



## Food Safety Attitude of Culinary Arts Based Students in Public and Private Higher Learning Institutions (IPT)

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### Abstract

Food safety issue is not new in Malaysia as problems such as unsafe food handling, doubtful food preparation, food poisoning outbreaks in schools and education institutions and spreading of infectious food borne illness has been discussed by the public more often than before. The purpose of this study is to examine the food safety knowledge and attitude of culinary based students from four (4) public and private higher learning institutions (IPT) with prior knowledge on food safety, hygiene and sanitation. The study involved a total of 114 group administered questionnaires that were usable and coded comprising of 34- questions assessing their knowledge and attitude on food safety. The research finds that higher learning institution's students who have prior knowledge on food safety partly do not represent their attitude towards food safety although their correlations recorded moderate positive relationships especially on personal hygiene practice ( $p=0.07$ ,  $r=0.42$ ) and keeping food at safe temperature ( $p=0.17$ ,  $r=0.36$ ). On the other hand, their knowledge in avoiding cross contamination ( $p=0.00$ ,  $r=0.50$ ) and avoiding food from unsafe sources ( $p=0.02$ ,  $r=0.36$ ) were positive and significant in influencing their food safety attitude. There were no significant differences among food safety knowledge and attitude based on the students' demographic profiles. The results urged for more improvement in both knowledge and practice of food safety among students in public and private higher learning institutions towards recommended food safety standards and positive attitude in food preparation process.

**Keywords:** Food safety, Knowledge, Attitude, Food borne illness, IPT students

### 1. Food safety historical issues

Food is a critical contributor to physical well-being and a major source of pleasure; worry and stress (Rozin, Fischler, Imada, et al., 1999). As a result, more stringent quality control is a must in the food industry, and customers' confidences are more dependent on the quality assurance promised by the food provider. One of the required outputs is to ensure that the food produced is safe to be consumed. Food safety has been defined as the conditions and measures that are necessary during the production, processing, storage, distribution and preparation of food to ensure that it is safe, sound, wholesome and fit for human consumption (World Health Organization [WHO], 1984). Food handlers neglecting the basic rule of food preparation such as mishandling and taking for granted hygiene practice contributed to the outbreaks of food poisoning. Common mistakes identified include serving contaminated raw food, cooking or heating food inadequately, obtaining food from unsafe sources, cooling food inadequately and having infected persons handle implicated food or practice poor hygiene (WHO, 1999).

Reported number of cases in Malaysia for the first month of 2008 alone showed that it is an alarming issue with 257 cases of food poisoning as compared to only 34 cases for the same period in 2007 (Ministry of Health [MOH], 2008). Most researchers have one common understanding regarding food safety education; most feedback gained is based on self-reported questions (e.g. Lynch, Elledge, Griffith & Boatright, 2003; Walczak, 1997). However, observational studies indicate that errors in food handling are more common than reported on questionnaires (Medeiros, Hillers, Gang, et al., 2004). Manning and Snider (1993) revealed that there were deficiencies in attitudes, knowledge and practices in safe food handling among food handlers. Therefore the core knowledge of food handlers may come from the root of the problem. Students/graduates who attended courses relating food hygiene and sanitation play a major role in determining the level of awareness among food handlers in the industry to-come. Previous research has been done on this topic but little efforts were found focusing on students' knowledge and attitudes towards safe food handling especially in public and private higher learning institutions (IPT) in Malaysia.

## 2. Literature review

### 2.1 Food safety knowledge

Knowledge is associated with current practices, which in turn affects willingness to change current practices if it is learned that current practices are unsafe (McIntosh, Christensen, & Acuff, 1994). However, actual food handling practices are known to differ from self-reported practices (Jay, Cormar, & Govenlock, 1999). This is important as studies by Evans, Madden, Douglas, et al. (1998) have shown that the main factors responsible for the outbreaks of food poisoning in England and Wales during 1992–1994 and 1995–1996, respectively, were inappropriate storage, inadequate cooking or reheating, and cross-contamination. Particular attention should be given to the importance of time and temperature control, personal hygiene, cross contamination, sources of contamination and the factors determining the survival and growth of pathogenic organisms in food (WHO, 1988; Goh, 1997). These are the factors that can double the effect of an outbreak.

Zain and Naing (2002) in their study showed that food stall had four times significantly higher odds of having poor knowledge. The main reason of this was food handlers who involved in food stall/hawkers activities were not all registered with local government, had low level of education and were not trained (Zain & Naing, 2002). Manning and Snider (1993) further concluded that assessment of workers in temporary public eating places revealed deficiencies in attitudes, knowledge and practices in the areas of cooling/reheating, temperature control and cross contamination. Sockett (1995) points out that many people do not know the basic rules of food hygiene. In contrast, surveys conducted in 1986 and 1995/1996 illustrated that respondents did know which foods were at high risk from food poisoning, but knowledge about how a food could be made safe to eat was limited (Raab & Woodburn, 1997). Many program planners believe that by enhancing knowledge or altering attitudes, they can induce behavioural change (Shaw, 2003). Numerous studies document that education alone may not result in behavioural change, and that to change most complex behaviours, multifaceted approaches are needed (McKenzie-Mohr & Smith, 1999).

#### 2.1.1 Personal hygiene

Research carried out from 1998-2000 showed that in 100 reported food poisoning outbreaks, the vast majority were attributed to inadequately trained staff (Food Safety Authority of Ireland [FSAI], 2001). This represented an improvement on the situation found by Tebbutt (1992) eight years earlier when 22 per cent of food businesses had failed to train managers or operatives in hygiene. Poor personal hygiene causes more than 90% of the food safety problems. Statistics showed that improper hand washing alone accounts for more than 25% of all food borne illnesses (Weinstein, 1991). Proper hand washing includes using water at least 100°F, applying enough soap to build a good lather, vigorously scrubbing hands together for a minimum of 20 seconds assuring that you scrub under your nails and between fingers, rinsing thoroughly under running water, and drying with a single use paper towel or warm air dryer (Snyder, 1998). Hand washing should always be completed after using the restroom; touching raw foods; touching the hair, face or body; sneezing, coughing, or using a tissue; smoking, eating, or chewing gum or tobacco; handling chemicals; taking out or handling trash; bussing or cleaning a table; touching clothing or aprons; and touching anything else that may contaminate hands (National Restaurant Association Educational Foundation [NRAEF], 2004).

Manning & Snider (1993) found that some personal hygiene and handling practices of workers did not support their knowledge and attitudes about hygiene and cross contamination. Even though the workers indicated frequent and thorough hand washing to be important, only one person was observed washing their hands, including workers handling food and money. As Chatterjee (2005) highlighted that unsafe and inefficient practices followed by food manufacturers were due to unhygienic practices and lack of personnel hygiene knowledge. A study in the U.S. suggested that improper food handler practices contributed to approximately 97% of food borne illness in foodservice establishments and homes (Howes, McEwan, Griffiths, & Harris, 1996). Education, training, and the development of food safety certification examinations are key components in the process of ensuring that food handlers are proficient in and knowledgeable about food safety and sanitation principles (Jacob, 1989).

### 2.1.2 Cross contamination

The transfer of germs from one food items to another is called cross contamination. Approximately 10 to 20% of food-borne disease outbreaks are due to contamination by the food handler (Zain & Naing, 2002). The common cause of cross contamination in the kitchen is because of contaminated hands and equipments used to prepare cooked and raw food at the same time. Cross contamination can also occur when uncovered raw foods are stored directly adjacent to or above ready-to-eat foods in a refrigerator or other holding equipments. In a recent review (Djuretic, Wall, Ryan, et al. 1995), cross-contamination was identified as an important contributory factor in 36.3% (147/405) outbreaks of food-borne disease. It is generally accepted that the hands of food handlers are an important vehicle of food cross-contamination and that improved personal hygiene and scrupulous hand washing would lead to the basic control of faces-to-hand-to-mouth spread of potentially pathogenic transient microorganisms (Allwood, Jenkins, Paulus, et al., 2004).

The food preparers' hands have been cited as the main factor or a contributory factor in up to 39% of domestic food poisoning outbreaks (Ryan, Wall, Gilbert, et al., 1996). Scott and Bloomfield (1990) identified the ability of the test organism *S. aureus* to cause cross contamination for up to 24 hours via the fingertips. The draining board and the counter-top showed the greatest frequency of contamination by the target microorganisms (Scott & Bloomfield, 1990). Food handlers often have little understanding of the risk of microbial or chemical contamination of food or how to avoid them (Hobbs and Roberts, 1993). A survey conducted by Williamson, Gravani & Lawless (1992) revealed that unsafe use of kitchen utensils were common. Their result showed that 37% of the survey respondents would only rinse the knife and cutting board used to cut fresh meat prior to using the same items again to chop fresh vegetables for a salad. On the other hand, 5% of the respondents would simply start chopping the vegetables with the same knife and cutting board. They summarized that only 54% would wash the knife and cutting board with soap and water prior to chopping the fresh vegetables.

### 2.1.3 Safe temperature of food

As explained by McSwane et al. (2004), controlling temperature of food cook is vital in assuring that food service establishment complies with food safety regulations. Food borne illness may be resulted from temperature abuse while preparing a dish. According to NRAEF (1999), time temperature abuse occurs when food has been allowed to stand for an extended period of time at temperatures favourable to bacterial growth. McSwane et al. (2004) further added that the abuse of temperature also may be caused by insufficient amount of cooking or reheating time and desired temperatures that should eliminate the existence of harmful microorganism. The usage of devices in measuring food temperature such as thermometers, thermocouples and infrared reading is essential in determining whether the food were in the danger zone or otherwise (McSwane et al., 2004). Nott & Hall (1999) explained that the major purpose of cooking is to increase the palatability of food, the heating of many foods is essential to kill bacteria thereby increasing the foodstuff's safety and storage life. In practice, pasteurization and other sterilization processes require stringent assurance that all parts of the food product have been heated above a certain temperature for a defined period of time (Nott & Hall, 1999). Several studies have reported that poor holding and cooking temperature control was a main factor contributing to food borne outbreaks (Todd, 1997). Improper holding temperature of food also can contribute to the growth of certain bacteria through its spores because not all of these spores will be destroyed with heating processes (McSwane et al., 2004). Thus it is important for all food handlers to recognize their responsibilities in ensuring that all food prepared were monitored in every stages of its preparation.

### 2.1.4 Food from unsafe sources

In most countries of the South East Asian Region, laboratories with the capacity to detect common food borne hazards are rare, and where they do exist, the high cost of testing is an obstacle (DeWaal and Robert, 2005). Walker & Jones (2002) explained that the traditional food safety control approaches have tended to focus on the general appearance, structure and cleanliness of food outlets. However, these methods have failed to successfully deal with the problem of food borne illness and have paid insufficient attention to the factors which actually cause illness (Walker & Jones, 2002). Miles, Brennan, Kuznesof, et al. (2004) demonstrates the result where the participants were worried to some extent about all of the food safety issues with which they were presented, but there was a tendency for worry to be higher for those hazards related to the use of technology applied to food production (e.g. hormones, pesticides, antibiotics, genetic modification) in comparison to those hazards related to cost, diet, hygiene and other lifestyle issues (e.g. food poisoning, fat in the diet, food hygiene). Foods originating from an unapproved source or imported foods can influence the likelihood of an outbreak (Sato, 2007).

## 2.2 Food safety attitude

The responsibility of having positive attitude towards food safety does not only lie on the shoulder of the management team. Employees, students and even any food handlers should take their own initiatives to enhance their knowledge in the matter and profiling themselves to be more positive. Pilling, Brannon, Roberts, Shanklin, and Howells (2008) found

that employees perceive many barriers to implementing food safety programs. Employees noted that lack of time, training, and resources, along with employee attitude, availability of hand sinks, and inconveniently located resources were barriers to hand washing within a foodservice operation (Pilling et al., 2008). It is undeniable that not all of teaching institutions in the developing countries which involved in the culinary field is equipped with the proper and more manageable facilities. It is well-known that improving knowledge does not necessarily lead to changes in attitude or behaviour (Ajzen & Fishbein, 1980). However, the gap between knowledge and behaviour is regarded as an affective dimension (Galli, 1978). Various studies have shown that the efficacy of training in terms of changing behaviour and attitudes to food safety is questionable (Mortlock, Peters, & Griffith, 1999).

A review of literature found only one research study that focused specifically on food safety knowledge of college students (Unklesbay, Sneed & Toma, 1998). Eight hundred twenty-four students in food-related and non-food related disciplines, in three geographic locations, completed a food safety questionnaire. Results indicated gaps in college students' knowledge. Students scored poorly when quizzed whether unsafe foods could be identified by the way they looked and smelled. Students also incorrectly indicated that unopened processed meats could be refrigerated long term without any risk of causing food borne illness. Only 50% of students were aware that older adults were more vulnerable to food borne illness than teenagers (Unklesbay et al., 1998). While focused on the challenges of obtaining a college education, many students eat whatever and whenever it is convenient. They may be unaware of proper food handling practices needed to avoid food borne illness (Yarrow, 2006).

A national food safety mail survey done by Li-Cohen & Bruhn (2002), which included college students/graduates examined consumer handling of fresh fruits and vegetables. Investigators concluded that college or post-college students were more likely to practice risky produce handling behaviour, compared to those with less formal education. College/ post-college students were also less likely to wash their food preparation surface before cutting produce, meat, poultry, and/or fish (Li-Cohen & Bruhn, 2002). Unklesbay et al. (1998) surveyed college students and found that students rarely check temperatures of their refrigerators and freezers. 20 Students also exhibited risky food consumption behaviours. An alarming 7% of the college sample consumed either raw fish or raw hamburger. Additionally, students consumed raw eggs (12.7%), unpasteurized eggnog (6.4%), and cookie dough (5.8%). When asked how they determined serving temperatures of leftovers, 24.3% of students indicated they relied on touching or feeling the food. Only 6% relied on temperature readings, and another 3% relied solely on microwave settings (Unklesbay et al., 1998). Based on the literature reviews mentioned above, the following hypotheses were proposed:

H1: Students' food safety knowledge positively influence food safety attitude.

H1a: Knowledge in personal hygiene practice positively influence food safety attitude.

H1b: Knowledge in avoiding cross contamination positively influence food safety attitude.

H1c: Knowledge in keeping food at safe temperature positively influence food safety attitude.

H1d: Knowledge in avoiding food from unsafe sources positively influence food safety attitude.

H2: Food safety knowledge and attitude scores significantly differ based on students demographic profiles.

### **3. Plan for data collection process**

This research was conducted by gathering and obtaining the responses from students of higher learning institutions in Malaysia. It was conducted among the final year students of Diploma in Culinary Arts (or similar category) in each of the higher learning institutions. The reason for doing this is to narrow down the scope of the study to focus only to those students who have taken Food Hygiene, Food Sanitation or Food Safety course during their study period and had already undergone practical/industrial training. They represent four higher learning institutions with two were from public IPT and the other two were from private IPT. The sample size was amounted to a total of 120 students and group administered questionnaires method were employed. Questionnaire was constructed by adopting from the Wales Food Safety Attitude Battery (WAFSAB) by Coleman, Griffith and Botterill (2000). At the end of the data collection process, a total of 114 questionnaires were gathered, usable and finally coded. This represents 95 percent of the total questionnaires distributed earlier.

### **4. Results & analysis**

#### *4.1 Reliability & validity analysis*

Reliability of the instruments used was tested by running Cronbach's alpha coefficient. The result outlines that the alpha coefficient value for all variables in the study were from .66 to .85 accordingly. The dependent variable or criterion variable of food safety attitude had a high reliability coefficient of .85 with a total of 17 scale items. The independent variable or predictor variable of food safety knowledge showed that its dimensions of personal hygiene practice had a coefficient value of .67, avoid cross contamination with value of .78, keeping food at safe temperature with value of .68 and avoid food from unsafe sources had a reliability coefficient value of .66. The overall coefficient value of food safety knowledge had a reliability coefficient value of .70. The results also indicated that the reliabilities of the scales used in

this study were high and aligned with previous research (Coleman et al., 2000). It also demonstrates the internal consistency of a reliable scale (Table 1).

#### 4.2 Descriptive statistics & analysis

Table 2 shows that the distribution of gender had almost equal distribution with female respondents were higher with 58 respondents (50.9%). The rest were male respondents (49.1%). Total respondents from public IPT were 61 respondents (53.5%) and the other 46.5 percent were from private IPT. In terms of ethnic origin or race, Malays were the prominent race or ethnic group in the study with 94 respondents (82.5%). It was followed by 15 Chinese respondents (13.2%), two Indian respondents (1.8%) and other race with three respondents (2.6%).

#### 4.3 Pearson correlations of the study variables

Table 3 presents correlations among four dimensions of food safety knowledge and food safety attitude. Moderate relationships were noted; with the strongest relationship being between avoid cross contamination and food safety attitude ( $r=.50, p<0.05$ ). The other dimensions were having moderate significant correlations with food safety attitude such as personal hygiene practice with  $r=.42 (p<0.05)$ , keep food at safe temperature with  $r=.36 (p<0.05)$  and avoid food from unsafe sources with  $r=.36 (p<0.05)$ . The correlations among the four dimensions of food safety knowledge were slightly low but significant relationships with the strongest were between avoid cross contamination and personal hygiene practice with  $r=.47 (p<0.05)$ .

### 5. Hypothesis Testing

#### 5.1 Students' food safety knowledge positively influence food safety attitude

The influences of the four dimensions of food safety knowledge on food safety attitude were explored and examined by using multiple regression analysis (as shown in Table 4). The coefficient of relationship ( $R^2$ ) of 0.35 showed that 35% of the variance in food safety attitude was explained by the four sub dimensions of food safety knowledge. Out of the four dimensions, only two were having significant influences on food safety attitude; avoid cross contamination ( $p=0.00$ ) and avoid food from unsafe sources ( $p=0.01$ ). Therefore, Hypothesis 1 (H1) was partially supported with only sub hypotheses of H1b and H1d were having significant influences on criterion variable (food safety attitude).

#### 5.2 Food safety knowledge and attitude scores significantly differ based on students demographic profiles.

The result from the independent-samples  $t$ -test which was conducted to compare the food safety attitude scores for public IPT and private IPT found that there was no significant difference in the food safety attitude scores. Public IPT recorded  $M=6.05$  with  $SD=0.58$  and private IPT ( $M=6.08, SD=0.66$ );  $t(112) = -0.21$ , with  $p=0.83$  (two tailed). The magnitude of the differences in the means (mean difference =  $-0.02$ , 95% confidence interval was between  $-0.26$  to  $0.21$ ) was very small (eta squared =  $0.00$ ). Comparing food safety attitude scores and gender of the respondents, it was found that there was no significant difference in scores for males with mean score of  $6.07 (SD=0.69)$  and females with mean scores of  $6.06 (SD=0.55)$  with  $t(112) = 0.06, p=0.95$  (two tailed). The magnitude of the differences in the means (mean difference =  $0.007$ , 95% confidence interval was between  $-0.22$  to  $0.24$ ) was very small (eta squared =  $0.00$ ). On the other hand, one way analysis of variance test (ANOVA) was computed to explore the impact of race on levels of food safety attitude. Subjects were divided into four race based groups (Group 1: Malay, Group 2: Chinese, Group 3: Indian & Group 4: Others). There was also no significant difference at the  $p<0.05$  level with  $F=1.12, p=0.35$ . Therefore, hypothesis 2 (H2) was not supported.

### 6. Discussion

#### 6.1 The relationship between food safety knowledge and attitude

Although several studies have shown a wide range of kitchen sites to be cross-contaminated by food preparation activities (De Boer & Hahne, 1990; Humphrey, Martin, Slader & Durham, 2001), this study proves that sufficient knowledge on avoiding cross contamination significantly influenced the students' food safety attitude. Proper preventive measures being taught to the students can create and develop positive attitude on food safety compliance. Preventive measures among them such as 1) always store cooked and ready to eat foods over raw products, 2) keep raw and ready to eat food separate during storage, 3) keeping all food-contact surfaces clean and sanitary, 4) avoid bare hand contact with ready to eat food, 5) keeping species of meat and poultry separate, 6) using clean, sanitized equipments and utensils for food production and 7) prepare raw and ready to eat food in separate area (McSwane et al., 2004). In this study, the students reportedly understand that these preventive measures are vital in ensuring that cross contamination can be avoided. Educating the student on the risk of contamination and source of it proves to be one of the contributing factors to positive food safety attitude. Risk of contamination can be educated to the students through interactive signage, labels and work manual or standard operating procedures in the kitchen.

Proper procurement and receiving procedures such as buying from approved sources, determine quality of food received and thorough checks upon receiving of goods were well understood. Although most of the process does not include the students and merely all of the process is being done by the staff of the institutions, students accept the fact

that the root of food borne illness starts from the receiving area. One of the most important rules is to reject any damaged and spoiled goods upon the receiving point. A lot of strict receiving and checking procedures were created and implemented by most food service establishment to check the condition of merchandise delivered. Among them is the physical check to see any foreseen damage, change of colours, smell and texture of the food. Next would be the grade of the merchandise whether it complies with the standard grade such as colour, weight, shape and appearance and overall quality. Perishable items usually come with an expiry date and items such as milk and other milk products such as cheese should be check for its overall state to avoid receiving spoiled items. Same goes to fish and other seafood products, fruits, juices, vegetables and frozen items. Proper ventilated dry storage is important in making sure that canned, bottled and dry items are stored safely until the day that it is used. The implementation of FIFO (First In, First Out) method ensures that the earlier ordered foods are used first. Thus the students need to be alarmed as to ensure that the food is safe to be consumed. Food storage should be strictly apart from chemical storage as it may lead to hazardous contamination. Site visits and store inspection routines by the students will allow them to recognize potential hazardous contamination and storage violation. While there is concern about chemicals and other substance in food, microbiological contamination of food is the primary cause of food borne illness (Snyder & Poland, 1990). Well taught learning modules in the kitchen could not only prevent chemical contamination but also putting microbiological contamination as the biggest threat to the kitchen operation.

Although the result of this study indicates that personal hygiene practice and keeping food at safe temperature were not the contributing factors to food safety attitude, it does not mean that the students were not aware of its importance. Lack of supervision also can be a contributing factor to this notion. Pilling et al., (2008) found that insufficient number of hand sinks, resource location and attitude of the food handlers had restraint them from implementing food safety program such as hand washing. It seems that although knowledge is sufficient, physical facilities might be an obstacle in guaranteeing that proper food safety attitude can commence and reported. Green and Selman (2005) also found that there were a number of factors that impacted foodservice employees' ability to prepare food safely, including time pressure; equipment and resource availability; food safety emphasis by management and co-workers; and food safety education and training. Work culture in the kitchen facility also a predetermined factor that positive personal hygiene can be implemented or not. If the students were used to the culture of not taking care of personal hygiene, good knowledge on food safety would not make any difference at all. Good personal hygiene maybe is not being taught at the early age thus making it difficult to set a habit in the later age.

### *6.2 The differences of food safety knowledge and attitude scores based on demographic profile*

College students who have taken courses relating to food safety such as nutrition and food science reported more food safety awareness and were more likely to report safer practices. In this study, it was found that there are no significant differences whether the respondents are from public or private IPT. This suggests that the same outline were use in the food safety education process by both types of institutions. Both IPTs plan on their educational outline based on the same goal; cultivating positive safe food handling knowledge, practices and behaviours among the students. Few researches reported differences in knowledge and attitude based on the respondents' demographic profiles such as gender and race or ethnic origin (e.g. Unusan, 2007; Albert, 1995; Bruhn & Schutz, 1999). But in this study, the results were contradicting to most of the researchers' earlier findings. Race or ethnic origin does not significantly impact the scores of food safety knowledge and attitude. Although most of the above said researches dictated that female respondents have more positive attitude on food safety compared to male, the result in this study proves it wrong; given the fact that this study recorded nearly equal distribution rate of male and female. Regardless of any different demographic characteristics of a food handler, improvement efforts through health education can be done to cultivate safe food handling behavior and practices.

## **7. Limitations & Future Research**

Several limitation noted in the earlier part of this research suggests more improvement and other recommended future explorations. The limited samples involved in this study have made it difficult for the researchers to generalize to all students of higher learning institutions. It would be worthwhile if future research can be undertaken by considering more variety of students' profiles such as their major of study. Future research can be done to explore the relationship between food safety knowledge level and attitude between health and hospitality major. Little participation by the higher learning institution also specifically limits the sample size. In the future, it is suggested that these kind of study which is known to have huge impact nationally, should be done as a national initiative and with collaboration from relevant government agencies such as the Ministry of Health or other related agencies. Involvement of the Malaysian Association of Hotels (MAH) can also be encouraged. Therefore, looking at the large participation and predicted impact, larger participation from the higher learning institutions are expected. Assessing students' beliefs and knowledge through self-reporting questionnaires limits findings on actual practices and behaviour of the students in actual kitchen setting. This notion suggests that a combination of various methods should be used such as interviews and observations to gain in-depth findings and more details insights.

## 8. Conclusion

The findings in this study is hoped to have offered some insights to the management of the institutions to better understand the continuous occurrence of food borne illness through lack of positive attitude in personal hygiene practice and keeping safe temperature of food in educational institutions including school, colleges and IPTs. The significant relationships between avoiding cross contamination and avoiding food from unsafe sources concluded that much attentions has been deliberately focused on the surface of the issue. Whereas the most important aspect that student should be aware of are the root of the issue. Basic hygiene practice can and proved to be the first line of defence against food borne pathogens. Temperature abuse is the first and major contributing factor of food borne illness. Current continuous occurrences of food borne illness in schools in Malaysia prompted the education management to focus on this issue more seriously. National initiatives should be highlighted and launched because the wide coverage by the media and news reports helps in delivering the message to those with little or no exposure on food safety education. It is important, therefore, to predict potential hazards and establish proactive control measures (Miller, Smith & Buchanan, 1998). The consensus among experts summarizes the need for food safety education as increased awareness of; 1) current and emerging food borne illness cases, 2) knowledge and consequent behaviours of proper food handling, and 3) the increased risk population (Wilson, 2002). Shiferaw, Yang, Cieslak, et al. (2000) noted that the media has given much attention to food borne illness and has strived to alert the public but much consideration have to be look into especially the demographic characteristics of the target audiences to ensure effectiveness. Cultures of certain race or ethnic origin may suggest positive or negative attitude towards food safety for example the culture of the Malays Muslims encourage its followers to use hand when eating thus exposing to more food borne illness risk. Same goes with the Indians whereas the Chinese are well-known to be using utensils such as chopsticks. Whatever methods of handling food are not important as long as they comply with the basic safe food handling practices. Early education is also vital in ensuring that future students will be more responsible of themselves especially in the food preparation process. Different environmental setting suggests different approaches in the demographic characteristics in implementing safe food handling practice.

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Table 1. Reliability coefficient values of study variables

Variables	Number of Scale Items	Cronbach's Alpha Coefficient ( $\alpha$ )
Food safety knowledge		.70
1. Personal hygiene practice	4	.67
2. Avoid cross contamination	5	.78
3. Keep food at safe temperature	4	.68
4. Avoid food from unsafe sources	4	.66
Food safety attitude	17	.85

Table 2. Respondents' demographic and work profiles

Profiles	Categories	Frequencies	Percentage (%)
Gender	Male	56	49.1
	Female	58	50.9
Race	Malay	94	82.5
	Chinese	15	13.2
	Indian	2	1.8
	Others	3	2.6
Type of Institutions	Public IPT	61	53.5
	Private IPT	53	46.5

Table 3. Pearson correlations matrix among food safety knowledge dimensions and food safety attitude

Scales	1	2	3	4	5	Mean	SD
1. Personal hygiene practice	-					5.24	1.44
2. Avoid cross contamination	.47**	-				6.03	1.22
3. Keep food at safe temperature	.43**	.38**	-			5.34	1.40
4. Avoid food from unsafe sources	.22**	.25**	.29**	-		5.49	1.32
5. Food safety attitude	.42**	.50**	.36**	.36**	-	6.06	1.12

The table outlined the correlation strength among the variables, its average mean and standard deviation.

N=114

\*\* $p < 0.05$

Table 4. Regression results of food safety knowledge dimensions and food safety attitude

Independent variable in the equation	B	$\beta$	t	p	R <sup>2</sup> (F)
constant	2.39		4.84	0.00	0.35 (14.54)*
Personal Hygiene Practice	0.18	0.17	1.81	0.07	
Avoid Cross Contamination	0.26	0.08	3.40	0.00*	
Keep Food at Safe Temperature	0.09	0.12	1.40	0.17	
Avoid Food from Unsafe Sources	0.18	0.23	2.81	0.01*	

The table showed the beta, significance and regression values between both variables.

\* $p < 0.05$

Table 5. Food Safety Knowledge and Attitude Scale Items

<b>FOOD SAFETY KNOWLEDGE</b>
<i>Personal Hygiene Practice</i>
1. Smoking is prohibited in the kitchen
2. Always wash hands after coughing or sneezing
3. Physical hazards (hair) can cause illness
4. Take care of personal hygiene ensures safe food
<i>Avoid Cross Contamination</i>
5. Ready to eat food contaminated if not handled properly
6. Contamination occurs when mix raw and ready to eat food
7. Avoid bare hand contact with ready to eat food
8. Should not store F&B containers in ice served to customers
9. Walk in freezer should be clean to avoid contamination
<i>Keep Food at Safe Temperature</i>
10. Cold food should be below 5°C
11. Improper hold temperature factor of food borne illness
12. Food temperature danger zone are between 5°C to 60°C
13. Freezer storage practice prevent growth of bacteria
<i>Avoid Food from Unsafe Sources</i>
14. Check the source of food to ensure it is safe
15. Damage merchandise should be rejected
16. FIFO method ensures earlier ordered foods are used first
17. Perishable items should be fresh upon receiving
<b>FOOD SAFETY ATTITUDE</b>
18. I have to ensure cleaning supplies stored separately
19. I will ensure cleaning supplies stored apart from all food
20. I will make sure food are obtained from reliable sources
21. I always wear hair restraint while at work
22. Previously cooked food must be reheated
23. I should consider freshness of food during purchasing
24. I should be aware of cleanliness of food purchased
25. Should keep hot food hot and cold food cold
26. I have to ensure internal temperature of food are checked
27. I will make sure smoking is prohibited in food preparation area
28. I have to ensure service area is non smoking area
29. Food contact surface should be cleaned using sanitizing agent
30. Frequent hand washing is a must so food is safe to eat
31. My responsibility that frozen food be thawed
32. I will always ensure that knives are cleaned after usage
33. I am informed that knives should be sanitized after use
34. Thoroughly washing chopping board prevent cross contamination