

## Examining Factors in Preventing Foodborne Diseases among Food Handlers at Military Dining Hall

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### ABSTRACT

This study aims to determine Food Safety (FS) knowledge, practice in preventing Foodborne Disease (FBD), and risk perception related to food handling among food handlers at military bases. An Optimistic Bias (OB) in preventing FBD were examined based on the risk perception responses. A set of questionnaires was sent to an officer at each military base in Malaysia. Later, the officer would conveniently distribute the questionnaire to approximately half of the targeted respondents. A total of 284 data were gathered and were analysed using SPSS version 20. The findings revealed that food handlers had good FS knowledge scores and practice to prevent FBD. However, it was found that different risk perception levels were present, indicating OB. The existence of OB was observed in all comparisons and situations except for the question about sanitising utensils. Hence, a conclusion can be made that there is a tendency that food handlers tend to neglect and overlook FS procedures, and can contaminate foods due to the presence of OB. This study will contribute significantly to military foodservice establishments in Malaysia regarding food hygiene and safety awareness.

**Keywords:** food contamination, food safety knowledge, optimistic bias, risk perceptions

### INTRODUCTION

Knowledge, attitude and practice play a vital aspect in preventing the occurrence of FBD. In addition, it is crucial to know the risk perception, knowledge and optimistic bias and its relationship with FS risk (de Andrade *et al.* 2019). Food handlers are expected to practise what they have learned during training. Enhancing education in FS through exercise is essential, but this does not indicate that the implementation would be appropriately commuted in practice (Sanlier *et al.* 2020). According to Hamade (2015), knowledge is essential in controlling FS, but it cannot guarantee the safety of the food being produced without proper practice. Hamade (2015) also stated that appropriate food handling knowledge and practices reflected the change of action on how food handlers prepare food. Food handlers with poor personal and food hygiene and inappropriate cleanliness at the premises will lead to FBD and the death of the consumer (Kamboj *et al.* 2020; Le *et al.* 2021).

Initially, food handlers' risk perceptions differ (Evans *et al.* 2020). In addition, increased

cases of food poisoning will influence behaviour (Bolek 2020), which will further increase the knowledge of the risk associated with FBD among food handlers (Al-Mohaithef 2021). Meanwhile, Optimistic Bias (OB) is a situation where a person's level of self-confidence is subjected to the optimistic perception of their partner (de Andrade *et al.* 2019). An over-optimistic food handler inclines to ignore safety procedures which can result in food contamination (Rossi *et al.* 2017). In addition, Rowell *et al.* (2013) also mentioned that common barriers such as time constraints, poor communication, limited resources, and ineffective leadership are important limitations that lead the food handler to ignore good practices. OB causes the presence of these barriers among food handlers (da Cunha *et al.* 2015).

Concerning this matter, extensive studies have been conducted related to FBD in foodservice institutions where Knowledge, Attitude and Practice (KAP) measurement of food handlers were mostly emphasised (Mshelia *et al.* 2022; Izyan *et al.* 2019; Zaujan *et al.* 2021). Similarly, many studies have been carried out

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in conjunction with food optimism from food handlers and peer risk perception towards FBD in many parts of the countries (de Andrade *et al.* 2019; Evans *et al.* 2020; de Freitas *et al.* 2019; Evans & Redmond 2019; Fujisaki *et al.* 2019; Aschemann-Witzel & Grunert 2015).

de Andrade *et al.* (2019) reported that food handlers are more likely to believe that they are less risky than their peers in hazardous situations. It is because a person tends to be very optimistic about risk, especially people who think they are in control (de Freitas *et al.* 2019). A similar situation happened in the military food service in which the perception of food handlers on their co-workers or peers who have limitations in performing their duties will cause FBD. Lee *et al.* (2012) stated that the military foodservice establishment poorly practised designated temperature and time control. Furthermore, Mustafa *et al.* (2009) found that military personnel perceived it as easy for them to encounter food poisoning because of the food-handling culture assembled within the kitchen. Hence, this study is vital to examine factors leading to the practice of preventing FBD by food handlers at military camps.

## METHODS

### Design, location, and time

A cross-sectional survey was conducted among food handlers at military bases in Malaysia between October and November 2019. Before the study was conducted, approval was obtained from higher authority at every military base.

### Sampling

There were 647 food handlers at military bases throughout Malaysia. According to Krejcie and Morgan (1970), a minimum sample size of 242 is needed. In this study, a purposive sampling method was adopted where approximately 50% of the food handlers at each military base were asked to complete the questionnaire. There was an informed consent statement at the beginning of the questionnaire.

### Data collection

Items for questionnaires were adapted from Patah *et al.* 2009; Kamal *et al.* 2015; Abdullah 2015; Abd Lataf Dora-Liyana *et al.* 2018; Rossi *et al.* 2017; Food Standard Australia & New Zealand 2019. The questionnaire was segmented

into four sections: demographic profiles, practice to prevent FBD, FS knowledge, and risk perception in handling food. The latter segment is to measure optimistic bias.

The practice to prevent FBD consists of 10 questions with a four-point Likert scale ranging from 1=never, 2=seldom, 3=sometimes and 4=always. A zero score was given to never (scale 1) response, while scale 2, scale 3 and scale 4 will get scores 1, 2 and 3, respectively. However, the FS knowledge consists of 15 items with three selections of answers: “true”, “false”, and “not sure”, where the correct answer would be given one mark, while incorrect and “not sure” answers would get zero marks. To facilitate score calculation, the practice and knowledge score points were transformed to 100 marks. The practice to prevent FBD and the FS knowledge scores percentage were ranked based on the following: below 50% is poor, a score between 50%–79% is defined as average score; and a score 80% and above as good score (Sani & Siow 2014).

Meanwhile, the risk perception in handling food consists of 13 questions which were adapted from Rossi *et al.* (2017) with five-point Likert scale ranging from 1= not at all likely; 2= likely not to happen; 3=50% chance of happening; 4= likely to happen and; 5= extremely likely. However, no scores were calculated since this variable was used to identify optimistic bias. Questions were asked indirectly to the respondent to indicate the risk of causing OB and separate questions about risk to other individuals (peers, friends/others) that may cause FBD (de Freitas *et al.* 2019). The first eight questions were on the food handler’s self-risk perception (Q1–Q8), while the following five were on peer risk perception (Q9–Q13). To further determine the OB, the respondent’s total score was compared to the peer score of the other in the same situation (Rossi *et al.* 2017) (shown below). A significant score difference would indicate OB and the width of the difference would reflect its magnitude (Chock 2011).

1) Pair 1 (Q1 and Q9) - Food handlers compared themselves with colleagues working at other dining halls; 2) Pair 2 (Q1 and Q10) - Food handlers compared themselves with colleagues working at the same dining halls; 3) Pair 3 (Q3 and Q11) - Food handlers compared themselves with colleagues working at the same dining hall but for a specific practice hall; 4) Pair 4 (Q7 and

Q12) - Food handlers compared themselves with colleagues working at the same dining hall but for a specific practice; 5) Pair 5 (Q4 and Q13) - Food handlers compared themselves with colleagues working at other dining halls but for a specific practice.

The instrument was checked for reliability and consistency with Cronbach’s alpha value above 0.90. Finally, the validated instrument was distributed among the food handlers at the respective military bases throughout Malaysia.

**Data analysis**

Data gathered were analysed using SPSS version 20 (SPSS Inc.) for descriptive statistics, while paired sample tests were conducted to examine the existence of OB (by comparing self-risk perception with peer risk perception).

**RESULTS AND DISCUSSION**

**Demographic Profiles**

A total of 284 data were analysed where most respondents were males (n=167, 58.8%) and aged between 26 and 35 (n=103, 36.3%). Approximately 200 (70%) of the respondents obtained secondary school qualifications. Most respondents had working experience of more than five years (n=136, 47.9%). As much as 264 (93%) of the respondents had attended the food handling courses conducted by either the Ministry of Health (MoH) (n=144, 50.7%), Malaysian Armed Forces (MAF) (n=64, 22.54%), or both (n=56, 19.72%). However, 20 (7%) did not attend any food handling course. Almost all food handlers had typhoid injections within the past three years (n=277, 97.5%).

**Food safety knowledge**

Food handlers had good FS knowledge, with an overall mean score of 86.85% (±19.169). The respondent has demonstrated excellent knowledge about food storage, the temperature of the chiller/freezer, wearing proper cloth and gloves and handwashing in handling food to reduce the risk of cross-contamination. The findings are consistent with Abdullah (2015). However, food handlers demonstrated inadequate knowledge of reheating food (69.7%). The finding is consistent with Martins *et al.* (2022) and Mbombo-Dweba *et al.* (2022). It is crucial to ensure that the food is reheated adequately since

some toxins produced by microbes are resistant to the heating temperature of food (Zyoud *et al.* 2019).

In addition, poor knowledge related to typhoid injection was also observed (77.1%), which is consistent with Izyan *et al.* (2019). In Malaysia, all food handlers must have typhoid injections, and only those with the injections can participate in food safety courses organised by the government and the authorised agencies. This is clearly shown in Table 1 that more than 97% of the respondents had typhoid injections, but only 77% of them gave a correct answer related to the role of the injections. Hence, food handlers may take

Table 1. Characteristics of the respondents (n=284)

Characteristics	Frequency	%
<b>Gender</b>		
Male	167	58.80
Female	117	41.20
<b>Age</b>		
18–25 years	79	27.82
26–years	103	36.27
36–45 years	55	19.37
46 years and above	47	16.55
<b>Educational level</b>		
Primary school	11	3.87
Secondary school	200	70.42
Certificate	21	7.39
Diploma	35	12.32
Degree	11	3.87
Others	6	2.13
<b>Working experience</b>		
<1 years	34	11.97
1–2 years	63	22.18
3–5 years	51	17.96
>5 years	136	47.89
<b>Typhoid injection within the past three years</b>		
Yes	277	97.54
No	7	2.46

typhoid injections to fulfil specific requirements or to avoid being penalised by the authority without understanding the purpose of the injections.

### Practice to prevent foodborne diseases

Most of the food handlers had good practices related to objects that can contaminate food (90.8%), food storing (93.3%), cleaning kitchen/serving utensils (92.6%), keep area clean (94.7%), storage of cleaning supplies (90.1%), ensure cleaning supplies stored separately from food (91.5%) (data not shown). However, the lowest score was obtained regarding wearing a hairnet (73.6%). It could be perceived that the food handlers feel uncomfortable wearing a hairnet or are not provided with enough hairnets. The finding was contradicted to Abd Lataf Dora-Liyana *et al.* (2018), where food handlers at the boarding schools were observed with a hairnet and clean uniforms.

Besides, hand washing practices have been claimed to be good (88%). This statement could be justified that the number of handwashing sinks is not enough, or they are difficult to wash their hand due to the location of the handwashing sink far from their working area. Similar findings were

reported by Tan *et al.* (2013), where most food handlers in primary schools in the Hulu Langat area of Selangor neglected hand hygiene and did not properly wash their hands.

### Self-risk perception in handling food

Table 2 summarises the self-risk perception in food handling. The food handlers perceived the slightest risk perception that customers would have food poisoning after eating the food they prepared (Q1), followed by the customer having severe/lethal risk after consuming contaminated food (Q2). Meanwhile, questions 3, 5, 6, 7 and 8 revealed that food handlers had moderate risk perception of FS, demonstrating that they were aware that food poisoning could occur if they did not comply with the correct FS practices. Conversely, the statement about preparing meals with expired ingredients (Q6) had the highest mean for risk perception ( $3.84 \pm 1.258$ ). Da Cunha *et al.* (2015) mentioned that if the food handlers believed that FBD would not happen when preparing the food, it would be hard for them to take preventive measures, that is, to ensure good food handling practices. In addition, da Cunha *et al.* (2019) mentioned that self-reported

Table 2. Food handler's self-risk perception in handling food (n=284)

Statement	Mean±SD
Q1. What is the customer's risk of having a stomachache and/or vomiting (food poisoning) after eating a meal prepared by you?	1.77±1.00
Q2. If a customer consumes contaminated food that prepares/served by you, what is the risk of the disease he contracts being severe or lethal?	2.66±1.35
Q3. If you do not wash your hands, what is the customer's risk of having a stomach ache and/or vomiting (food poisoning) after consuming a meal prepared by you?	3.08±1.28
Q4. If you work while wearing earrings, jewellery, a watch or uncovered hair, what is the customer's risk of having a stomach ache and/or vomiting (food poisoning) after consuming a meal prepared by you?	2.98±1.19
Q5. What is the customer's risk of having a stomachache and/or vomiting (food poisoning) after consuming a hot meal that did not reach the temperature 70°C that prepared/served by you?	3.23±1.24
Q6. If you provide your customer with a meal prepared with an expired ingredient, what is his risk of him having a stomachache/or vomiting (food poisoning) after consuming this meal?	3.84±1.26
Q7. If you do not properly sanitise a utensil, what is the customer's risk of having a stomachache and/or vomiting (food poisoning) after consuming a meal prepared by food handlers from the foodservice where you work?	3.76±1.24
Q8. If you prepare meat that has been improperly thawed, what is the customer's risk of having a stomachache and/or vomiting (food poisoning) after consuming the meal?	3.39±1.15

Q1, Q3, Q4 and Q7 will be paired with statements in Table 3 to determine OB (as presented in Table 4)

risk perception usually differed from actual or observed practices.

**Peer risk perception in handling food**

As can be seen in Table 3, questions 9 and 10 had lower scores than questions 11, 12 and 13. The respondents believe that their colleagues working at different halls but receiving the same amount of training or who worked in the same place have a low chance of causing food poisoning to their customers. One possible reason for the findings was probably because they recognised the food handlers and knew how their friends worked. The findings indicate that food handlers are confident that if their colleague/co-worker handles food correctly with the correct FS procedures, it will prevent the customer from having food poisoning. It is known that improper food handling will lead to food contamination and allow the bacteria to multiply, resulting in an increasing number of patients receiving FBD (Kibret & Abera 2012). The overall mean score for risk perception was 3.0014±0.72. This result indicates that there is a moderate risk perception among food handlers in the military base in Malaysia.

**Optimistic bias among food handlers**

OB has been identified based on four situations: 1) Food handlers compared themselves to colleagues working at the same dining halls;

2) Food handlers compared themselves with colleagues working at other dining halls; 3) Food handlers compared themselves with colleagues working in the same dining room but for a specific practice; and 4) Food handlers distinguished themselves from colleagues working in the same dining room but for a particular practice.

To determine the presence of OB, an individual’s score will be compared to the peer score of the other (Rossi *et al.* 2017). Positive results with significant differences demonstrate the presence of OB, and a high score indicates a high degree of tendency of OB (Chock 2011). OB is where a person feels that he or she is not doing/experiencing something negative and is always positive about him or herself (Rossi *et al.* 2017). Hence, the findings of this study revealed that food handlers feel that they are not at risk of doing anything harmful.

This result means that if the individual/food handlers who score lower than their peers show a tendency existence of OB. Individual/food handler senses and marks a lower response or scale than the peer/other people’s question to determine the presence of OB. After comparison and if the negative result means OB.

As shown in Table 4, significant differences were observed for pair 1, 2, 3 and 4, where pair 1 (questions 1 and 9): -348, p=0.000; pair 2 (questions 1 and 10): -390, p=0.000; pair 3 (questions 3 and 11): -285, p=0.000; and

Table 3. Peer risk perception in handling food (n=284)

Statement	Mean±SD
Q9. What is the customer's risk of having a stomachache and/or vomiting (food poisoning) after eating a meal prepared by a food handler similar to you (who is a similar age and has participated in the same amount of training as you), but working at other dining hall?	2.11±1.13
Q10. What is the customer's risk of having a stomachache and/or vomiting (food poisoning) after consuming a meal prepared by a colleague (food handler working in the same place as you- at the same dining hall)?	2.16±1.14
Q11. If your co-worker does not wash his/her hands, what is the customer's risk of having a stomachache and/or vomiting (food poisoning) after consuming a meal prepared by him?	3.37±1.10
Q12. If your colleagues do not properly sanitise a utensil, what is the customer's risk of having a stomachache and/or vomiting (food poisoning) after consuming a meal prepared by him?	3.58±1.15
Q13. If your friends at other dining halls work while wearing earrings, jewellery, a watch or uncovered hair, what is the customer's risk of having a stomachache and/or vomiting (food poisoning) after consuming a meal prepared by him?	3.03±1.25

All statements in this table need to be paired with some statements in Table 2 to determine OB (as presented in Table 4)



Table 4. Paired independent t-test for risk perception (n=284)

Pair	Question <sup>†</sup>	Mean±SD	Mean difference±SD	p
1	Q1	1.771±1.006	-0.349±1.262	0.000*
	Q9	2.120±1.128		
2	Q1	1.771±1.006	-0.391±1.277	0.000*
	Q10	2.162±1.144		
3	Q3	3.088±1.276	-0.285±1.318	0.000*
	Q11	3.373±1.100		
4	Q7	3.761±1.235	0.176±0.896	0.001*
	Q12	3.585±1.148		
5	Q4	2.982±1.193	-0.053 (1.138)	0.435
	Q13	3.035±1.249		

\*indicate a significant difference at  $p < 0.05$

†: The full statement for the respective question number can be found in Table 2 and 3

pair 4 (questions 7 and 12): 0.176,  $p = 0.001$ . The p-values for each pair  $< 0.05$  indicate the existence of OB. However, no existence of OB was observed for pair 5 (questions 4 and 13): -0.052,  $p = 0.435 > 0.05$ .

In addition, pair 2 was having larger mean value than pair 1 (Pair 2:  $-0.39085 \pm 1.277 >$  Pair 1:  $-0.34859 \pm 1.261$ ). When a comparison is made with a known person, the individual is aware of and can evaluate the nature of his or her attitude, and this is different compared to other people even though both have similar characteristics. However, there were differences between pair 4 and 5, where pair 4 was smaller than pair 5. Pair 4 mean differences (Pair 4:  $0.176 \pm 0.896 <$  Pair 5:  $0.052 \pm 1.137$ ). This result indicates that if the food handlers assess a known person rather than an unknown person under certain circumstances, then the rating is low, and they place a higher risk on the known person.

### CONCLUSION

The findings of this study show that food handlers at the Malaysian military bases had good FS knowledge and practice in preventing FBD. Consumers perceived safety and hygiene

of food as the most important attribute for their satisfaction, although many studies clarified that good FS knowledge does not guarantee good food handling practices and hygiene results. Hence, upholding the fact that food handling courses are a compulsory requirement for all food handlers in Malaysia, it is, therefore, a corporate way to increase knowledge on FS in preventing foodborne disease.

Lastly, this study's findings presented that food handlers' self-risk perception is always positive compared to their friends' understanding, and their perceptions also differ from known people and unknown people. Food handlers who are more likely to say they are better than their peers will then cause OB. OB occurs especially when the food handlers put judgements of themselves to other food handlers. Hence, OB is significantly good at assessing one's perceptions and risks. By knowing the level of perception respectively, the management will be able to determine what kind of training and courses to be provided to suit overall targets. In this way, continuous FS training, as well as suitable intervention programs, will help food handlers not to put judgement on others, hence reducing and preventing FBD from happening excessively.

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### DECLARATION OF CONFLICT OF INTERESTS

The authors declare no conflict of interest.

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