was only a minority, 9 (10.6%) respondents did not know that they were supposed to wash their hands after using the toilet. A total of 83 (97.6%) respondents knew that the best method of washing hands is using water along with soap. Other than that, 81 (95.3%) of them knew that they were supposed to use a clean towel/napkin when drying wet hands, and 83 (97.6%) knew that they were not supposed to wipe their wet hands using their work outfits.

3.3 Attitude towards WASH

Table 3 shows that 80 (94.1%) respondents prefer to have water pipes at their stall since it will increase the accessibility and supply of safe water. There were 35 (41.2%) respondents who have an attitude to consider rainwater as an alternative to clean dishes and kitchen tools. On the other hand, 81 (95.3%) will use treated water for drinking purposes, 76 (89.4%) will use colourless water, and

65 (76.5%) will use odourless water.

Table 2. Distribution of knowledge items on WASH

Knowledge items	Correct, n (%) ^a
General knowledge:	
Water	
Source of drinking water	
1. Surface water/pipe	77 (90.6)
2. Tube well/borehole	36 (42.4)
3. Rainwater	67 (78.8)
Source of water for kitchen and other uses	
1. Surface water/pipe	83 (97.6)
2. Tube well/borehole	42 (49.4)
3. Rainwater	40 (47.1)
Water treatment	
1. Boiling	68 (80)
2. Filtration (ceramic, sand, composite)	77 (90.6)
3. Filter using cloth	74 (87.1)
4. Let it stand and settle	77 (90.6)
5. Water treatment makes water safe for drink	85 (100)
Safe drinking water	
1. Colourless	69 (81.2)
2. Odourless	68 (80)
3. No sediments	53 (62.4)
4. Boiled water	70 (82.4)
5. Filtered water	74 (87.1)
6. Free from germs	73 (85.9)
Water-related diseases/illnesses	
1. Diarrhoea	71 (83.5)
2. Stomach pain	70 (82.4)
3. Dysentery	26 (30.6)
4. Cholera	28 (32.9)
5. Tapeworm	23 (27.1)
6. Typhoid	28 (32.9)
Water contamination	
1. Dispose trash near water	78 (91.8)
2. Trash falls into the water	81 (95.3)
3. Animals get contact with the water	53 (62.4)
4. Contaminated water combined with safe/clean water	70 (82.4)
5. Contaminated pot/bucket/barrel	78 (91.8)
6. Handling container with dirty hands	68 (80)
7. Putting hand/fingers into the water	54 (63.5)
8. Using unwashed containers as storage	81 (95.3)
9. Stored water not covered properly	64 (75.3)
10. Larvae found in water	78 (91.8)

11. Stored water should be kept close at most of the time	76 (89.4)
12. The piped water container can reduce the risk of contamination	51 (60)
13. Pouring can reduce the risk of contamination rather than using handling cups	49 (57.6)
14. The water container should be wash daily/weekly depends on the purposes	71 (83.5)
Sanitation	
Toilet / latrines	
1. Using a clean toilet can reduce the risk of contamination at a food stall	68 (80)
2. Toilet facilities that experiencing water disruption/ no water supply cannot be used	53 (62.4)
Hygiene	
Personal hygiene	
1. Both hands need to be wash before eat preparing food/drinks	85 (100)
2. After using toilet facilities	
3. Wash hands using water and soap	76 (89.4) 83 (97.6)
4. Drying wet hands with a clean towel/napkin	81 (95.3)
5. Cannot dry wet hands with work outfits	83 (97.6)

^aPercentage of respondents who gave correct answers

In addition, 73 (85.9%) respondents will clean water storage containers to remove seen and unseen dirt and avoid the growth of fungal or moss, and 70 (82.4%) want their stored water to be free from microbes. There were 76 (89.4%) respondents who want their stored water to be free from contamination of chemical substances, and 72 (84.7%) respondents want to ensure that the water used for drinking or cooking is clean and safe so that water-related illness can be prevented.

As for sanitation and hygiene items, 83 (97.6%) respondents will search for and use a clean toilet while at work, while 74 (87.1%) will never consider open urination and open defecation. Moreover, 83 (97.6%) will make sure their hands are clean most of the time while at work, and the same percentage will use soap when washing their dirty hands rather than using water only. Lastly, 56 (65.9%) will make sure that the working outfits that they wore were clean.

Table 3. Distribution of attitude items on WASH

Attitude items	Good attitude, n (%) ^a
Water	
1. I prefer to have a water pipe at my stall since it will increase the accessibility towards safe water, hygiene and reduce the risk of contamination	80 (94.1)
2. I may consider use rainwater as it is a possible alternative for pipe water in case of emergency, for kitchen and other uses only	35 (41.2)
3. I will use treated water (boiled/filtrated) compared to direct pipe water for drinking purposes	81 (95.3)
4. I will use colourless water as it is a sign of safe water	76 (89.4)
5. I will use odourless water as it is a sign of safe water	65 (76.5)
6. I will clean the water storage container to remove dirt and avoid the growth of moss	73 (85.9)
7. I will prevent my stored water from being contaminated with microbe (uncovered/unwashed water containers)	70 (82.4)
8. I will prevent my stored water from being contaminated with chemical drops (harmful kitchen chemical products)	76 (89.4)
9. I will ensure clean and safe water was used in my stall, as it can prevent water-related diseases like diarrhoea and stomach pain	72 (84.7)
10. I will ensure clean and safe water was used in my stall, as it can prevent parasite diseases like tapeworm	64 (75.3)
Sanitation	
1. I will use a clean toilet as it will affect my personal cleanliness	78 (91.8)
2. I will use the toilet and never consider open urination and defecation	74 (87.1)
Hygiene	
1. I will make sure my hand is clean most of the time since dirty hands can contaminate water/food prepared/handle	83 (97.6)

2. I will make sure my working outfits are clean since dirty outfits can contaminate water/food prepared/handle	56 (65.9)
3. I will use soap for washing dirty hands	83 (97.6)
4. I will use soap as it cleans more thoroughly compared to wash with water only	82 (96.5)

^aPercentage of good attitude of respondents who answered "strongly agree" or "agree" for attitude that they should have agreed.

3.4 Practice towards WASH

Table 4 shows that among 85 respondents, 84 (98.8%) used clean and safe water at their stalls, 83 (97.6%) did not use any other water from an unimproved source even during a water crisis and 81 (95.3%) used treated water for drinking purposes. They used a filtration (ceramic, sand, composite) system in which were from water filtration machine, 82 (96.5%) cleaned and properly covered their water storage containers, 81 (95.3%) will use a clean and functioning toilet whenever they feel the urge to go to the toilet at the workplace. The same number of respondents (n=81,95.3%) will wash their hands after going to the toilet. In addition, 83 (97.6%) respondents bathed more than twice a day and wore clean clothes for work.

Table 4. Distribution of practice items towards WASH

Practice items	Good practice, n (%) ^a
Water	
1. I use clean and safe water sources from surface water/pipe water, or underground water or protected well	84 (98.8)
2. I did not use water source from a pond or unprotected dug well even during a water crisis	83 (97.6)
3. I use treated water for drinking purposes	81 (95.3)
4. I practice filtration (ceramic, sand, composite)/ boiling as my water treatment method	81 (95.3)
5. I keep my water container clean and covered so that no possible contamination from microbes, animals and vectors.	82 (96.5)

6. I place my stored water far from a trash site and dirty place 83 (97.6)

Sanitation

1. I use a toilet that is clean and functions well whenever I feel the urge to go to the toilet when I am at the stall 81 (95.3)

Hygiene

1. I wash hand using soap after using the toilet 81 (95.3)
 2. I bath more than twice a day and wear clean work 83 (97.6)

*Percentage of good practice of respondents who answered "strongly agree" or "agree" for practice that they should have agreed.

3.5 Level of KAP

Table 5 shows the level of knowledge, attitude and practice of the respondents. The mean percentage of score (SD) obtained for knowledge is 76.4% (n=14), attitude 84.4% (n=15), and practice 96.6% (n=13). In addition, 82 (96.5%) respondents had good knowledge, 83 (97.6%) had a good attitude, and 84 (98.8%) showed good practice towards water, sanitation and hygiene (WASH), as shown in Table 6.

Table 5. Descriptive analysis of the score

	Descriptive Statistics			
	Mini- mum	Maximum	Mean	Std. Deviation
Knowledge	47.73	100.00	76.47	14.05
Attitude	37.50	100.00	84.41	14.99
Practice	.00	100.00	96.60	12.72

Table 6. Distribution of knowledge, attitude, and practice

Category	N (%)
Knowledge	
Good	82 (96.5)
Poor	3 (3.5)
Attitude	
Good	83 (97.6)
Poor	2 (2.4)
Practice	
Good	84 (98.8)
Poor	1 (1.2)

3.6 Association towards Level of KAP

Table S1 in the supplementary material shows an association between citizenship and the level of knowledge since the p-value of the chi-square test was 0.01 (p<0.05). There was no association between other sociodemographic characteristics (age group, gender, level of education) and the level of knowledge, attitude and practice (p>0.05), as shown in Table S1, Table S2, and Table S3. Moreover, there was no association between the food handling course attend and the level of knowledge, attitude and practice (p>0.05) based on the chi-square test shown in Table S4.

4. Discussion

In this study, the number of Serdang's street food vendors that were male, aged 18 to 35 years old, local and in or have finished secondary education dominated the numbers in their respective sociodemographic characteristics. In addition, the percentage of respondents who attended the food-handling course was more than those who did not attend, and the majority of Serdang's street food vendors studied showed good knowledge, attitude and practice towards WASH. There was no similar previous study on KAP of WASH among street food vendors. However, there were a few KAP studies on WASH among households that use similar questionnaires and a few studies of KAP on food safety among street food vendors that contained most of the WASH items.

A study conducted by Ismail et al. (2016) in Shah Alam, Selangor, found that from 320 respondents involved in a study among mobile food handlers which consisted of more males than females, most of them had completed and stopped at secondary education. In contrast, Jores et al. (2018) conducted a study among 117 street food vendors in Padawan, Sarawak, and found that female respondents were more than their male counterparts. In addition, the authors also found that the percentage of respondents who did not attend food handling courses was higher than vendors attending the same courses.

In contrast to this study, a KAP study in Tigray Region, Northern Ethiopia, found that most respondents had good knowledge, less than half of respondents had shown a favourable attitude, an

almost equal level of good and poor practice among the respondents. However, most respondents knew that unsafe water could cause diarrheal diseases and water can get contaminated. Most of them agree that the consumption of safe and enough water supply can prevent waterborne diseases; diarrheal diseases are caused by poor personal hygiene and sanitation; washing hands after using latrine prevent diarrheal diseases and disagree on washing hands with water alone is enough to sanitise hands. They also believed that boiling water before consumption helps to remove disease-causing microorganisms, and water containers must always be clean. As for sanitation, only a minor percentage of respondents practised appropriate solid waste disposal. However, this result may be affected as only 35.3% have latrines, and only 84% among those having latrines utilise it. As for hygiene, the majority of respondents wash their hands using water and soap (Berhe et al., 2020).

Most Serdang's street food vendors studied knew that diarrhoea and stomach pain are examples of diseases or illnesses that one can get from consuming unsafe water, and the water they stored can be contaminated. They will use treated water either from filtration or from boiling and clean the water storage container to remove seen or unseen dirt. Moreover, they will use clean toilets as the cleanliness of toilets may affect their personal cleanliness, and had an attitude to use soap for washing dirty hands. They use the toilet whenever they feel the urge to urinate or defecate while at their workplace. However, there were still a minority of respondents who may practice open urination or even open defecation based on the attitude score of these items. This might happen because toilet facilities were too far from the workplace or the lack of staff prevents one from being absent at his/her position for too long.

Another study in Wundwin, Myanmar, showed that out of 500 respondents, about 60% believe that water can be made safe to drink by straining it through a piece of cloth, while 90% believed that water could be made safe by boiling it. According to the respondents' perceptions, the majority believe the treated water is clean, and the water they have treated is entirely safe (United Nations Human Settlements Programme, 2015). These findings were similar to the current study except for straining with cloth items. Most of Serdang Street's food vendors studied knew that filtration

(ceramic/sand/composite) and boiling were effective water treatment methods. Only a minority believed that filtering water using cloth is a correct water treatment method. In contrast, regarding water treatment practices, a study in Kurnool district in Andhra Pradesh, India among residents showed that most respondents did not use any water treatment methods, while only a minority used filtration and boiling as well preferred for their water treatment methods. The absence of water treatment is due to a belief that water is already pure, the cost of purifying methods, a lack of time, and knowledge about water treatment procedures (Hothur et al., 2019).

Moreover, the most important regulation of food service personal hygiene is that vendors must often wash their hands, according to the majority of respondents from a study in Padawan, Sarawak. More than 96% of street food vendors could properly answer the personal hygiene knowledge questions (Jores et al., 2018). Correspondingly, a study in Greater Jakarta found that 99.2% of street food vendors knew that washing hands before work reduces the risk of food contamination and using raw water in food preparation can increase the risk of food contamination.

However, only 43.8% of food workers wash their hands, indicating poor practice. This is possible because there are insufficient facilities for food handlers to wash their hands, such as a sink, clean toilets, and a clean water source (Cempaka et al., 2019). These were similar to the current study findings since more than 89% of vendors knew the importance of personal hygiene, including maintaining hand hygiene at the workplace. Although Serdang's street food vendors were facing the same problems, such as being far from direct piped water supply, no sink and no toilet on-premises, the majority of them showed good practice on washing hands with soap and

4.1. Association towards the level of KAP

In this study, we found no association between all sociodemographic characteristics with the level of knowledge, attitude and practice except for citizenship and the level of knowledge on WASH. There was also no association between the food-handling courses attended and the level of knowledge, attitude, and practice. The possible

reason behind this is because of the items assessed in the knowledge assessment were not taught specifically in the course, or maybe the question of knowledge items are too general and can be correctly answered without the knowledge gained from attending any food handling courses. Citizen-ship was the only variable that was statistically associated with the level of knowledge. This is due to differences in working experience and surrounding environment, Malaysia's policies and infrastructure corresponding to SDG Goal No.6, making local vendors more knowledgeable than non-local vendors. All locals involved in this study were Malay. A study by Rahman et al., (2016) found that Malay vendors in Northern Kuching City, Sarawak showed about three times the tendency to obtain good knowledge based on regression analysis.

5. Conclusion

Serdang's street food vendors have access to piped water, but not at their food stall. They had stored the water so that the water can be used occasionally. They showed a good level on the three assessed items: knowledge, attitude, and practice towards water, sanitation, and hygiene. Although a small percent of street food vendors showed poor practice, as a customer, it can still be improved further by good propagations of policies and measures by the authorities. Availability and easy access to clean, safe, and potable water is very important to improve street food stalls' working conditions and amenities. The findings from this study should inspire local authorities to promote street food safety strategies even more.

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Conflicts of Interest

The author declares no conflict of interest.

References

- Berhe, A. A., Aregay, A. D., Abreha, A. A., Aregay, A. B., Gebretsadik, A. W., Negash, D. Z., Gebreegziabher, E. G., Demoz, K. G., Fenta, K. A., & Mamo, N. B. (2020). Knowledge, Attitude, and Practices on Water, Sanitation, and Hygiene among Rural Residents in Tigray Region, Northern Ethiopia. *Journal of Environmental and Public Health*, 2020. <https://doi.org/10.1155/2020/5460168>
- Cempaka, L., Rizki, A. A., & Asiah, N. (2019). Knowledge, Attitudes and Practices Regarding Food Hygiene and Sanitation of Food Street Handlers in the Public Elementary School at Greater Jakarta, Indonesia. *Asia Pacific Journal of Sustainable Agriculture, Food and Energy*, 7(2). <https://doi.org/10.36782/apjsafe.v7i2.1944>
- FAO. (1990). Street foods. Report of an FAO Expert Consultation, Jogjakarta, Indonesia, 5-9 December 1988. *FAO Food and Nutrition Paper*, 46, 1-96. <https://pubmed.ncbi.nlm.nih.gov/2767251/>
- Goal 6: Clean water and sanitation. UNDP. (2021). <https://www.my.undp.org/content/malaysia/en/home/sustainable-development-goals/goal-6-clean-water-and-sanitation.html>.
- Hoffmann, S., & Scallan, E. (2017). Epidemiology, Cost, and Risk Analysis of Foodborne Disease. In *Foodborne Diseases: Third Edition* (pp. 31-63). Elsevier Inc. <https://doi.org/10.1016/B978-0-12-385007-2.00002-4>
- Hothur, R., Arepalli, S., & Doddoju Veera Bhadrashwara, A. (2019). A KAP study on water, sanitation and hygiene among residents of Parla village, Kurnool district, Andhra Pradesh. *International Journal Of Community Medicine And Public Health*, 6(5), 2081. <https://doi.org/10.18203/2394-6040.ijcmph20191823>
- Ismail, F. H., Chik, C. T., Muhammad, R., & Yusoff, N. M. (2016). Food Safety Knowledge and Personal Hygiene Practices amongst Mobile Food Handlers in Shah Alam, Selangor. *Procedia - Social and Behavioral Sciences*, 222, 290-298. <https://doi.org/10.1016/j.sbspro.2016.05.162>
- Jores, D., Arif, M. T., & Rahman, M. M. (2018). Factors Associated with Food Hygiene Practices Among Street Food Vendors in Padawan, Sarawak. *Borneo Journal of Resource Science and Technology*, 8(1), 56-65. <https://doi.org/10.33736/bjrst.824.2018>

- Mizanur, R., Taha, A. M., Kamaluddin, B., & Zainab, T. (2012). FOOD SAFETY KNOWLEDGE, ATTITUDE AND HYGIENE PRACTICES AMONG THE STREET FOOD VENDORS IN NORTHERN KUCHING CITY, SARAWAK. Undefined.
- Muzaffar, A. T., Huq, I., & Mallik, B. A. (2009). Entrepreneurs of the Streets: an Analytical Work on the Street Food Vendors of Dhaka City. *International Journal of Business and Management*, 4(2). <https://doi.org/10.5539/ijbm.v4n2p80>
- Rahman, M., Arif, M. T., Bakar, K., & Bt Tambi, Z. (2016). FOOD SAFETY KNOWLEDGE, ATTITUDE AND HYGIENE PRACTICES AMONG THE STREET FOOD VENDORS IN NORTHERN KUCHING CITY, SARAWAK. In *Borneo Science*. <https://jurcon.ums.edu.my/ojums/index.php/borneo-science/article/view/169>
- United Nations Human Settlements Programme. (2015). Knowledge, Attitudes and Practices Survey On WATER, SANITATION AND HYGIENE Wundwin Township MYANMAR KAP Survey on Water, Sanitation and Hygiene in Wundwin Township.
- Wesson. (2006). Wesson DW. *Biostatistics: A Foundation for Analysis in the Health Sciences*. 8th Ed. Lexington, SC: John Wiley and Sons Inc; 2006. https://scholar.google.com/scholar_lookup?title=Biostatistics:+A+Foundation+for+Analysis+in+the+Health+Sciences&author=DW+Wesson&publication_year=2006&
- WHO. (2021.-a). Sanitation. Retrieved June 14, 2021, from <https://www.who.int/news-room/factsheets/detail/sanitation>
- WHO. (2021.-b). Water, sanitation and hygiene (WASH). Retrieved June 14, 2021, from <https://www.who.int/westernpacific/health-topics/water-sanitation-and-hygiene-wash>
- WHO. (2021.-c). Water, sanitation and hygiene (WASH). Retrieved June 14, 2021, from <https://www.who.int/westernpacific/health-topics/water-sanitation-and-hygiene-wash>
- WHO. (1996). WHO | Essential safety requirements for street-vended foods. In WHO. World Health Organization.

Supplementary Material

Table S1. Association between sociodemographic and knowledge

Table S2. Association between sociodemographic and attitude

Table S3. Association between sociodemographic and attitude

Table S4. Association between food handling course and KAP level

Table S1. Association between sociodemographic and knowledge

Variable	Knowledge, N (%)		Test statistics	
	Good	Poor	X ²	p-value
<u>Age Group</u>				
Young (18-35)	60 (98.4)	1 (1.6)	2.712 ^a	0.258
Middle age (36-55)	20 (90.9)	2 (9.1)		
Elderly (56 and older)	2 (100)	-		
<u>Gender</u>				
Male	53 (96.4)	2 (3.6)	0.05 ^b	0.942
Female	29 (96.7)	1 (3.3)		
<u>Level of Education</u>				
No education	5 (100)	-	4.396 ^c	0.222
Primary education	5 (83.3)	1 (16.7)		
Secondary education	43 (95.6)	2 (4.4)		
Tertiary education	29 (100)	-		
<u>Citizenship</u>				
Local	76 (98.7)	1 (1.3)	11.957 ^d	0.01*
Non-local	6 (75)	2 (25)		

^a4 cells (66.7%) have expected count less than 5. The minimum expected count is .07.

^b2 cells (50.0%) have expected count less than 5. The minimum expected count is 1.06.

^c5 cells (62.5%) have expected count less than 5. The minimum expected count is .18.

^d2 cells (50.0%) have expected count less than 5. The minimum expected count is .28.

*p-value more less than 0.05, shows association

Table S2. Association between sociodemographic and attitude

Variable	Attitude, N (%)		Test statistics	
	Good	Poor	X ²	p-value
<u>Age Group</u>				
Young (18-35)	60 (98.4)	1 (1.6)	0.644 ^a	0.725
Middle age (36-55)	21 (95.5)	2 (9.1)		
Elderly (56 and older)	2 (100)	-		
<u>Gender</u>				
Male	54 (98.2)	2 (3.6)	0.194 ^b	0.660
Female	29 (96.7)	1 (3.3)		
<u>Level of Education</u>				
No education	5 (100)	-	0.420 ^c	0.936
Primary education	6 (100)	-		
Secondary education	44 (97.8)	1 (2.2)		
Tertiary education	28 (96.6)	1(3.4)		
<u>Citizenship</u>				
Local	75 (97.4)	2 (2.6)	0.213 ^d	0.645
Non-local	8 (100)	2 (25)		

^a4 cells (66.7%) have expected count less than 5. The minimum expected count is .05

^b2 cells (50.0%) have expected count less than 5. The minimum expected count is .71.

^c5 cells (62.5%) have expected count less than 5. The minimum expected count is .12

^d2 cells (50.0%) have expected count less than 5. The minimum expected count is .19

Table S3. Association between sociodemographic and practice

Variable	Practice, N (%)		Test statistics	
	Good	Poor	X ²	p-value
<u>Age Group</u>				
Young (18-35)	60 (98.4)	1 (1.6)	0.398 ^a	0.819
Middle age (36-55)	22 (100)	-		
Elderly (56 and older)	2 (100)	-		
<u>Gender</u>				
Male	54 (98.2)	1 (1.8)	0.552 ^b	0.458
Female	30 (100)	-		
<u>Level of Education</u>				
No education	5 (100)	-	0.899 ^c	0.826
Primary education	6 (100)	-		
Secondary education	44 (97.8)	1 (2.2)		
Tertiary education	29 (100)	-		
<u>Citizenship</u>				
Local	76 (98.7)	1 (1.3)	0.105 ^d	0.746
Non-local	8 (100)	-		

^a4 cells (66.7%) have expected count less than 5. The minimum expected count is .02.

^b2 cells (50.0%) have expected count less than 5. The minimum expected count is .35.

^c5 cells (62.5%) have expected count less than 5. The minimum expected count is .06.

^d2 cells (50.0%) have expected count less than 5. The minimum expected count is .09.

Table S4. Association between food handling course and KAP level

Variable	Food Handling Course		Test statistics	
	Attend	Not attend	X ²	p-value
<u>Knowledge</u>				
Good	56 (96.6)	26 (96.3)	0.004	0.953
Poor	2 (3.4)	1 (3.7)		
<u>Attitude</u>				
Good	57 (98.3)	26 (96.3)	0.314 ^a	0.575
Poor	1 (1.7)	1 (3.7)		
<u>Practice</u>				
Good	57 (98.3)	27 (100)	0.471 ^b	0.493
Poor	1 (1.7)	-		

^a2 cells (50.0%) have expected count less than 5. The minimum expected count is .64.

^b2 cells (50.0%) have expected count less than 5. The minimum expected count is .32.