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Food Borne Illness Risk Factors Assessment in UiTM Shah Alam, Malaysia

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Abstract: This study was conducted on 14 food dining halls in UiTM Shah Alam, Malaysia to seek compliance and degree to food safety practices based on Food and Drug Administration, 2004 (FDA) assessment method and practices. The study incorporate interviews, observations, field assessments and discussion with the campus management in order to verify current states and practices. Overall results showed that food safety practices implemented in students' dining halls in UiTM Shah Alam were at a good level (7 dining halls), satisfactory (6 dining halls) and unsatisfactory (1 dining hall). Food borne illness risk factors that were analyzed include safe food sources, food storing temperature and stock control, personal hygiene, cross contamination and safe food holding temperature. The two risks factors were at an acceptable level; safe food sources and personal hygiene. Safe food sources had achieved 92% and personal hygiene with 92.3% of the compliance level set by the FDA's Food Safety Risk Level. Other risk factors; food storing temperature and stock control, safe food holding temperature and cross contamination were recorded at 74%, 72.5% and 69.6% of the level set which were out of compliance level based on the FDA assessment.

Key words: Food borne illness · Risk factors · Compliance level

INTRODUCTION

Food borne illness can be defined as an illness caused by consuming food contaminated with pathogenic bacteria or chemical [1]. The main source of food borne illness is through bacterial contamination, followed by physical factors (preparing and handling methods) and chemical usage. It is undeniable that food borne illness cases could not 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 [2].

Although in Malaysia the trend of food poisoning cases has shown significant decrease since the past 10 years, it has been among the highest number of food borne illness cases as compared to cholera, typhoid, dysentery and hepatitis A (Ministry of Health [MOH], [3]). Most food poisoning cases reported as shown in Figure 1 occurred in education and learning institution premises such as school canteens, hostels and higher institution dining halls [4]. Robert [5] states that cross contamination caused by mass food production and the usage of the same preparation equipment and utensils in the process of preparing students' daily meals could be the main contributing factor to the high percentage of food poisoning cases in education institutions.

FDA [6] and MOH [7] have outlined five (5) risk factors that need to be evaluated and assessed in complying with safe food preparation and consumption by reducing further food borne illness occurrences. They are:

Safe Food Sources: According to Longree and Blaker [8], food that is safe to eat should be from a safe source and received from sources that have quality assurance and safety. Other than that, 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.

Food Storing Temperature and Stock Control: Every raw food items received, either dry or wet and cooked items' temperature should be at an appropriate level. For example, FDA [6] has outlined that raw food items received especially chilled items; the temperature

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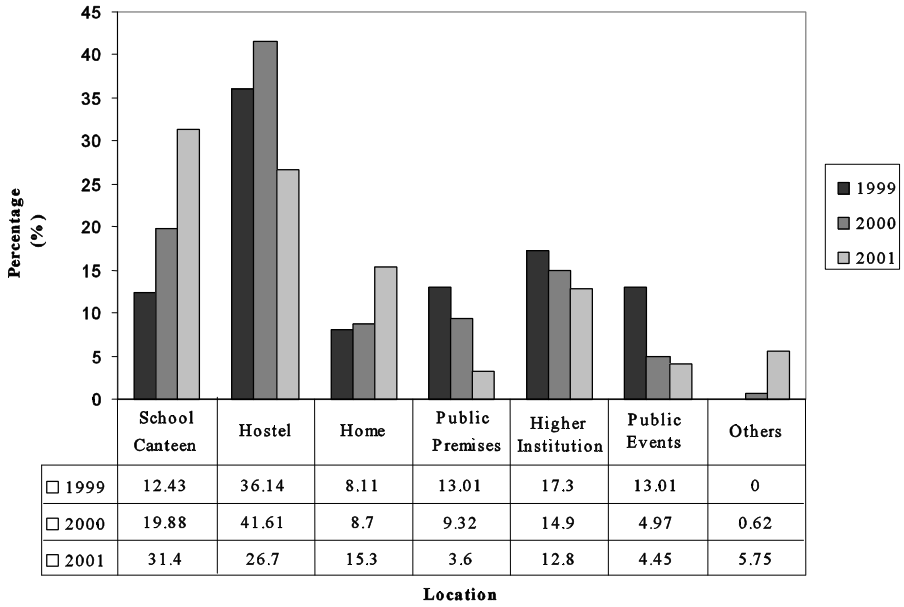

Fig. 1: Percentage of Food Poisoning Cases in Malaysia based on Premise / Location (1999-2001). Source: MOH [4]

should be below than 5°C, while frozen items should be below than -10°C. For dry items, FDA recommends that the store room's temperature should not exceed 27°C. Other than the above mentioned aspects, the implementation of first in, first out (FIFO) system and discarding expired items were also stressed.

Personal Hygiene Practice: In the process of food preparation, Minor and Marth [9] stress that personal hygiene practice of the food operators is the most important factor to be looked into by the management. Foodservice operators are the main threat to public health, from the primary stage until the serving stage of food production. For example, foodservice operators and cooks with cuts and wounds should not be allowed to enter the food preparation area. This is because of the risks that they bring together with them. The potential spread of bacterial disease such as *Staphylococcus* is high if they are given permission to prepare meals. Altekruse *et al*. [10] report that practically, *Staphylococcus* bacteria can not be eliminated but it can be reduced through frequent hand washing with warm water and hand soap. It is believed that in United State (U.S) alone, 86% of foodservice operators are aware of the food borne illness risks and personal hygiene but only a mere 66% of them actually practice the right and proper personal hygiene practices especially after handling raw food items [10]. Other contributing factors such as mannerism and smoking can contaminate hands and the possibility of transferring the microorganism to food is high [9, 11]. MOH [12] also reminds all foodservice operators to restrict sick employees from preparing meals. They should be given sick leave and should not be allowed to work until they have fully recovered from the illness.

Cross Contamination: Sprenger [13] states that food poisoning risks can be reduced through the implementation of FIFO system and the separation method of raw food and cooked food items. All food preparation equipment and cooking utensils should also be cleaned thoroughly before they are to be reused. In the U.S., it is reported that from 1973 to 1982, cross contamination between raw food and cooked food had contributed at least 5% of the overall food poisoning cases [14].

Safe Temperature of Holding Food: FDA [6] outlines that long holding time will increase the bacterial growth inside the food and caused food poisoning. Cooked food should be served and consumed within four (4) hours and holding temperature of 60°C and above is highly recommended. On the other hand, chilled food should be held at the temperature of 5°C or less and -10°C and below for frozen food. Based on the aforesaid findings and practices, this study intended to assess the compliance level of food safety practices in students' dining halls in UiTM Shah Alam and to reduce the risks of food borne illness occurrence.

Methodology: The sample of the study was 14 dining halls in UiTM Shah Alam. These samples were chosen because of the potential hazards of food poisoning with regards to the number of the students patronizing this dining hall (20,617 students) on a daily basis. The dining halls involved are Anggerik, Cempaka, Delima, Jati, Mawar I, Mawar II, Melati I, Melati II, Meranti, Perindu I, Perindu II, Puncak Perdana, Seroja and Teratai. Assessment and auditing process based on the five risk factors of food borne illness was conducted with the help and cooperation of the university's Health Inspector (HI) from the University Health Centre.

Audit Form Development: The audit form used in this study was adopted from the form of UiTM Health Centre which is based on the Premise and Food Safety Ordinance under the Section 10 and 11 of the Malaysian Food Act 1983 [15]. Minor modifications were made especially on the sentence structure to ease the assessment process. The audit form evaluation criterion is based on compliance level of foodservice operators involved in the FDA assessment's methods and practices. Combination of assessment questions from both organizations was used and not all of the assessment criteria are applicable to the Malaysian setting.

Food Premises Auditing Process: Premise and food auditing process was conducted which involved interviews with the dining halls' management, related record reviews, dining halls ambience as verification measure and food temperature recording. The audit score scale is based on four points; 4 (>80%) is good, 3 (60-79%) is satisfactory, 2 (40-59%) is unsatisfactory, 1 (1-39%) is very unsatisfactory and nil (0) is for unable to observe and audit. Scores given by the Health Inspector (HI) were formulated to get the percentage of compliance as outlined by the FDA. The acceptable compliance level percentage for education institutions is 80% [6]. The formula for the compliance level is as follows:

Study Status:

Compliance = within the compliance guidelines and based on the on site observation. Scores given to this level is 80%.

Not in compliance = out of the compliance guidelines and based on the on site observation basis. Scores set is below 80%;

Formula for determining compliance level according to FDA assessment methods and guidelines:

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

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

Thermocouple-EFC Fast, Pyrometer CH945: Two (2) thermocouples were used to prevent cross contamination between raw food and cooked food. The thermocouples used in the auditing process were being inserted into the food respectively to obtain the temperature readings. Then both of them were sanitized with tissue soaked with 70% ethanol and 30% distilled water. The desired temperature according to the compliance level is 60°C and above (hot food, 0-5° (cold food) and -10 and below (frozen food).

Laser Thermometer, Retek (Calibrated by Teak) Pyrometer Service (M) Sdn Bhd: Laser thermometer was also used by pointing at the food item with the distance of less than 30.4 cm to determine food surface and surrounding temperature. Desired surrounding temperature set by the FDA is below -10°C for freezer room, 3°C to 5°C for chiller, 27°C and below for dry store and 27°C to 30°C for food preparation room/kitchen.

Data Analysis: Data obtained from the study was analyzed both quantitatively and qualitatively. The data analysis process was done by using SPSS software version 14.0. The analyses involved were mean comparison, *t*-test (significance level set at $p<0.05$) and Microsoft excel 2003 (spider web).

RESULTS AND DISCUSSIONS

Assessment of the five risk factors of food borne illness and food poisoning (Table 1) shows a significant average mean differences ($p<0.05$) for all factors except for the fifth factor; safe temperature of holding foods ($p>0.05$). This happen because of the menu set by most of the dining halls' operators does not include much on chill and frozen items except for two (2) dining halls; Perindu 1 and Mawar. These two premises offer chilled and frozen items such as salad, pickles and ice creams.

Table 1: Five Food Poisoning Risk Factors Assessment Result

Variables	Sig. (2-tailed)	Mean	SD
Risk Factor 1:			
Safe Food Sources			
1.Purchasing			
a. List of reliable suppliers	0	3.43	0.94
2. Receiving			
a. Visual inspection	0	3.86	0.54
b. Expiry date checking and return	0	3.79	0.58
c. Clean receiving area	0	3.64	0.75
Risk Factor 2			
Food Storing Temperature & Stock Control	0	3.43	0.85
1. Raw Food Items	0	2.07	1.04
a. FIFO implementation	0	3.00	1.39
b. Proper storage	0	2.50	1.40
c. Chiller storing temperature			
d. Freezer storing temperature	0	3.14	1.16
2. Dry Items	0	3.21	1.05
a. FIFO Implementation	0	3.36	1.08
b. Clean storage space			
c. Store room humidity temperature <280°C			
Risk Factor 3	0	4.00	0.00
Personal Hygiene Practice			
1. Typhoid immunization			
a. Food handlers (employees) immunization	0	3.21	1.19
2. Personal hygiene practice	0	3.57	0.94
a. Clean uniform	0	4.00	0.00
b. Physical cleanliness			
c. Sick employees restricted to handle food			
Risk Factor 4			
Cross Contamination	0	2.50	1.09
1. Equipments and utensils			
a. Containers and space for raw food items and cooked foods	0	2.43	0.93
b. Different usage of utensils			
2. Food	0	3.21	1.19
a. Excess foods not kept	0	3.00	1.18
b. Ready to eat foods are not expose to cross contamination			
Risk Factor 5			
Safe Temperature of Holding Food			
1. Cooking temperature	0	3.46	1.04
a. Boiling point > 1000°C	0	3.27	0.91
b. Frying > 5-7 minute			
2. Chill holding temperature	0.344	2.5	2.12
a. Chilled foods from 2-30°C	0.094	2.67	1.52
b. Frozen foods < -100C			
3. Hot holding temperature	0	2.57	1.28
a. Hot holding > 600°C			
4. Holding time	0	2.93	1.32
a. Foods consumed within 4 hours			

Risk factor in Table 1 below that received an average mean less than 3.2 (<80%) is considered as not complying to the food safety practices and become one of the possible causes of food poisoning. In the other risk factor such as proper storage, the result shows that only 7 dining halls comply to the food safety practices; Anggerik, Cempaka, Mawar I, Melati I, Melati II, Perindu I and Seroja. In assessing safe storage temperature; chilled and frozen, only 4 dining halls comply with the practices. They are Anggerik, Delima, Puncak Perdana and Seroja. Among the reasons given by the managers of the other dining halls are that the chiller and freezer were not properly maintained by the university and frequent usage and opening of the chiller makes it

impossible to reach the desired temperature. MOH [12] stresses that this type of food storage should be properly wrapped with plastic or aluminum foil and the chiller should not be frequently opened to preserve the quality and safety of the food items kept inside. The assessment on the FIFO concept implemented on dry items was made by looking into the product expiring date which indicates that the compliance to the food safety practices was followed only by Cempaka, Jati, Mawar I, Mawar II, Melati I, Melati II, Perindu I and Seroja.

Factors such as getting typhoid immunization for foodservice operators and prohibition on the physically unfit employees to enter the food preparation area show that all dining halls' operators comply with the practices. This is because of the food safety policy set by the university which emphasize on the importance of getting typhoid immunization and proof of immunization should be on display.

To investigate whether the operators were using the same cooking equipment and utensils, the result in Table 1 signifies that most of the dining halls were not in compliance with the practices except for Seroja. The risk of using the same preparation equipment and cooking utensils is the contribution to cross contamination. Due to the closing of Seroja II, all the existing preparation equipment and cooking utensils were transferred to Seroja I, resulting in sufficient numbers of the said equipment and utensils. Seroja I was later named Seroja. The other dining halls' managers however mentioned that the trend of significant increase in the number of students for each semester and the additional menu offerings contributed to the lack of resources that they are currently experiencing. Through the observation conducted, it can be said that most of the dining halls are still using the same utensils in handling raw food and cooked food at the same time. The risk of cross contamination is high especially on the most frequently used utensils and equipment that involved both raw and cooked foods. Abrishami, *et al*. [16] further clarify that most food borne illness bacteria can be found on the chopping board made from wood as compared to the one made from plastic. Besides that, Hodate [17] who conducted a study in Malaysian boarding schools' dining halls found the existence of *Escherichia coli*, *Staphylococcus aureus*, *Bacillus cereus* and *Salmonella* among the 3,500 food samples taken through the total plate count procedure. These bacterial existences were due to the poor and unsuitable cooking procedures and contaminated utensils.

Risk factor for safe temperature of holding food states lower means for chill and hot holding temperatures and food holding time. This is due to the implementation of the new systems in certain dining halls which is known as computerized cafeteria system. This system allowed the food operators to display their products on the counter up to eight hours. Improper hold of the machine temperature (at longer period) contributes to the decreasing of the temperature. Bryan [18] stresses that food displayed on the counter more than 4 hours at improper temperature will lead to cross contamination and increased of harmful microbial growth such as *Bacillus*, *Clostridium*, *Enrobacter*, *Escherichia coli* and *Micrococcus*.

Overall scores of the dining halls in UiTM Shah Alam as shown in Figure 2 depicts that 7 out of 14 dining halls were significantly in compliance with the food safety practices with an average score of above 80%; Anggerik, Cempaka, Mawar I, Melati I, Melati II, Perindu I dan Seroja.

Nine other dining halls show their inability to comply to the food safety practices with average scores of below 80%. Meranti dining hall records the lowest result with the score of 2 (unsatisfactory) owing to its status as a new dining hall and its building infrastructure which is not fully completed. Besides that, the lack of basic amenities and improper documentation/practices were among the contributing factors to the low scores obtained by Meranti.

Summary and Future Recommendations: In conclusion, food safety practices implemented in students' dining halls in UiTM Shah Alam were at a good level (7 dining halls), satisfactory (6 dining halls) and unsatisfactory (1 dining hall). However, the percentage of certain risk factors needs to be monitored closely as each of these risk factors can be one of the many causes of food poisoning cases. Two risk factors; safe food sources and personal hygiene practice respectively recorded scores of 92% and 92.3% which were good and well accepted level set by FDA. On the other hand, risk factors of storage temperature and stock control and safe food holding temperature were at the satisfactory level with a percentage of 74% and 72.5%. Cross contamination risk factor recorded the lowest scores with 69.6% respectively from the overall risk factors as outlined in the compliance level assessment and practices.

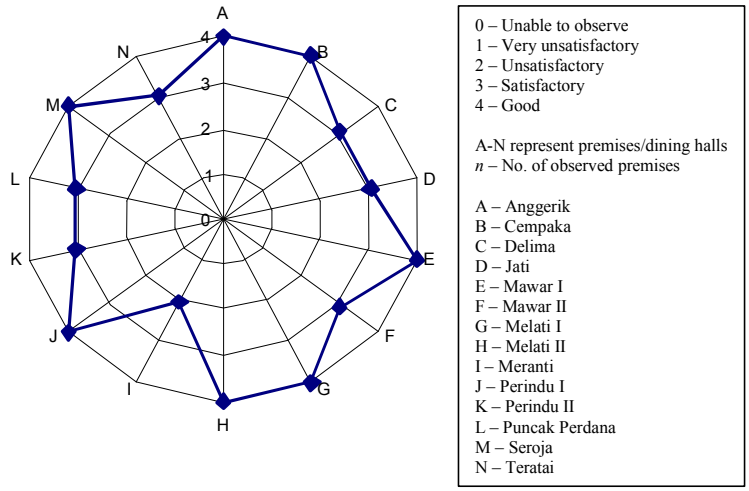

Fig. 2: Overall Scores of Food Premises and Dining Hall in UiTM Shah Alam

Since this study only focuses on dining halls in UiTM Shah Alam, further research needs to be done to seek and compare the scores of other dining halls in each faculty and branch campuses of UiTM in Malaysia; in order to see the overall scenario of the dining halls' operations and compliance to food safety standards and practices. Furthermore, this study only stresses on the management systems of each individual dining hall based on the five risk factors of food borne illness. Further laboratory tests on microorganism existence and microbiological tests, which should be done to seek correlation between both audit process outcomes and laboratory test results, are recommended. Through comprehensive analyses in data gathering methods and more precise risk assessment can be establish thus helping the government in reducing the worrying rate of food borne illness (food poisoning) in the country.

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