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## Foodborne Illness Risk Factors Assessment: Evidence from Penang Tabung Haji Hotel Kitchen Outlet

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### Abstract

This study was conducted on two (2) kitchen outlets at Tabung Haji Hotel in Penang, Malaysia to seek compliance and degree to food safety practices based on Food and Drug Administration, 2018 (FDA) assessment method and practices. The study incorporated interviews, observations, field assessments, and discussions with the kitchen and hotel management team to verify current states and practices. The two (2) kitchen outlets involved in this study were Western and Malay cuisine kitchens. Meanwhile, the foodborne illness risk factors that were analyzed include improper holding time and temperature, poor personal hygiene, contaminated equipment/ cross-contamination, inadequate cooking and safe food resources. Audit form based on Ministry of Health (MOH); Premise and Food Safety Ordinance under section 10 and 11 of the Malaysian Food Act 1983 and thermometer were used as a tool in collecting the data. Results for risk factors compliances level showed that all risk factors were at an acceptable level which achieved >80% of the compliance level, except poor personal hygiene was recorded out of compliance <80% for both outlet kitchens based on the FDA 2018 assessment. Overall findings based on FDA assessment guidelines and onsite observation on these 2-kitchen outlet at Tabung Haji Hotel Penang, showed both kitchens were at the compliance level >80% which obtained 88% for Western and 85% for Malay Kitchen.

**Keywords:** Food Borne Illness, Risk Factors, FDA Compliance Level

### Introduction

Foodborne disease can be defined as an illness due to consuming contaminated food (Soon *et al.*, 2011). Foodborne illness can be caused by bacteria, virus or parasite which multiply in the intestine or the consumption of non-infectious agents like toxin and chemicals (Linscott, 2011). It is undeniable that foodborne illness cases cannot be eliminated thoroughly as it is self-inflicted or accidentally caused by food operators and servers across the world due to contamination of new bacteria and viruses found in the food and beverages prepared and served (Hayes & Forsythe, 2000). Restaurants, cafeterias, and bars are the most frequently mentioned locations where foods implicated in reported food-borne disease outbreaks are consumed (Redmond & Griffith, 2003)

FDA (2018) mentioned restaurant industry is a major driver of foodservice and food safety all over the world. The demand of the consumer to consume food away from home has led to increased spending in both fast food and restaurant (Powell et al., 2012; Stewart et al., 2004). Along with this high demand comes the need for careful attention to food safety practices and behaviors that minimize the incidence of foodborne illness in these locations. According to Ying (2019), the former Health Minister, Dr. Dzulkefly Ahmad said, the number of food poisoning cases in Malaysia went up by 24% in 2019 compared to 2017, which is from 401 cases to 496 cases. Understanding the foodborne illness risk factors can reduce the number of foods contaminated at the restaurant outlet kitchen (FDA, 2018).

## **Literature Review**

### **Foodborne Illness Risk Factors**

FDA (2018) and MOH (2001) have outlined five (5) risk factors that need to be evaluated and assessed in complying with safe food preparation and consumption by reducing further foodborne illness occurrences. They are:

#### ***Improper holding time and temperature***

FDA (2018) outlines an effective way to prevent microbial growth is to keep the food at the right temperature. Cooked food should be served within four hours at the temperature of 63°C and above is highly recommended (MOH, 2015). On the other hand, frozen food should be held at -10°C and chilled at 5°C and below (MOH, 2015).

#### ***Poor Personal Hygiene Practices***

In the process of food preparation, serving, and distribution, personal hygiene and good health condition are the most important factors to be considered by the management (Food Hygiene Regulation, 2009). Poor food handler hygiene is the main threat to public health as the potential of bacteria spreading, especially *Staphylococcus* easily happens to the food (Green et al., 2007.). *Staphylococcus* bacteria produce toxins and they cannot be eliminated but they can be reduced by frequent hand washing with clean warm water and soap (Altekruse et al., 1995). In Malaysia it has been reported food handlers fail to perform the basic rule of food preparation such as mistreatment of the food and lack of hygiene practice contributed to food poisoning (Rashidi et al., 2009). Other contributing factors such as mannerism and open wound among food handler also can contaminate the food by transferring the microorganism to the food (Mushaireen, et al., 2010). MOH (2015) reminded all foodservice owners to restrict sick and unfit employees from handling meals. The sick food handler should be given sick leave and only allow to work when they are fully recovered from the illness.

#### ***Contaminated Equipment/ Cross Contamination***

Food may be contaminated by polluted water, insects, pests, dust, dirt, and unclean utensils (Gudeta, 2007). Contaminated equipment and utensils can transfer that contamination to the foods and cause a foodborne illness. All food preparation equipment and cooking utensils should also be cleaned thoroughly before reusing (MOH, 2015). The best way to reduce the number of microbial contaminations related to equipment thoroughly washes the equipment, rinses, and sanitize with hot water (MOH, 2015). This usually can be done manually in a 3-compartment sink, mechanical dish machine, or through a clean-in-place procedure for large pieces of equipment.

***Inadequate Cooking***

Raw animal foods are cooked to appropriate temperatures and cooked foods are reheated to required temperatures are the main items being highlighted in this risk factor. Cooking is the best way to kill bacteria meanwhile, proper holding temperatures can slow down the reproduction of bacteria (FDA, 2018). The appropriate temperature for different kind of raw items is shown in Table 1:

Table 1

*Minimum temperature and cooking time (FDA Code, 2017)*

Items	Minimum cooking temperature	Minimum time for cooking
Raw whole eggs	63 °C (145 °F)	15 seconds
Comminute fish	68 °C (155 °F)	17 seconds
Roasting foods (whole)	54 °C (130 °F)	112 minutes
Stuffed food (pieces); stuffed meat, chicke & stuffed fish	74 °C (165 °F)	Less than 1 minute
All potential hazardous food	63 °C (14 5°F)	15 seconds

***Safe Food Resources***

Safe food resources are defined as an approved source, where the food produced, prepared, or processed, meets or exceeds the standards of the responsible regulatory agency and has a valid permit, also inspected regularly by a regulatory agency (FDA, 2017). Thus, foodservice operators should be aware and knowledgeable on the list of raw food items received and should be able to identify reliable suppliers or vendors.

Based on the aforementioned findings and practices, this study intended to assess the compliance level of foodborne illness risk factors on 2 different outlet kitchens at Penang, Tabung Haji Hotel

***Methodology***

The study sample was 2 outlet kitchens at Penang, Tabung Haji Hotel. These samples were chosen because of the potential hazards of food poisoning with regards to the number of consumer patronizing the food produced by this kitchen outlet, especially during hajj season as the hotel being used to transit pilgrims before the flight to Mecca. The outlet kitchens involved were Western and Malay. Assessment and auditing process based on the five risk factors of foodborne illness was conducted with the help and cooperation of the kitchen staffs and management of the hotel.

***Audit Form Development***

The modified audited form of UiTM Shah Alam Health Centre which is based on the Premise and Food Safety Ordinance under Section 10 & 11 of the Malaysian Food Act 1983 (Lembaga Penyelidikan Undang-Undang, 2003) and FDA assessment (2018) was used to suit with Malaysian setting.

### **Study Status**

Compliance = Within the compliance guideline and based onsite observation. Scores given to this level is >80%.

Out of compliance =Based on guidelines and onsite observation. Scores given is <80%.

### **Food Premises Auditing Process**

On-site outlet kitchens observation and food auditing process was conducted which involved interviews with the restaurant and kitchen management, related record reviews, the ambiance as verification measure, and food temperature recording. The score given by the researcher was based on MOH Premises Hygiene under Section 10 and 11 of Food Act and FDA 2018 are as follows:

### **Full Mark**

Those elements or people involved complying with auditing form requirements received full marks for the particular factor.

### **Zero Mark**

If one of the elements or people did not comply with the auditing form requirement, they will receive a zero mark.

### **Why Zero Mark**

Any element or person that did not comply with the requirement of the auditing factor will automatically receive zero marks as any small out of compliance may lead to food contamination or foodborne illness.

The acceptable compliance level percentage for restaurant outlet kitchens is 80% (FDA, 2018). The formula for the compliance level is as follows:

### **Study Status**

Compliance = Within the compliance guideline and based onsite observation. Scores given to this level is >80%.

Out of compliance = Based on guidelines and onsite observation. Scores given is <80%.

### **The formula for determining compliance level according to FDA assessment methods and guidelines:**

$$\frac{\text{Score given to each variables/subjects}}{\text{Total scores of each variable/subject}} \times 100$$

Food temperature measures were set in the audit form, there were two (2) types of temperature checking devices or thermometers used

*Thermocouple – EFC Fast, Pyrometer CH945*

Two types of thermocouples were used to check the food temperature to prevent cross-contamination between the raw and cooked food. To get an accurate reading the thermocouples were calibrated using hot boiling water (100°C) or ice water (0°C). Then the

thermocouple was inserted into the food to get the temperature. The required temperature based on MOH (2015) is 5°C or below for cold food, frozen -10°C, and cooked food at 63°C. Both of the thermocouples were sanitized with alcohol tissue consisting of 70% ethanol and 30% distilled water.

### ***Laser thermometer Retek (calibrated by teak)***

Laser thermometer is also known as an infrared thermometer. It is used to measure accurately the surface temperature from a distance. Setting the desired temperature of the chiller is less than 5°C, freezer -10°C and room temperature at 27°C to 30°C.

### ***Data Analysis***

Data obtained from the study were analyzed both quantitatively and qualitatively. The data analysis process was done by using an audit form mark received by the kitchen outlet based on a standardized system to rate each food safety management system element (Procedures, Training, and Monitoring (PTM) method (FDA, 2018). The analysis involved a compliance level >80% based on FDA 2018.

### **Findings & Discussions**

The results in percentage value in assessing foodborne illness risk factors compliances level on 2 outlet kitchens at Penang, Tabung Haji Hotel illustrated below:

Table 2

*Risk factor on improper holding time and temperature*

<b>Risk Factor</b>	<b>Allocation Mark</b>	<b>Western Kitchen (Marks Received)</b>	<b>Malay Cuisine Kitchen (Marks Received)</b>
<b>1. <u>Improper holding time and temperature</u></b>			
Storage of raw materials in the refrigerator should be orderly and clean: “freezer” temperature = 0°C until -10°C	4.0	4.0	4.0
“chiller” temperature = 0°C until 4°C	4.0	4.0	4.0
Storage of cooked food should be in a closed container	9.0	9.0	9.0
Food served less than 4 hours (room temperature)	7.0	7.0	7.0
TOTAL	24.0	24.0	24.0
% of Compliance Level	100%	100%	100%

A sufficient number of large holding time and temperature equipment at Penang Tabung Haji Hotel was the main reason this risk factors received full marks for each item. Walk-in chiller, freezer, and the usage of food bain marie are the contribute of the food prepared able to be at the appropriate temperature as a guideline by FDA 2018. Nurmaisari & Vita (2019) highlighted it requires the commissary foodservice production to use proper holding equipment with temperature gauges such as bain marie and walk-in storage in ensuring the food products were at a suitable temperature in preventing the growth of microbial.

Risk Factor	Allocation Mark	Western Kitchen (Marks Received)	Malay Cuisine Kitchen (Marks Received)
<b>2. <u>Poor Personal Hygiene</u></b>			
All food handler should undergo health screening and get typhoid vaccination	4.0	4.0	4.0
All food handler are obligated to follow food handler course	4.0	4.0	4.0
All food handler should wear clean, appropriate clothing and cover their heads, wear aprons and wear gloves	2.0	0	0
All food handler should wear safety shoes while handling food inside the premises	4.0	4.0	4.0
All food handler should take care of personal hygiene such as short nails, no injuries, or infectious disease and do not wear a ring during handling of food	6.0	0	0
TOTAL	20.0	12.0	12.0
% of Compliance Level	100%	60%	60%

Table 3: Risk factor on poor personal hygiene

### Methodology

Poor personal hygiene risk factors showed that both kitchens were out of compliance level. Ignoring proper attire was identified during onsite observation at Penang Tabung Haji Hotel, which wearing a dirty uniform, and inappropriate clothing such as not covering the head and not wearing aprons and gloves. Selamat & Hassan (2003) stated that poor food hygiene and food handling practices and awareness were among the most alarming problems faced by the food control authority. Contamination from the food handler is the most common way the microorganism to be transmitted into food caused by salmonella microorganism (Abdalla et al., 2009).

Table 4

*Risk factor on contaminated equipment/ cross contamination*

<b>Risk Factor</b>	<b>Allocation Mark</b>	<b>Western Kitchen (Marks Received)</b>	<b>Malay Cuisine Kitchen (Marks Received)</b>
<b>3. <u>Contaminated Equipment/Protection from Contamination</u></b>			
Cooked or eaten food should be kept separated from the raw material	9.0	9.0	9.0
All ingredients and foods used in food preparation should have a complete label	1.5	1.5	1.5
All equipment and utensils for food preparation should always be clean, easy to wash, and in perfect condition	5.0	5.0	5.0
Dishes and other utensils should be washed in a high place and not on the floor	3.0	3.0	0
Unused equipment should be removed from premises to reduce congestion	2.0	2.0	2.0
<b>TOTAL</b>	<b>20.5</b>	<b>20.5</b>	<b>17.5</b>
<b>% of Compliance Level</b>	<b>100%</b>	<b>100%</b>	<b>85.4%</b>

The risk factor of contaminated equipment/ cross-contamination showed both kitchens were at compliance level and received scores of more than 80% as the strict Standard Operation Procedure (SOP) and Halal implementation has been implemented in this hotel. Tabung haji hotels have been listed as Syariah compliant hotel that provides services, food and makes financial transactions based on completely Shariah principles (Jurattanasan & Jaroenwisana, 2014). Regular inspection of the internal officer of Tabung Haji Hotel known as the Halal Assurance officer is the reason this risk factor meets the marks of compliance level. According to Nuratifah et al (2019) aspect of thorough assessment in getting and maintaining the Halal certification is also a reason many food companies and establishments are carefully taking care of their hygiene and cleanliness. Besides that the Halal Certification Procedure is tough and strict as many guidelines and regulations were referred and adopted for *halal* certification used by JAKIM and other authorities such as Malaysia *Halal* Certification Procedure Manual 2014, Guidelines for *Halal* Assurance Management System of Malaysia *Halal* Certification 2011, Department of Standard (2009; 2013), Food Act 1983, Food Regulations 1985 and Food Hygiene Regulations 2009 (Nuratifat et al., 2019).

Table 5

*Risk factor on Inadequate cooking*

<b>Risk Factor</b>	<b>Allocation Mark</b>	<b>Western Kitchen (Marks Received)</b>	<b>Malay Cuisine Kitchen (Marks Received)</b>
<b>4. <u>Inadequate cooking</u></b>			
Cooked temperature: Boiling point > 100°C	4.0	4.0	4.0
Frying > 175°C	4.0	4.0	4.0
Hot food serve > 63°C	4.5	4.5	4.5
TOTAL	12.5	12.5	12.5
% of Compliance Level	100%	100%	100%

On-site observation at these 2 outlet kitchens using thermocouple and laser thermometer *Retek* shows both kitchens received 100% marks. This is happened due to the usage of commercial and advanced equipment in preparing meals. The usage of temperature indicator equipment such as standing deep fat fryer, combi oven, tilting skillet, and food warmer was very helpful in ensuring food served was at the appropriate temperature. According to Wayne Gisslen, 2011, specialized equipment and machine for kitchens nowadays enable the chef to cook a large amount of dish. Besides that, proper equipment and tools also able to contribute good taste, appearance, and safe food for human consumption (Gisslen, 2011).

Table 6

*Risk factor on food from unsafe sources*

<b>Risk Factor</b>	<b>Allocation Mark</b>	<b>Western Kitchen (Marks Received)</b>	<b>Malay Cuisine Kitchen (Marks Received)</b>
<b>5. <u>Food From Unsafe Sources</u></b>			
Visual inspection on receives items	6.0	6.0	6.0
Expiry date checking and return	4.0	4.0	4.0
Clean receiving area	4.0	0	0
List of reliable suppliers	9.0	9.0	9.0
TOTAL	23.0	19.0	19.0
% of Compliance Level	100%	83%	83%

Risk factor for unsafe resources stated both kitchens complied as both received 83% except for cleanliness items. Clean and hygiene receiving area received 0 marks as the food stock received was put on the floor and the area seemed uncleaned with existed of cats. Others were recorded in compliance. The strict policies and enforcement of Syariah-compliant hotels lead to high marks received for this factor. According to Zakiah & Fadhilah, 2013 seven basic requirements of Syariah complaint in handling halal food are stated in MS 1500:2004/2009 such as sources of halal food and drinks should be halal animal and plant-based, slaughtering for example halal and non-halal animals must never slaughter together, product processing, handling, and distribution should comply with halal regulations, product storage, display and serving for instance equipment's, machinery and other materials used must not be made of non-halal materials, hygiene, sanitation, and food safety should comply with the concept of *halal tayyib*, packing and labelling must be carefully evaluated by JAKIM and legal requirements which in line with MS 1500: 2004 revised 2009. These seven basic requirements have led the Syariah hotel to receive good marks for the safe resources risk factor.

Overall, the score on these 2- outlet kitchens at Penang, Tabung Haji Hotel showed they were at an acceptable level (> 80%) which obtained only 88% for Western and 85% for Malay Kitchen. The result was illustrated in table 7.

Table 7

*Result the total food borne illness risk factor assessment*

Risk Factor	Allocation Mark	Western Kitchen Given Marks	Malay Cuisine Kitchen Given Marks
<b>1. <u>Improper holding time and temperature</u></b>			
Storage of raw materials in the refrigerator should be orderly and clean: "freezer" temperature = 0°C until -18°C	4.0	4.0	4.0
"chiller" temperature = 0°C until 4°C	4.0	4.0	4.0
Storage of cooked food should be in a closed container	9.0	9.0	9.0
Food served less than 4 hours (room temperature)	7.0	7.0	7.0
<b>2. <u>Poor Personal Hygiene</u></b>			
All food handler should undergo health screening and get typhoid vaccination	4.0	4.0	4.0
All food handler are obligated to follow food handler course	4.0	4.0	4.0
All food handler should wear clean, appropriate clothing and cover their heads, wear aprons and wear gloves	2.0	0	0
All food handler should wear safety shoes while handling food inside the premises	4.0	4.0	4.0

All food handler should take care of personal hygiene such as short nails, no injuries, or infectious disease and do not wear a ring during handling of food	6.0	0	0
<b>3. <u>Contaminated Equipment/Protection from Contamination</u></b>			
Cooked or eaten food should be kept separate from the raw material	9.0	9.0	9.0
All ingredients and foods used in food preparation should have a complete label	1.5	1.5	1.5
All equipment and utensils for food preparation should always be clean, easy to wash, and in perfect condition	5.0	5.0	5.0
Dishes and other utensils should be washed in a high place and not on the floor	3.0	3.0	0
Unused equipment should be removed from premises to reduce congestion	2.0	2.0	2.0
<b>4. <u>Inadequate cooking</u></b>			
Cooked temperature: Boiling point > 100°C	4.0	4.0	4.0
Frying > 175°C	4.0	4.0	4.0
Hot food serve > 63°C	4.5	4.5	4.5
<b>5. <u>Food From Unsafe Sources</u></b>			
Visual inspection on receives items	6.0	6.0	6.0
Expiry date checking and return	4.0	4.0	4.0
Clean receiving area	4.0	0	0
List of reliable suppliers	9.0	9.0	9.0
Grand Total	100	88.0	85.0
% of Compliance Level	100%	88%	85%

In conclusion, food safety practices implemented at Penang Tabung Haji Hotel were at the acceptable level >80%. However, the percentage of personal hygiene factors needs to be monitored as it can be one of the many causes of food poisoning cases. Both of the kitchens recorded 60% during the on-site observation. The ignorance and awareness of personal hygiene is the reason this factor received out-of-compliance marks. Motivation and refreshment course on personal hygiene is advisable in ensuring the staff kitchen are always be reminded on the clan and hygiene practices.

Since this study is only focused on the Penang Tabung Haji outlet kitchen, further research needs to be done to seek and compare the scores of other Tabung Haji hotels in Malaysia; to see the overall scenario of the kitchen operation and compliance level to food standards and practices. Furthermore, a lab test on microorganism existence is recommended to seek a correlation between both audit outcomes, the lab test, and management systems analysis. Through comprehensive analysis, it is expected able to get much accurate and, precise data gathering and analysis in reducing the worry of food-borne illness (food poisoning) in the foodservice industry especially the Tabung Haji chain Hotel in Malaysia.

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