



# INTERNATIONAL JOURNAL OF RESEARCH IN PHARMACEUTICAL SCIENCES

Published by JK Welfare &amp; Pharmascope Foundation

Journal Home Page: <https://ijrps.com>

## Measuring hand hygiene practice: Comparison between self-reported and direct observation among food truck vendors in Klang Valley, Malaysia

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### Article History:

Received on: 02.10.2018  
Revised on: 14.12.2018  
Accepted on: 16.12.2018

### Keywords:

Direct observation,  
Food safety,  
Food hygiene,  
Food truck vendors,  
Hand hygiene,  
Self-reported question-  
naire

### ABSTRACT

Contamination of food by food handlers contributes to vast food outbreaks due to the transmission of pathogens from the food handlers' hands. Thus, hand hygiene is a great manner to reduce the infections from harmful pathogens. The aims of this study were to assess the hand hygiene practice among food truck vendors based on a self-reported questionnaire and direct observation. A cross-sectional study was conducted among food truck vendors at Klang Valley. The self-reported questionnaire and direct observation were used to identify the hand hygiene practice and the significant difference of outcomes between these two instruments. Cohen kappa reveals a poor agreement between self-reported questionnaire and direct observation on hand hygiene practice among respondents. The mean difference on hand hygiene practices for the self-reported questionnaire and direct observation among the food handlers were  $17.77 \pm 3.15$  and  $11.45 \pm 3.00$  respectively, where a significant difference was observed ( $p=0.003$ ). The results revealed that over-reporting errors should be considered when analyzing and interpreting the data derived from the self-reported survey. The outcome also indicated that food safety education and enforcement is necessary for promoting food safety practice.



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ISSN: 0975-7538

DOI: <https://doi.org/10.26452/ijrps.v9iSPL2.1750>

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IJRPS | <https://ijrps.com>  
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### INTRODUCTION

About 80% of communicable diseases comes from touches which explain the outbreak of foodborne illness due to unhygienic food handling (Government of Northern Ireland, 2017). In 2008, over 256 foodborne illness cases were reported in Malaysia and there is an increasing trend observed over the years which indicate the negligence of safe food handling among food handlers (Abdul-Mutalib *et al.*, 2015). In addition, the increasing trend of eat-

ing outside among Malaysian due to rapid urbanization and the emergence of the middle class may impose the risk of foodborne illness as a result of uncontrolled unsanitary practices of food handler (Abdul-Mutalib *et al.*, 2015; Meftahudin *et al.*, 2002).

Proper hand hygiene and food handling practices have come to be recognized as the most effective mechanism to prevent the spread of infection especially during food preparation (Dharod *et al.*, 2007; Sani and Siow, 2014). As such, quantitative surveys and observations have been employed to gain insights on food handling practices among handlers in food service operation (Tan *et al.*, 2013; Saidatul Afzan and Hayati, 2014; Sani and Siow, 2014; Suleiman, 2014). Food handling surveys are particularly useful to ascertain food safety practices, attitudes and knowledge among food handlers in food establishments. These surveys also serve an important role in the development of food safety education programmes (Dharod *et al.*, 2007). Thus, it is important to identify the extent of agreement between self-reported and actual food safety practices among food handlers.

Several studies among consumers in households have been compared between self-reported and observed food safety practices (Jay *et al.*, 1999; Redmond and Griffith, 2003; Anderson *et al.*, 2004; Kendall *et al.*, 2004; Dharod *et al.*, 2007). A study conducted in 40 households in Melbourne, Australia showed a lack of agreement between self-reported and observed food handling practices. The observation was conducted using a video camera for two weeks after self-reported questionnaire administration (Jay *et al.*, 1999). Researchers have documented that self-reported cleaning of kitchen and hand hygiene was seriously over reported. Similarly, Anderson *et al.* (2004) found that 87% of respondents reported washing their hand with soap and water before preparing food but only 38% were observed doing so. Dharod *et al.* (2007) on the other hand indicated a high level of inaccuracy for socially desirable behaviour such as hand washing, where the majority of the respondents reporting practising this behaviour but were also observed not doing so.

Information on a comparison between self-reported and observed food handling practices among the food handler in street food vending is scant. Several studies have evaluated on self-reported food handling behaviour among handlers in food establishments which include hand washing practices, food preparation and premise hygiene (Mohd Firdaus *et al.*, 2015; Kunadu *et al.*, 2016; Lee *et al.*, 2017). However, there were too little local studies reported on food hygiene practices among street food vendors since this sector is flourishing in Malaysia due to changing of food demands among the consumers (Meftahudin *et al.*, 2002). Only one study assessed self-reported food hygiene practices among the street vendors in Sarawak, Malaysia. The researchers found that the food safety practices score was high, and this is true for those who attended the food safety training and possessed good knowledge on food safety (Md Mizanur *et al.*, 2012). Following an extensive search, no study reports the comparison between self-reported and observation on hand hygiene among the street vendors in Malaysia. Hence, this current study was conducted to assess hand hygiene practice using self-reported survey and observation among the street vendors, particularly the food truck operators.

## MATERIALS AND METHODS

### Sampling Procedure

This study employed convenient sampling among 384 food truck vendors in Klang Valley, Malaysia. The sample size was calculated based on the protocol by Daniel (1999). Written permission was acquired from the food truck operators prior to the research and briefed about the study. Respondents

were recruited among those who are directly or indirectly in contact with food such as cook, cashier, cleaner and those involved in food preparation.

### Questionnaire and Hand Hygiene Observation

A set of bilingual (Bahasa Malaysia and English) questionnaire which included questions on socio-demographic profile and hand hygiene practices was prepared and pre-tested on ten street food vendors in Kajang, Selangor in order to ensure the wording consistency and items clarity. Following questionnaire validation, it was self-administered to the food truck respondents. They were required to assess their hand hygiene practice based on the closed-ended questions adapted from Tan *et al.* (2013). On the other hand, the observation was performed during the business operation. A set of the modified checklist (Manoa, 2014) was used for this purpose. The respondents were not notified on the observation exercise as to avoid Hawthorne effect.

### Statistical Analysis

Data entry and analyses were performed using SPSS version 20.0 for Windows (SPSS, Chicago). Descriptive analysis was conducted for both categorical and continuous data. Data were presented as n (%) and mean (S.D). Mean score differences between hand hygiene practices for self-reported and observation was evaluated using student t-test. Hand hygiene practices were classified as 'Good hand hygiene practice' and 'Poor hand hygiene practice' by calculating the median score. Those who scored above the median score is classified as 'Good practice' and below median score as 'Poor practice'. The degree of agreement between questionnaire responses and data from observation was evaluated using Kappa statistics (Manun' Ebo *et al.*, 1997). Mc Nemar's test was performed to indicate systematic differences between self-reported and observation data (Manun' Ebo *et al.*, 1997).

## RESULTS AND DISCUSSION

186 respondents responded to the survey (48.4% response rate). The low response rate was due to refusal and ignorance which may not reflect the whole population of food truck vendors in Klang Valley. Involvement of local authorities may assist in gaining a high response rate for future studies. More than half of the respondents were in the age range between 21 to 30 years old, and most of them were Malays and dominated by males. Most of the vendors received secondary and tertiary education. In addition, more than half of the respondents

**Table 1: Descriptive analysis of respondents' socio-demographic data**

Variable	Categories	Frequency (%)
Age	Below 20	14 (7.5)
	21-30	106 (57)
	31-40	47 (25.3)
	Above 40	19 (10.2)
Gender	Male	141 (75.8)
	Female	45 (24.2)
Race	Malay	183 (98.4)
	Chinese	1 (0.5)
	Others	2 (1.1)
Education Background	Primary	6 (3.2)
	Secondary	79 (42.5)
	College/University	96 (51.6)
	No formal education	5 (2.7)
Attended Safe Food Handling Course	More than 3 years	51 (27.4)
	Less than 3 years	110 (59.1)
	Not attend	25 (13.4)
Job Responsibility	Cooking	77 (41.4)
	Cleaning & wash dishes	12 (6.5)
	Serve food	25 (13.4)
	Preparation of food	47 (25.2)
	Others (cashier, manager)	25 (13.4)

Data were presented as n (%) for categorical variables

**Table 2: Mean score and classification of the self-reported questionnaire and direct observation (N=186)**

Instrument	Mean (S.D)	P-value
Self-Reported Questionnaire	17.77 (3.15)	0.003*
Direct Observation	11.45 (3.00)	
	Good practice	Poor practice
	n (%)	n (%)
Self-Reported Questionnaire	127 (68.3)	59 (31.7)
Direct Observation	117 (62.9)	69 (37.1)

Descriptive analysis and student t-test were conducted. Data were presented as mean (SD) and n (%) for categorical variables. \*p< 0.05

attended food safety handling course for less than 3 years. 41% of the respondents were involved in cooking activities, followed by food preparation and serving (25.2% and 13.4% respectively), cashier or manager (13.4%) and cleaning (6.5%) (Table 1).

The present study was carried out at several different food trucks at Klang Valley areas which are considered as urban and suburban. Majority of the food trucks are located at the roadside area or in the park. Most of the park areas provide electricity and potable water from mobile restrooms for public and vendors. This allows the food truck vendors to obtain water supply and mobile restrooms. From our observation, most of the food truck vendors brought their own water supply for hand and utensils washing. Food truck vendors who run their business during special events or festivals reported that they brought their own water supply for more than two gallons per business day for

their operation. As such, access to water supply is not a major issue among the food truck vendors in Klang Valley.

With regards to food hygiene practice, there was a significant difference between the mean score of self-reported and observation ( $17.77 \pm 3.15$  and  $11.45 \pm 3.00$  respectively with  $p = 0.003$ ) (Table 2). It is clearly evident that respondents tend to over-report their hand washing practices. This result is similar to those studies conducted among the household consumers (Jay *et al.*, 1999; Anderson *et al.*, 2004; Dharod *et al.*, 2007) and could be explained due to the 'desirable' behaviours when completing the questionnaire (Manun' Ebo *et al.*, 1999). When classifying the Good and Poor hand hygiene practices, the result exhibited more than 60% of respondents were classified as practising good hand hygiene for both self-reported and observation (Table 2). It should also be noted that single observation may be prone to biases, thus

**Table 3: Cohen's Kappa Agreement between Self-Reported Questionnaire and Direct Observation among Food Handlers**

Behaviour	Self-reported behaviour n (%)	Observed behaviour n (%)	K statistic (95% CI)	Mc Nemar's p-value
a. Wear glove during food preparation				
Yes	90 (86.5)	69 (84.1)	-0.022 (0.48-	<0.001
No	14 (13.5)	13 (15.9)	0.66)	
b. Wash hand after touching unwrapped raw food	7 (8%)	10 (10.1)	0.010 (0.59-	<0.001
Yes			0.77)	
No	80 (92%)	89 (89.9)		
c. Wash hand after using the toilet	10 (83.3%)	164 (94.3)	0.100 (1.17-	1.000
Yes			1.25)	
No	2 (16.7%)	10 (5.7)		
d. Wash hand after touch face/hair/body	20 (11.4)	3 (27.3)	-0.021 (0.04-	<0.001
Yes			0.12)	
No	155 (88.6)	8 (72.7)		
e. Wash hand after handling garbage	3 (21.4)	10 (5.8)	0.161 (1.15-	1.000
Yes			1.25)	
No	11 (78.6)	162 (94.2)		
f. Handle money and food at the same time	78 (47.6)	14 (63.6)	-0.056 (0.57-	<0.001
Yes			0.74)	
No	86 (52.4)	8 (36.4)		
g. Wash hand after coughing	16 (8.9)	1 (14.3)	0.041 (0.61-	<0.001
Yes			0.77)	
No	163 (91.1)	6 (85.7)		
h. Keep fingernails clean, trimmed and unpolished	43 (87.8)	128 (93.4)	0.073 (0.88-	<0.001
Yes			1.03)	
No	6 (12.2)	9 (6.6)		
i. Wearing jewellery, watches, and bracelet	21 (19.8)	14 (17.5)	0.029 (0.47-	<0.001
Yes			0.65)	
No	85 (80.2)	66 (82.5)		
j. Handling food while having a cut	21 (12.6)	2 (10.5)	0.005 (0.08-	<0.001
Yes			0.18)	
No	146 (87.4)	17 (89.5)		
k. Smoking during food handling		2 (1.3)	0.036 (1.04-	<0.001
Yes	1 (3.6)		1.17)	
No	27 (96.4)	156 (98.7)		
l. Wash hand using soap or hand sanitizer	6 (7.2)	14 (13.6)	-0.079 (0.64-	<0.001
Yes			0.80)	
No	77 (92.8)	89 (86.4)		
m. Wipe hand using a clean cloth	14 (73.7)	161 (96.4)	0.279 (1.11-	0.115
Yes			1.22)	
No	5 (26.3)	6 (3.6)		

Data were analyzed using Chi-square test for categorical data and Cohen Kappa for agreement. Data presented as n (%) and  $\kappa$  ( $\beta$ ) respectively.

repeated observation by different observers can be proposed as an effective mechanism to assess hand hygiene practice.

At the individual level, the agreement between observation and questionnaire was very poor (Table 3). The kappa statistics for most of the behaviours examined were close to zero, indicating that the agreement might be expected by opportunity (Manun' Ebo *et al.*, 1997). There was evidence of over reporting for wearing glove during food preparation ( $p < 0.001$ ), washing hand before touching face/hair/body ( $p < 0.001$ ) handling money and food at the same time ( $p < 0.001$ ), washing hands after coughing ( $p < 0.001$ ), keeping fingernails clean and trimmed ( $p < 0.001$ ), handling food while having cut ( $p < 0.001$ ) and wiping hand using clean cloth ( $p < 0.001$ ) (Table 3). A similar finding was reported by Sani and Siow (2014) on poor hand hygiene practices among food handlers in a food establishments that includes smoking and wearing jewellery during food preparation. The researchers concluded that although their respondents possessed a higher education level, the majority of them did not practice good hand hygiene. Fair agreement was observed in wiping hand using a clean cloth ( $k = 0.279$ ,  $p = 0.115$ ) (Table 3). Although the agreement was not significant, it demonstrated that few of the respondents were practising good hand hygiene. Our result reflects a need for proactive support from the management in the form of facilities (soaps, sinks, portable clean water) and motivation towards promoting hand hygiene. As such, this might assist the transition of knowledge acquired from the food handling course (Philip and Anita, 2010).

Codex Alimentarius Commission (2003) emphasized that improper food handling is a major foodborne, and poor hand hygiene is one of the risk factors of food contamination. The Centers for Disease Control and Prevention (CDC), USA has outlined that handlers who directly prepare ready-to-eat (RTE) foods should wash their hands thoroughly using soap under hot running water and dry with a single-use towel. Hand sanitizers may be used as a proper step in hand washing and waterproof gloves which have been cleaned and disinfected should be worn during food handling (CDC 2010).

Several limitations from this study should be addressed. The structured questionnaire which employed close-ended questions may invoke a positive response (Manun' Ebo *et al.*, 1997; Sani and Siow, 2014). Therefore, it is suggested that the open-ended questionnaire can be exercised to reduce the over-reporting bias. The present study also did not incorporate the evaluation of attitudes on food safety which may affect hygiene practices.

Thus, further research is warranted to better understand the hygiene behaviours and its association with attitudes on food safety, especially among the food truck and other mobile food vendors.

## CONCLUSION

Findings of this study demonstrated that there is no 'gold standard' in measuring hygiene behaviours. Similar to many previous studies, our results exhibited lack agreement between self-reported questionnaire and direct observation measuring hand hygiene practices among the food truck vendors. The disagreement between the two instruments, however, at this time did not indicate which method is more valid. Nevertheless, our results were consistent with the hypothesis that in general, most of the food truck vendors tend to over-report 'desirable' hand hygiene behaviours.

## ACKNOWLEDGEMENT

The authors would like to express their gratitude to all respondents and the food truck organizers for their contribution and participation throughout the research.

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