

A survey study on the assessment of food handler's compliance to personal hygiene practices regulation in selected Malaysia food outlets

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Abstract

Food safety remains a major issue around the world particularly when the COVID-19 pandemic becomes the main issue nowadays. Food safety is essential to the human population worldwide because food is the primary energy source and nutrition for humans. Therefore, food handlers' personal hygiene is one of the factors that are necessary to maintain food safety. The purpose of this study was to assess the food handler's compliance with personal hygiene practices in randomly any food outlets across Malaysia including Kuching, Sarawak; Lawas, Sarawak; Johor Bahru, Johor; Kuala Penyu, Sabah, and Gurun, Kedah. A quantitative method, a cross-sectional descriptive study to one thousand and five (N = 1005) food handlers who participated in the questionnaire and observation checklist was developed by modifying questions in accordance with the Food Hygiene Regulations 2009. Overall, the mean percentage of conformity in adhering to food handler attire was the highest observed at Gurun, Kedah and Kuala Penyu, Sabah with 86.96% and 80.79%, respectively, followed by Kuching, Sarawak with 77.5%, Johor Bahru with 76.71%, and Lawas, Sarawak with 74.93%. Personal hygiene practices conformity showed a high mean percentage with all districts scoring >91% higher than non-conformity. The food handlers also show less unhygienic behaviour while on duty and scored a mean percentage of > 92%. Although in that positive behaviour, some of the food handlers did not perform some unhygienic practices ($\leq 8\%$). In conclusion, there is no significant difference (p-value > 0.05) in the level of conformity between the mean percentages among all districts. Thus, this issue shall raise a concern to the food industries in order to make sure their workers comply with the legal requirement and to avoid any food poisoning outbreak related to food hygiene and food safety in the future.

1. Introduction

Food safety is still a significant problem all around the world. Every year, millions of people throughout the world are hospitalized and even die caused of the consumption of contaminated food and developing foodborne illness (World Health Organization, 2015). This situation could be the result of those countries' weak food safety and hygiene standards. In 2014, Malaysia recorded 49.79 incidents of food poisoning per 100,000 people, with improper food handling accounting for more than half of all cases (Ministry of Health Malaysia

(MOH), 2014). The MOH reports that the use of untreated water for non-beverage consumption, ineffective food handling training and poor sanitation and hygiene are recognized as major national risk factors for food poisoning (Ministry of Health Malaysia, 2012).

The food service sector in Malaysia has gained traction as lifestyles have shifted from "home cooking" to "eating out", especially among the urban population, leading to the phenomenon of local food industries "mushrooming" (Yeo and Leu, 2014). Furthermore, as

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Malaysia is one of the countries affected by COVID-19, people have had to adapt to new norms, including the MOH standard operating procedure (SOP) guidelines for food establishments (Shah *et al.*, 2020). Moreover, since the pandemic has affected all strata of society, most citizens' jobs are at stake. Therefore, the main alternative is the food industry as it is or is only slightly affected by the pandemic as food is one of the most important factors for survival. This has led to the emergence of many new food vendors who do not adhere to and/or comply with the personal hygiene practices listed in the Food Hygiene Regulations 2009. Therefore, food contamination by food handlers can occur and lead to foodborne illnesses if they do not follow the right practices in their establishments (Abdul Mutalib *et al.*, 2015). In this situation, food safety and food hygiene have become important issues for society nowadays.

Malaysian Food Hygiene Regulations 2009 stated in Part IV, Regulation 30: Food handlers training is compulsory for all food handlers, Regulation 31: Medical examination and health condition of food handler are compulsory for all food handlers, food handler who suffers from, or is a carrier of foodborne diseases shall: (a) not be allowed to enter food premises and handle food (b) report to the management of the food premises (c) be suspended from working in food premises until certified cured of the disease and fit to work. In addition, Regulation 32: Clothing of food handler: Food handlers shall wear, clean, suitable, and proper clothing, clean, suitable, and light coloured overall/ light coloured apron, head cover, and footwear, clothing kept in a suitable cupboard/ locker when not in use. Reg 33: Personal hygiene: Food handlers shall maintain a high degree of personal cleanliness, remove their coveralls/headcover/apron before going to the toilet, wash their hands before beginning work, refrain from actions that can contaminate food, wear no jewellery, watches, pins and accessories (Food Safety and Quality Division, Ministry of Health Malaysia, 2009).

According to the Malaysian Food Act 1983, all food handlers must attend and complete a safe food handling course developed by the Malaysian government and be vaccinated against typhoid fever, which is endemic in the country (Lee *et al.*, 2017). Apart from this, knowledge and training on proper food handling is required (Martins *et al.*, 2012). This is to ensure that food handlers follow excellent hygiene practices to reduce cross-contamination and protect consumers from foodborne illnesses. Previous studies have emphasized the importance of food handlers' knowledge, attitudes and practices (Ismail *et al.*, 2016; Lee *et al.*, 2017; Akabanda *et al.*, 2017). This indicates the importance of this

assessment study in providing sufficient data for further action such as planning and defining future approaches to improve food safety in the country. The purpose of this study is therefore to determine the level of food hygiene practices among food handlers. Understanding the level of food hygiene habits is very important in order to improve the health of an individual or population in the next step. Therefore, this study was conducted to obtain more information on Malaysian food handlers' compliance with food SOPs. Therefore, the purpose of this study is to assess the compliance of personal hygiene practices by food handlers in randomly selected food outlets in Malaysia including Kuching, Sarawak; Lawas, Sarawak; Johor Bahru, Johor; Kuala Penyu, Sabah, and Gurun. Kedah.

2. Methodology

2.1 Study area

A quantitative, cross-sectional descriptive study of an observation checklist was conducted to assess the compliance of food handlers according to Malaysia Standard practise, Food Hygiene Regulations 2009 in any food outlets in Kuching, Sarawak; Lawas, Sarawak; Johor Bahru, Johor; Kuala Penyu, Sabah; and Gurun, Kedah. A random sampling method was used in choosing the location site, and 1005 food handlers were enlisted in this study (Murwira *et al.*, 2015). The probability random sampling method was used in this study in the duration of April 2021 to May 2021. The larger the sample the lesser the likelihood that findings will be biased, diminishing returns can quickly set in when samples get over a specific size that needs to be balanced against the resources (Gill *et al.*, 2010).

2.2 Data collection and data quality assurance

The questionnaire survey has been performed on the socio-demographic of food handlers, while a cross-sectional descriptive study using an observation checklist was performed on the assessment of Food Handlers Compliance with food handlers' attire, personal hygiene practices, and personal unhygienic behaviour. The questionnaires were performed by face-to-face interview, for the first section as referred to in Table 1, while direct observation was implemented in a quantitative, cross-sectional descriptive study of an observation checklist as referred to in Tables 2, 3, and 4. The observation checklist was designed by adapting and modifying questions based on previous studies (Murwira *et al.*, 2016). This also refers to MOH guidelines in food safety and hygiene elements highlighted in Malaysian Food Hygiene Regulations 2009.

2.3 Ethical consideration

Ethical approval for this study was obtained from the Faculty of Resource Science and Technology (FRST) of the University Malaysia Sarawak (UNIMAS). Throughout the research, the confidentiality and anonymity of respondents were guaranteed.

2.4 Data analysis

This research uses descriptive statistics to provide an overview of the raw data and to help explain the characteristics of the sample. Frequencies, percentages, means, and standard deviations were computed on demographic variables for this purpose. SPSS version 21.0 and Microsoft Excel were used to handle and analyze the data gathered. The SPSS tools for descriptive data, factor, and reliability analyses were used in this study (Saad *et al.*, 2013). The mean percentage scores were utilized in this study to determine the level of hygienic practices among food handlers (Woh *et al.*, 2016).

3. Results

3.1 Socio-demographic of food handlers

Based on the result from Table 1, the total of responses from the participants was 100% (N = 1005) with a total of two hundred (n = 200) respondents from each locality except for Gurun, Kedah with 205 respondents. A total of 74 (37%) of the food handlers who undertook the questionnaire in Kuching, Sarawak is aged from 19 to 25 years old, while 90 (45%) are 26 to 35 years old and 36 (18%) are 36 years old and above.

Meanwhile, a total of 46 (23%) respondents in Lawas, Sarawak are ages between 19 to 25 years old, 91 (45.5%) from 26 to 35 years old, and 63 (31.5%) respondents are 36 years old and above. The case is

similar in Johor Bahru, Johor as the number of participants who responded in the age distribution of 19-25 years old is 46 (23%), while 87 (43.5%) for 26-35 years old and 67 (33.5%) for 36 years old and above. However, the case is different in Kuala Penyu, Sabah as the number of respondents was the highest in the age range of 26-35 years old with 111 (55.5%), followed by above 36 years old with 45 (22.5%) and lastly 19-25 years old range with 44 (22%) of the total respondents. In Gurun, Kedah on the other hand comprises most from the age of 26-35 years old with 75 (36.6%) follows by 36 years old and above with 68 (33.2%) and lastly age 19-25 years old with 62 (30.2%) respondents.

During the assessment, the number of female respondents topped the male respondents in terms of food handlers such that the majority of the food handlers in Kuching, Lawas, Kuala Penyu, and Gurun are female with a percentage of 50.5% (n = 101), 53% (n = 106), 60.5% (n = 121), 54.6% (n = 112), respectively. This however changed in Johor Bahru, such that the male-dominated with 73% (n = 146) of total respondents.

Meanwhile, for the level of education of the participant in Kuching, only 11 (5.5%) participants were at the primary level, 144 (72%) were at the secondary level and lastly, 45 (22.5%) were at the tertiary level. For Lawas and Gurun, 29 (14.5%) and 42 (20.5%), respectively respondents only had their primary education, the majority 131 (65.5%) and 93 (45.4%), respectively respondents had up until secondary education level and only 40 (20%) and 70 (34.1%), respectively were in tertiary level. This case is similarly seen in Kuala Penyu with a majority of 131 (65.5%) in the secondary level followed by 69 (34.5%) only until the primary level and 6 (3%) managed until the tertiary level. The condition is different in Johor Bahru as most of the respondents had a tertiary level of education with

Table 1. Socio-demographic characteristics of participants

Demographic Variable	Categories	Kuching, Sarawak		Lawas, Sarawak		Johor Bahru, Johor		Kuala Penyu, Sabah		Gurun, Kedah	
		(n)	(%)	(n)	(%)	(n)	(%)	(n)	(%)	(n)	(%)
Age	19-25	74	37.0	46	23.0	46	23.0	44	22.0	62	30.2
	26-35	90	45.0	91	45.5	87	43.5	111	55.5	75	36.6
	>36	36	18.0	63	31.5	67	33.5	45	22.5	68	33.2
Gender	Male	99	49.5	94	47.0	146	73.0	79	39.5	93	45.4
	Female	101	50.5	106	53.0	54	27.0	121	60.5	112	54.6
Level of Education	Primary	11	5.5	29	14.5	5	2.5	69	34.5	42	20.5
	Secondary	144	72.0	131	65.5	58	29.5	131	65.5	93	45.4
	Tertiary	45	22.5	40	20.0	137	68.5	6	3.0	70	34.1
Food Handler Training Course	Yes	103	51.5	99	49.5	140	70.0	116	58.0	166	81.0
	No	97	48.5	101	50.5	60	30.0	78	39.0	29	19.0
Typhoid Vaccine	Yes	103	51.5	164	82.0	115	57.5	43	21.5	175	85.4
	No	97	48.5	36	18.0	85	42.5	157	78.5	30	14.6

n: frequencies, %: percentage

137 (68.5%), secondary level with 58 (29.5%), and primary level with 5 (2.5%).

Among 200 food handlers, almost half, 97 (48.5%) of the food handlers had not completed a Food Handler Training Course nor been vaccinated against typhoid in Kuching. In Lawas, half of the respondents, 99 (49.5%) attended Food Handler Training Course before, and 164 (82%) food handlers have undergone anti-typhoid vaccination. Meanwhile, in Johor Bahru, a total of 140 respondents (70%) had undertaken the Food Handler Training Course with 115 (57.5%) have taken the anti-typhoid vaccine. Furthermore, in Kuala Penyu, more than 50% of food handlers did not attend the Food Handler Training Course, and a total of 157 (78.5%) food handlers did not undertake the typhoid injection. Moreover, among 205 respondents in Gurun, 166 (81.0%) had undertaken the Food Handler Training Course, while a total of 175 (85.4%) of them had typhoid injection before being part of the Food industries in Malaysia.

3.2 Assessment of food handlers' attire

The assessment of food handler attire shown in Table 2 is according to Part IV, Regulation 32, Food Hygiene Regulations 2009. Of the two hundred (n = 200) respondents in Kuching, 143 (71.5%) of food handlers were wearing an apron. Furthermore, 151 (75.5%) of the food handlers were wearing a clean hat or hair restraint, almost all of them which are 186 (93%) were observed wearing face masks, and 135 (67.5%) were using disposable gloves while handling food. Moreover, 86 (43%) of them were observed wearing some accessories on their hand or wrist most of them were a wristwatch. A total of 165 (78.5%) of them were wearing covered shoes while almost all food handlers which are 198 (99%) were wearing clean clothes.

In Lawas on the other hand, 144 (72%) food handlers were wearing an apron, 56 (28%) did not wear it, and 31 (15.5%) food handlers wore a dark or dirty apron and kept a notepad or pen in the apron pocket. A total of 178 (89%) food handlers were wearing a face mask, and 103 (51.5%) respondents were using disposable gloves while handling food. Around 162 (81%) respondents confirm that they did not wear accessories or jewellery, while 38 (19%) did not comply with it, in which 35 (17.5%) of them wore rings, watches, and bracelets. Moreover, 118 (59%) food handlers wore covered shoes, and 82 (41%) with 70 (35%) did not conform and/or by wearing open toes shoe. Finally, all 200 (100%) food handlers in Lawas food outlets wore clean clothes.

Meanwhile, in Johor Bahru, a total of 134 (67%) out

of the 200 food handlers wore clean aprons while 66 (33%) did not wear their apron. Next, a total of 128 (64.00%) respondents wore a hat or hair restraints. However, 200 (100%) of the respondents wore their facemasks but only 166 (83%) of them were wearing disposable gloves while handling the food. Moreover, 110 (55%) of the food handlers were confirmed not wearing any accessories or jewellery while 90 (45.00%) did not confirm, and 72 (36%) out of the 90 non-conformities were wearing watches and bracelets. Next, 136 (68.00%) of the food handlers were wearing covered shoes, while 64 (32.00%) with 30 (15.00%) of the non-conformities were wearing open toes shoes. Finally, 200 (100.00%) of the food handlers wore clean clothes.

In Kuala Penyu, a total of 160 (80%) food handlers were wearing aprons while 40 (20%) respondents were not wearing any aprons. However, up to 80 (63.5%) of them were wearing dark and pocket aprons. Other than that, 180 (90%) of food handlers confirmed wearing clean hats or hair restraints followed by 192 (96%) of them wearing face masks. However, 108 (54%) out of 200 respondents were not using disposable gloves while handling food. Moreover, 155 (77.5%) food handlers were confirmed they not wearing any jewellery or accessories whilst handling food and 154 (77%) of them wore covered shoes and 198 (99%) of the respondents were confirmed to be wearing clean clothes.

On the other hand, in Gurun, Kedah 183 (89.3%) of 205 respondents were wearing aprons. Despite that, 191 (93.3%) of them had pocketed aprons and 151 (73.5%) were wearing a dark-coloured apron. A total of 181 (88.3%) and 171 (83.4%) of the respondents conformed to be wearing clean hats or hair restraints, and face masks, respectively. While 53 (25.9%) of them did not use disposable gloves while handling food 23 (11.2%) of them did not wear any accessories or jewellery on their wrist and hands. In terms of their physical attire overall, 194 (94.6%) and 185 (90.2%) of them were wearing clean clothes and covered shoes, respectively.

3.3 Personal hygiene practices

Table 3 shows the personal hygiene practices of the respondents, in which the observation assessment was based on Part V, Regulation 33, Food Hygiene Regulations 2009. From a total of two hundred (n = 200) food handlers in Kuching, 188 (94%) had their fingernails clean and short, 194 (97%) had no open wounds or sores, 151 (75.5%) had their hair covered, 177 (88.5%) had neat facial hair, and 187 (93.5%) were observed to have not complied with the nail polish and all of the food handlers were not exposed to skin infection or skin diseases, such as eczema.

Table 2. Assessment of food handlers' attire

Food Handler Attire	Kuching, Sarawak				Lawas, Sarawak				Johor Bahru, Johor				Kuala Penyu, Sabah				Gurun, Kedah			
	Conformity		Non-Conformity		Conformity		Non-Conformity		Conformity		Non-Conformity		Conformity		Non-Conformity		Conformity		Non-Conformity	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Wearing an apron (clean)	143	71.5	57	28.5	144	72	56	28	134	67	66	33	160	80	183	89.3	22	10.7	191	93.2
Wearing a clean hat or hair restraint	151	75.5	49	24.5	144	72	56	28	128	64	72	36	180	90	181	88.3	24	11.7	181	88.3
Wearing face mask	186	93	14	7	178	89	22	11	200	100	0	0	192	96	171	83.4	34	16.6	171	83.4
Using disposable gloves while handling food	135	67.5	65	32.5	103	51.5	97	48.5	166	83	34	17	92	46	152	74.1	53	25.9	152	74.1
No accessories are to be worn on hands or wrist	115	57.5	86	43	162	81	38	19	110	55	90	45	155	77.5	182	88.8	23	11.2	182	88.8
Wearing covered shoes	156	78.5	44	22	118	59	82	41	136	68	64	32	154	77	185	90.2	20	9.8	185	90.2
Wearing clean clothes	198	99	2	1	200	100	0	0	200	100	0	0	198	99	194	94.6	11	5.4	194	94.6

n: frequencies, %: percentage

“**” represent remarks. A specific number and its percentage of respondents that appears differently from the food handler attires general characteristics.

Table 3. Personal hygiene practices

Food Handler Attire	Kuching, Sarawak				Lawas, Sarawak				Johor Bahru, Johor				Kuala Penyu, Sabah				Gurun, Kedah			
	Conformity		Non-Conformity		Conformity		Non-Conformity		Conformity		Non-Conformity		Conformity		Non-Conformity		Conformity		Non-Conformity	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Clean and short fingernails	188	94	12	6	199	99.5	1	0.5	200	100	0	0	188	94	12	6	189	92.2	16	7.8
No open wounds or sores	194	97	6	3	199	99.5	1	0.5	200	100	0	0	189	94.5	11	5.5	196	95.6	9	4.4
Hair covered	151	75.5	49	24.5	142	71	58	29	152	76	48	24	182	91	18	9	180	87.8	25	12.2
Neat facial Hair	177	88.5	23	11.5	199	99.5	1	0.5	146	73	54	27	196	98	4	2	185	90.2	20	9.8
Not using a nail polish	187	93.5	13	6.5	200	100	0	0	200	100	0	0	194	97	6	3	188	91.7	17	8.3
No exposed skin infections or skin disease	200	100	0	0	200	100	0	0	200	100	0	0	199	99.5	1	0.5	193	94.1	12	5.9

n: frequencies, %: percentage

Meanwhile, in Lawas, 199 (99.5%) food handlers had short and clean fingernails, with no open wounds or sores, and had neat facial hair, with 1(0.5%) food handlers who did not comply with these characteristics. Besides that, 142 (71%) respondents had neat hair and were covered with a cap or hairnet, but 58 (29%) of them did not cover their hair. Furthermore, not all food handlers used nail polish, and no exposed skin infections or skin diseases like those that Eczema observed.

In Johor Bahru, 200 (100%) food handlers had their fingernails short and clean, and do not have any open wounds or sores. Other than that, 152 (76%) of the food handlers have their hair neat and covered with a hair net or hat, while 48 (24%) did not have their hair covered. Nevertheless, 146 (73%) of the food handlers have their facial hair neat while 54 (27%) respondents were non-conformity. Lastly, 200 (100%) of the food handlers did not use any nail polish and did not have any exposed skin infections or skin diseases.

Other than that, Table 3 shows the personal hygiene of food handlers in Kuala Penyu. A total of 188 (94%) food handlers had clean and short fingernails followed by 189 (94.5%) conformity with no open wounds and sores. Besides, regarding covered hair and neat facial hair, the majority of food handlers confirmed with 182 (91%) and 196 (98%) respondents, respectively. Next, 194 (97%) of respondents were not using nail polish. Lastly, only 1(0.5%) food handlers had exposed skin infection and skin disease.

Meanwhile, in Gurun, Kedah among the 205 respondents, a total of 189 (92.2%) respondents had clean and short fingernails while the remaining 16 (7.8%) had unclean and long fingernails. Besides, 196 (95.6%) respondents had no open wounds or sores and only 9 (4.4%) did not conform with it. A total of 180 (87.8%) had covered their hair while 25 (12.2%) did not cover them. Furthermore, 185 (90.2%) were observed to have neat facial hair but 20 (9.8%) did not. One hundred and eighty-eight (91.7%) respondents were not using nail polish and 17 (8.3%) were using it. A total of 193 (94.1%) respondents not have exposed skin infections or skin diseases such as eczema and the remaining 12 (5.9%) respondents were having it.

3.4 Personal unhygienic practices

Referring to Table 4, a few personal unhygienic behaviours were spotted. In Kuching, 8 (4%) food handlers were observed chewing while preparing food, 4 (2%) were coughing, sneezing, or blowing their nose, 12 (6%) food handlers were observed scratching while on duty and touching food with bare hands, respectively. Meanwhile, 11 (5.5%) food handlers were found

smoking outside their food outlet. Lastly, none (0%) of them were observed to have tasted the food by dipping their finger into it but 4 (2%) of them were observed to be touching food with bare hands.

Referring to Table 4, in Lawas, 193 (96.5%) food handlers have not been found chewing while preparing food, no coughing, sneezing, blowing their nose, no scratching, no smoking, and no tasting the food by dipping a finger into it. However, there were 7 (3.5%) of them who practised these personal unhygienic behaviours. On top of that, 155 (78.3%) out of 200 food handlers did not touch the food with bare hands, but 43 (21.7%) of them did.

Meanwhile, in Johor Bahru, 199 (99.5%) of the food handlers have not been chewing while preparing food, 197 (98.5%) were not coughing, sneezing, or blowing their nose, 199 (99.50%) did not scratch at all, and 192 (96%) of the food handlers did not smoke in the food premises. Other than that, 200 (100%) food handlers did not taste their food by dipping their fingers into it. Finally, 198 (99.00%) did not touch the food with bare hands, but only 2 (1.00%) did.

In Kuala Penyu on the other hand, up to 197 (98.5%) of food handlers did not chew while preparing food, and 194 (97%) were not coughing, sneezing, or blowing their nose. A total of 188 (94%) of them were not scratching and smoking whilst preparing food, but 12 (6%) did. Regarding the no-tasting by dipping fingers into food, 185 (92.5%) of food handlers conformed. Moreover, 171 (85.5%) complied with not touching foods with bare hands.

Moreover, the result in Table 4 showed that a total of 200 (97.6%) respondents have not chewed while preparing food and only 5 (2.4%) respondents did not conform to Gurun. Moreover, 187 (91.2%) were not coughing, sneezing, or blowing their nose while preparing food but 18 (8.8%) were doing those while preparing food. One hundred and ninety-four (94.6%) respondents did not scratch and 11 (5.4%) did not conform. Besides that, the result showed that 173 (84.4%) did not smoke, but the remaining 32 (15.6%) were smoking during preparing food. A total of 202 (98.5%) conformed with not tasting the food by dipping a finger into it and 3 (1.5%) were doing that. Finally, one hundred and seventy-six (85.9%) respondents did not touch the food with bare hands while 29 (14.1%) did not comply by touching the food with bare hands.

3.5 Mean percentage of conformity

Table 5 illustrates the mean and percentage of conformity of each district, such that Gurun and Kuala Penyu have the highest mean percentage of conformity,

Table 4. Assessment of personal unhygienic behaviour of food handler

Food Handler Attire	Kuching, Sarawak		Lawas, Sarawak		Johor Bahru, Johor		Kuala Penyu, Sabah		Gurun, Kedah											
	Conformity	Non-Conformity	Conformity	Non-Conformity	Conformity	Non-Conformity	Conformity	Non-Conformity	Conformity	Non-Conformity										
	n	%	n	%	n	%	n	%	n	%										
Not chewing while preparing food	192	96	8	4	193	96.5	7	3.5	199	99.5	1	0.5	197	98.5	3	1.5	200	97.6	5	2.4
Not coughing, sneezing, or blowing their nose	196	98	4	2	193	96.5	7	3.5	197	98.5	3	1.5	194	97	6	3	187	91.2	18	8.8
Not scratching	188	94	12	6	193	96.5	7	3.5	199	99.5	1	0.5	188	94	12	6	194	94.6	11	5.4
Not smoking	189	94.5	11	5.5	193	96.5	7	3.5	192	96	8	4	188	94	12	6	173	84.4	32	15.6
Not tasting by dipping finger into food	200	100	0	0	193	96.5	7	3.5	200	100	0	0	185	92.5	15	7.5	202	98.5	3	1.5
Not touching food with bare hand	196	98	4	2	155	78.3	43	21.7	198	99	2	1	171	85.5	29	14.5	176	85.9	29	14.1

n: frequencies, %: percentage

Table 5. Mean and percentage of conformity

District	Mean percentage of conformity (%)			
	Food handlers' attire	Personal hygiene practises	Personal unhygienic practice	Mean
Kuching, Sarawak	77.50	91.42	96.75	88.56
Lawas, Sarawak	74.93	94.92	93.45	87.77
Johor Bahru, Johor	76.71	91.50	98.75	88.99
Kuala Penyu, Sabah	80.79	95.67	93.58	90.01
Gurun, Kedah	86.96	91.93	92.03	90.31

Values are presented as mean.

more than 90%. The percentage was then followed by the other three districts with a range of 87-88%. Note that there is no significant difference between the mean percentage ($p>0.05$), this indicated that the level of conformity between districts is more or less the same.

4. Discussion

The present study provides an evaluation of food handlers' adherence to personal hygiene practices in several district localities in Malaysia. In this study, a random sampling based on the quantitative method, a cross-sectional descriptive study that took the form of a questionnaire and observation checklist was performed in any food outlets located in Kuching and Lawas, Sarawak, Johor Bahru, Johor, Kuala Penyu, Sabah, and Gurun, Kedah. Any food outlet included in this study was cafeterias, coffee shops, family dining restaurants, fast food outlets, food courts, and street food, vendors. Based on the respondents' socio-demographics shown in Table 1, out of the 200-205 food handlers in each district who participated in this study, a greater number of participants (43.5- 55.5%) were from 26 to 35 years old. Meanwhile, research from Akabanda *et al.* (2017) found that workers in the older age groups got better hygiene scores than their younger colleagues, presumably due to their greater experience in this profession. Other than that, a similar study conducted by Stratev *et al.* (2017) showed that food handlers at the age of 26-35 years old have a better understanding of the food safety aspect such as personal hygiene compared to younger food handlers.

Moreover, the majority of the participants are females, even though only a 1% difference between male and female respondents in Kuching. Although this study found no correlation between gender and safe food handling, a study by Sylvia *et al.* (2015) found that female food handlers had superior hygiene scores and practices than male food handlers. Similar studies also showed many females involved in the food industry (Akabanda *et al.*, 2017). However, the situation is very different in Johor Bahru such that the number of male participants exceeded the number of female participants with an almost 3:1 ratio. This result contradicted studies done by other researchers before, but considering that the

other three districts have female food handlers more compared to males, it can be concluded that this study agrees with previous studies.

The levels of education of food handlers are widely seen as one of the reasons that have caused food safety and hygiene in compliance. In this study, a great number of participants from Kuching, Lawas, Kuala Penyu, and Gurun (45.4-72%) were in the secondary level of education which is the *Sijil Pelajaran Malaysia* (SPM) level. However, the participants in Johor Bahru show differences on the other hand by majority had completed or were in their tertiary level of education. Based on previous research that was conducted by Toh and Birchenough (2000), the level of education can have an impact on the understanding of food safety and personal hygiene. This is in agreement with a total number of 140 (70%) of the food handlers in Johor Bahru who have attended the food handler training, as compared to the other districts with percentages that only range from 49.5 to 58%. The food handlers that attended the Food Handler Training at Gurun were considered high at 81% because the tertiary level of their education was not that much different compared to the highest secondary level. Based on the observation in this study, personal hygiene practices among those with higher education are better compared to those who are in lower education or without formal education. A similar study shows secondary education participants are influenced by different family economic backgrounds, parents' education level, and location demographics that are far from the city to get higher education (Murwira *et al.*, 2015; Low *et al.*, 2016). Compared to Johor Bahru and Gurun, the demographic of the other districts is hillier than ground level.

In Malaysia, food handlers are required to be trained in the Food Handler Training Course by the Ministry of Health Malaysia (MOH) under the Food Hygiene Regulations 2009 and according to Food Safety and Quality Department, 2017 anti-typhoid vaccination among food handlers is mandatory in Malaysia. However, relatively a great number of un-conformities in attending food safety training courses and taking typhoid vaccination has a similar percentage up to 78.5% in Kuala Penyu. Although this finding contradicts another

study that states Malaysian food handlers must attend Food Handler Training Course before opening food premises (Ncube *et al.*, 2020), most food handlers in this study had completed a Food Handler Training Course as a minimum requirement prior to employment. According to the findings of this study, food handlers who attend a Food Handler Training Course have a more favourable attitude toward food cleanliness than those who do not, which is similar to a previous study by Tirmizi *et al.* (2018). Hence, the Food Handler Training Course is extremely important because it raises awareness and understanding of basic food hygiene and the preventive measures of foodborne hazards, whereas typhoid vaccination prevents the spread of infectious diseases, such as typhoid fever. Anti-typhoid vaccination among food handlers is mandatory under the Food Act of 1983 because typhoid fever is an endemic disease in Malaysia (Lee *et al.*, 2017).

According to Part IV, Regulation 32, Food Hygiene Regulations (2009), food handlers are compulsory to wear suitable attire while handling food as stated in Table 2. The observation visit showed that the percentage of conformity in following the guideline in food handler's attire is higher than un-conformity in all the districts. Among the 1005 food handler participants in this study, 67- 89.3% were wearing an apron but not all of them follow the guideline in Food Hygiene Regulations 2009 which is a light-coloured apron some even do not wear an apron at all. Besides, some of the workers were wearing dark-coloured aprons, and dirty aprons and putting personal stuff in their apron pockets which is not recommended. Bacteria from food handlers' hands can be transmitted and accumulated in dirty and wet aprons when they wipe their hand on the apron (Ncube *et al.*, 2020). Next, 46-83% of food handlers used disposable gloves while handling food. A recent study demonstrated that coagulase-positive *Staphylococci* and *Salmonella* were found on food handlers' hands (Ncube *et al.*, 2020). Therefore, the potential for bacteria to transmit into food is high if the food handlers were not wearing disposable gloves. Meanwhile, based on the observation, as high as 171-100% of food handlers were using a surgical mask, KN95 or cloth mask that was regulated in nowadays situations which is due to the pandemic caused by COVID-19. Gastroenteritis is usually caused by the transmission of *Staphylococcus aureus* from individual infectious nostrils into food preparation, according to Murwira *et al.* (2015). Furthermore, a facemask can prevent COVID-19 from being transmitted into food, even though there is no proof that COVID-19 infection can be transmitted from food to humans (Yekta *et al.*, 2021). Thus, by using a face mask, any bacteria or viruses from the food handler's nose and mouth are

prevented from contaminating the food.

Most of the food handlers have favourable attitudes toward most aspects of personal hygiene practices according to Part IV, Regulation 33, Food Hygiene Regulations (2009) listed in Table 3. First, 92.2- 100% of food handlers were having clean and short fingernails. This research study is similar to a study done by Murwira *et al.* (2016) which is 115 (94%) out of 122 food handlers were observed to have short and clean fingernails. Besides, food handlers with untrimmed fingernails may contribute to or facilitate the spread of microorganisms that cause food poisoning. (Mengist *et al.*, 2018). However, it was found that a small number of 6.5% in Kuching, 3% in Kuala Penyu, and 17% in Gurun were using nail polish which is against the law. According to the FDA Food Code (2017), the food employee may wear artificial nails or fingernail polish only if they also wear gloves that are clean and in good condition. Moreover, 94.1 -100% of food handlers had no open wounds. Based on the research study by Ismail *et al.* (2016), it was stated that any person with open cuts, sores, or wounds should not prepare or serve food, and if a person is wounded while preparing or serving food, the person should stop immediately and cover the wound to avoid bacteria from contaminating the meal. Next, 71-91% and 73-99.5% of food handlers were having their hair covered and neat facial hair, respectively. This aspect of personal hygiene was important to a food handler because based on a study by Kim *et al.* (2017), having messy facial hair gives a negative perception of hygienic and cleanliness issues to the customers. Besides, food may be found to be contaminated by hair. Bacteria attach to the hair and scalp, while dust and sweat accumulate in the hair (Ababio and Adi, 2012). Hence, it is significant for food handlers to keep their hair covered while on duty. Food handlers also must not suffer from exposed skin infections or skin diseases. Besides, in research from Soares *et al.* (2012), when it comes to contagious skin disease, 98.2 % of handlers agree that it is vital to take time off work. This is to avoid any microbial contamination that is caused by skin disease (Baluka *et al.*, 2015).

The five major risk factors that contribute to the outbreak of foodborne illness in restaurants include improper personal hygiene of food handlers, improper food temperature, contaminated equipment, inadequate cooking, and unsafe food (Mjoka and Selepe, 2018). Based on direct observation, this study also revealed the unhygienic behaviour of some of the food handlers listed in Table 4. Behaviours that could result in food contamination were observed which is 0.5- 4% of food handlers were spotted chewing while preparing food, 1.5

-8.8% of them were coughing, sneezing, or blowing their nose. According to a study by Dhand and Li (2020), coughs and sneezes produce a variety of respiratory droplets that spread respiratory virus diseases. According to Soon *et al.* (2020), droplets of fluid emitted from sneezing and coughing contain infectious bacteria that can travel up to 7-8 meters. Bacteria can transmit into the food, although the food handler was sneezing and coughing without covering their mouth at a far distance from food. Furthermore, food workers with infected hands can transmit virtually any foodborne illness through their "hand habits," which are automatic hand movements including touching one's face, rubbing one's nose, and scratching an itch (Tan *et al.*, 2013). While 3.5 - 15.6% of food handlers were found smoking outside their food outlet. Smoking transfers pathogens from the mouth to the hands, and cigarettes release particles that can contaminate food (Mjoka and Selepe, 2018). As a result, wearing a mask to protect the nose and mouth, as well as practising good hand hygiene, should be required to avoid the problems. In addition, there are some food handlers in Lawas, Kuala Penyu, and Gurun, 3.5%, 7.5%, and 1.5%, respectively dipping their finger to taste the food. There are also as high as 1- 21.1% of them touching the food with bare hands which are correlated directly with the non-usage of disposable hand gloves in Table 2 or non-usage of utensils such as tongs. According to Akabanda *et al.* (2017), *S. aureus* isolated from food handlers' hands can cause food contamination. In addition, the most common foodborne pathogens isolated from hands were *Bacillus*, *Escherichia coli*, *Enterobacter*, *Klebsiella*, and *S. aureus* (Murwira *et al.*, 2015).

5. Conclusion

In conclusion, this study shows that awareness of personal hygiene habits and SOPs for food sites is important in this pandemic situation to reduce the infection rate of COVID-19 and to ensure that people working in the food industry follow standard food safety requirements. Understanding the level of food hygiene practices is critical to prevent food contamination and reducing the risk of foodborne illness outbreaks. While there are a high number of food handlers who have complied with the personal hygiene practices standardized by the Malaysian Food Hygiene Regulations in 2009, there are also those among food handlers who engage in unsanitary practices while on the job and have not attended food handler training and have not received typhoid vaccinations. This is still a concern as it may contribute to food contamination.

Conflict of interest

The authors declare no conflict of interest.

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