

**THE EFFECTIVENESS OF FOOD SAFETY AND  
NUTRITION TRAINING PROGRAMME ON THE  
PREPARATION OF SAFE AND HEALTHY FOOD  
AMONG FOOD HANDLERS AT PRIMARY  
SCHOOL CANTEEN IN KOTA BHARU,  
KELANTAN**

**by**

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## LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
APC	Aerobic plate count
BA	Behavioural attitude
BI	Behavioural intention
CDC	Centers for Disease Control
CI	Confidence interval
df	Degree of freedom
EHEC	Enterohaemorrhagic Escherichia Coli
EIP	Epidemic Intelligence Programme
FoSIM	Food Safety Information System of Malaysia
GES	Good environmental sanitation
GFSH	Good food safety & hygiene
GPH	Good personal hygiene
HACCP	Hazard Analysis and Critical Control Point
IqR	Interquartile range
KAP	Knowledge, attitude and practice
KFP	Knowledge on food poisoning
KFS	Knowledge on food safety
KFN	Knowledge on food nutrition
KHC	Knowledge on healthy food choice
KHD	Knowledge on healthy diet
KHRCC	Knowledge on high-risk food and cross-contamination
KHS	Knowledge on healthy food serving
KPH	Knowledge on personal hygiene
KTC	Knowledge on temperature control
MD	Mean difference
MOE	Ministry of Education
MOH	Ministry of Health

MyFoodNet	Malaysian Foodborne diseases Network
NB	Normative belief
NSLP	National School Lunch Programme
PBC	Perceived behavioural control
RMT	Rancangan Makanan Tambahan
RPSF	Rules in preparing safe food
SBP	School Breakfast Programme
TCC	Total coliforms count
TPB	Theory of Planned Behaviour
USDA	United States Department of Agriculture

**KEBERKESANAN PROGRAM LATIHAN MAKANAN SELAMAT DAN  
BERZAT DALAM PENYEDIAAN MAKANAN YANG SELAMAT DAN  
SIHAT DALAM KALANGAN PENGENDALI MAKANAN DI KANTIN  
SEKOLAH RENDAH DI KOTA BHARU, KELANTAN**

**ABSTRAK**

Kesihatan dan perkembangan pelajar dipengaruhi oleh makanan yang disediakan di rumah dan sekolah. Pelbagai usaha telah dilakukan untuk meningkatkan penyediaan makanan selamat dan diet sihat di kantin sekolah. Akan tetapi, keberkesanan usaha tersebut adalah pelbagai dan jarang dinilai. Kajian ini bertujuan untuk membangunkan program intervensi baru bagi penyediaan makanan yang selamat dan berzat dalam kalangan pengendali makanan di kantin sekolah rendah di Kota Bharu, Kelantan. Kajian ini dijalankan dalam dua bahagian. Dalam Bahagian 1, 16 daripada 98 buah sekolah rendah dipilih secara rawak ke dalam kumpulan intervensi dan kawalan dengan menggunakan kaedah pensampelan rawak mudah. Kemudian, 79 pengendali makanan telah dipilih sebagai responden. Bahagian 2 melibatkan 293 pelajar Tahun Enam dari tiga buah sekolah yang dipilih secara rawak dari sekolah kumpulan intervensi. Program Latihan Makanan Selamat dan Berzat telah dibina berdasarkan Teori Perilaku Terancang. Pemerhatian tapak dan soal selidik yang telah disahkan digunakan untuk mengumpul data pada garis dasar dan selepas 6 minggu (Post1) dan 12 minggu (Post2) program intervensi. Keputusan Bahagian 1 menunjukkan bahawa pengendali makanan yang dilatih telah menunjukkan peningkatan yang signifikan dan berterusan berkaitan: pengetahuan berkenaan kebersihan diri, kaedah-kaedah untuk menyediakan makanan selamat, pilihan

makanan sihat, dan pengetahuan keseluruhan berkenaan makanan sihat; laporan sendiri amalan keselamatan dan kebersihan makanan; dan pengendalian makanan mentah dan peralatan memasak. Amalan mencuci tangan dalam kalangan kumpulan yang dilatih telah meningkat dengan signifikan dari 29% pada garis dasar kepada 50.8% pada Post1 ( $p=0.004$ ). Skor kebersihan persekitaran kantin untuk kumpulan intervensi telah meningkat dengan signifikan sebanyak 13.8 mata ( $p=0.012$ ) dan peningkatan ini berterusan sehingga Post2 ( $p=0.0168$ ). Tahap ketidakpuasan terhadap Kiraan plat aerobik, Kiraan koliform total dan *Staphylococcus aureus* dari permukaan yang menyentuh makanan berkurang dengan signifikan sebanyak 20.2%, 50.4% dan 27.5% masing-masing selepas intervensi. Kantin sekolah dalam kumpulan intervensi secara signifikan menyediakan lebih banyak menu sayur-sayuran pada Post1 ( $p = 0.040$ ) dan susu dan produk susu pada Post2 ( $p=0.015$ ) berbanding dengan kumpulan kawalan. Pada Bahagian 2, berbanding dengan kumpulan kawalan, pelajar sekolah dalam kumpulan intervensi secara signifikan menunjukkan: peratusan lebih tinggi untuk membeli makanan bersaing di kantin sekolah (49.1% vs 47.2%), dan susu dan produk susu (16.0% vs 10.6%); peratusan lebih rendah pelajar untuk membeli makanan segera (2.7% vs 22.5%); persepsi lebih baik terhadap kebersihan dan sanitasi kantin sekolah ( $p<0.001$ ), dan makanan bersaing yang disediakan ( $p=0.001$ ). Kesimpulannya, intervensi ini adalah berkesan dalam meningkatkan pengetahuan dan perilaku pengendali makanan berkaitan dengan keselamatan makanan dan diet sihat yang disediakan di kantin sekolah rendah yang terpilih.

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BHARU, KELANTAN**

**ABSTRACT**

The health and development of schoolchildren is influenced by the home and school food environment. Many efforts were conducted to improve the safety of food preparation and the healthy diet served in school canteens. However, the effectiveness of interventions are varied and rarely evaluated. This study aims to develop new intervention programme for the preparation of safe food and healthy diet among food handlers at primary school canteen in Kota Bharu, Kelantan. This study was conducted in two parts. In the Part1, 16 out of 98 primary schools were randomized into intervention and control groups using a simple random sampling. Then, 79 food handlers were selected. In Part2, 293 standard six students were recruited from the three randomly selected schools from the intervention group. The Food Safety and Nutrition Training Programme was developed based on the Theory of Planned Behaviour. On-site observations and validated questionnaires were used to collect data at the baseline and the following 6-week (Post1) and 12-week (Post2) after intervention. Results of Part1 showed that trained food handlers demonstrated significant and sustained improvement in the following: the knowledge related to personal hygiene, rules for preparing safe food, healthy food choice, and the overall knowledge of healthy diet; the self-reported practice of food safety and hygiene; and the handling of raw food and cooking equipment. Handwashing practices in the

trained group significantly increased from 29% at the baseline to 50.8% at Post1 ( $p=0.004$ ). The environmental sanitation score for the intervention group was significantly increased by 13.8 points ( $p=0.012$ ), and sustained up to Post2 ( $p=0.0168$ ). The unsatisfactory level of Aerobic plate count, Total coliforms count, and *Staphylococcus aureus* from food contact surfaces were significantly reduced 20.2%, 50.4% and 27.5% respectively following the intervention. School canteens in the intervention group significantly served more vegetable menu at Post1 ( $p=0.040$ ) and milk and milk products at Post2 ( $p=0.015$ ) compared to the control. In Part2, compared to control group, schoolchildren in the intervention group showed significantly: higher percentage to purchase competitive foods in school canteens (49.1% vs. 47.2%), and milk and milk products (16.0% vs. 10.6%); lower percentage of students who purchased fast food (2.7% vs. 22.5%); better perception of the hygiene and sanitation of school canteens ( $p<0.001$ ), and competitive foods served ( $p=0.001$ ). In conclusion, the intervention was effective in improving the knowledge and behaviours of food handlers in relation to food safety and healthy diet serving in the selected primary school canteens.



## CHAPTER 1

### INTRODUCTION

#### 1.1 Background

Consuming safe and healthy diet is very important to human wellbeing. However, consuming unsafe and unhealthy diet will affect many aspects of life, especially in children as well as debilitated adults. Food is the primary vehicle for foodborne disease that contributed to one-third of the population in the developed countries suffers this illness annually (Akhtar *et al.*, 2014), and attributed 54% of the total burden globally (WHO, 2016) (World Health Organization, 2016) . Many reports have shown that the current foodborne disease outbreak in Malaysia occurred mostly in schools and learning institutions rather than in the community (Meftahuddin, 2002; MOH, 2006; Soon *et al.*, 2011). The occurrence of foodborne diseases is quite persistent even though many preventive actions were taken by government including mandatory food hygiene training for all food handlers.

Nowadays, in line with urbanisation, larger economic opportunity and the high cost of living in Malaysia, more and more women especially those married with children are forced to work to support their family needs. Thus, most working parents may not have ample time to prepare and provide food for their children especially during school hours. Consequently, most of these schoolchildren will have to eat at the school canteen. It is also important to note that schoolchildren have to stay back in school for extracurricular activities. Thus, these children are very

dependent on food sold in the school canteen. There are two main avenues in which schools may influence children's diets. One is the competitive foods, which are foods that are sold in addition to school meal programme. The other is the government sponsored school meal programme (the National School Lunch Programme [NSLP] and the School Breakfast Programme [SBP]) (Fox, 2010; Snelling *et al.*, 2007).

In Malaysia, the school meal programme is known as "Rancangan Makanan Tambahan" (RMT) which is a free breakfast served to those students with family income of RM400 or less per month or RM800 or less per capita per year. The food is prepared by the school canteen. The aim of the SBP is to ensure improvement in the physical growth as well as mental and general health of schoolchildren by providing a free serving balanced diet via a predetermined list of 20 foods menu. The SBP is regulated directly under the Ministry of Education (MOE), Malaysia. Since SBP only served breakfast, schoolchildren still have the opportunity to buy competitive food during school break or for their lunch.

Those students who do not meet the criteria for SBP will buy food from the school canteen for their breakfast or lunch. In most situations, competitive foods may affect the objectives of the school meal programme by being more attractive to schoolchildren and thus reducing participation in SBP. In the year 2014, of the 5,120,802 schoolchildren in Malaysia, 2,704,046 (52.8%) were primary schoolchildren and 196,077 (3.8%) were preschool children (EMiS, 2015). This indicates the majority of pupils are dependent on the school canteen for meals throughout their school hour, every year. Past studies in United States indicated

more than one-third of schoolchildren aged 11-13 years purchased competitive food for their lunch (Templeton *et al.*, 2005).

Regardless of the avenues in which students get their food, both competitive and sponsored school meal are prepared and handled by similar food handlers working in the school canteen. As a consequence, the sanitary quality of food preparation and handling and also food quality is a matter of concern in ensuring the food served is saved as well as healthy for consumption. Personal hygiene of the food handlers is the utmost concern because they are one of the known mechanical agent for contaminating food (Campos *et al.*, 2009). Naturally, humans carry with them variety of microorganisms, some of which are non-pathogenic, while others are pathogenic. The most common potentially pathogenic bacteria isolated from hand of food handlers were *Bacillus* spp. (28.6%), *Escherichia coli* (22%), *Entrobacter* spp. (14.6%), *Klebsiella* spp. (13.3%) and *Staphylococcus aureus* (12.6%) (Shojaei *et al.*, 2006).

Microbial contamination in foods may transmit microbial diseases of the gastrointestinal system in schoolchildren and thus resulting in school absenteeism, poorer school performance, impaired cognitive function, less productive, reduce quality of health and financial burden to their family and government. Due to these existing consequences of foodborne disease outbreak, Malaysian government, especially through the Ministry of Health (MOH), has implemented many programmes, initiatives and improving law and regulation aiming to curb the problem. One of the initiatives done was the food handlers' training programme. The training programme specifically focused on food handlers and the contents of the

training are related to the Food Act 1983 and Food Hygiene Regulations 2009. Thus far, there were 125 accredited food handlers' training institutes as of September 2010 in Malaysia (Soon *et al.*, 2011).

Although the status of food safety in Malaysia has improved, according to Malaysia Health indicators (MOH, 2005; MOH, 2010b), the incidence rate for certain foodborne diseases such as cholera and food poisoning were on an increasing pattern especially in schools. Schoolchildren are among the highest risk group in succumbing to foodborne disease when sanitary control in food preparation and handling are compromised. In Malaysia, to date, there is still a limited study carried out on food safety in primary school setting. None of the studies have reported the intervention programme to improve the food hygiene and safety in the school canteen. Based on advanced search builder using keywords Malaysia, school, food, children, safety or health in the different search engine, such as the Cochrane Library, ProQuest, Scopus, ScienceDirect, Wiley Online Library, PubMed google scholar, only 3 related articles were found (Norazmir *et al.*, 2012; Serene Tung *et al.*, 2011; Soon *et al.*, 2011). One of the articles was a reviewed article and the other two were cross-sectional studies. None was carried out in primary school.

Besides food safety, there is a need to also consider seriously the quality of food served in term of the nutrition content as recommended by the Malaysian Dietary Guideline (MOH, 2010c) and Management Guide for Healthy School Canteen (MOE, 2011). The alarming issue was that the popular competitive food choices are often of low nutritional value (Briefel *et al.*, 2009; Probart *et al.*, 2006; Templeton *et al.*, 2005). The common unhealthy type of competitive foods sold at

school canteen includes soft drinks, candy bars or sweets, chips, fast foods and other snacks that contributed to an obesogenic environment (Buck *et al.*, 2013; Van Hook and Altman, 2012).

Several previous studies documented the relationship and the importance of the school food environment in influencing the schoolchildren eating pattern and the development of non-communicable food related diseases. Schoolchildren are not only exposed to the risk of foodborne disease, but may be predisposed to overweight, obesity and imbalance micronutrients due to over consumption or under consumption of healthy foods. The escalating trend of obesity, overweight and undernourished in schoolchildren has been reported in many studies either locally (Lee and Manan, 2014; Tee *et al.*, 2002) or worldwide (Best *et al.*, 2010; Florentino *et al.*, 2002; Jus'at and Jahari, 2002; Wong *et al.*, 2005).

In short, school food environment plays a substantial impact by influencing the eating pattern amongst schoolchildren. It is a great challenge nowadays when most of the food served in school canteen is of energy-rich foods and nutrient-poor snacks (Bell and Swinburn, 2004; Larson and Story, 2013). Thus, there is an urgent need to assess the current situation on the type of food served at the primary school canteen. The findings could help improve the availability of nutritious food rather than food high in fat, sugar or calorie served in school canteens. Previous researchers agreed with the significant improvement in the food environment and dietary intake in schools following an effective implementation of school food policies (Jaime and Lock, 2009; Zaini *et al.*, 2005).

## 1.2 Statement of the problem

School canteen should serve safe and healthy food for the consumption of their children since majority of them are dependence on school food for their meal throughout their schooling period. However, current report and statistics shows an increasing trend of FBD in Malaysian schools (MOH, 2005; MOH, 2010b), a substantial high prevalence of obesity, overweight and undernourished in Malaysian schoolchildren (Ishak *et al.*, 2013; Ismail *et al.*, 2002; Khor *et al.*, 2011; Lee and Manan, 2014; Tee, 2002), and a wide availability of unhealthy competitive food in school canteen (Larson and Story, 2013; Probart *et al.*, 2006; Templeton *et al.*, 2005). The escalating trend of FBD in schools environment and other non-communicable disease related with food among schoolchildren carries a significant impact on public health issues and economic burden. These scenarios utmost reflect insufficient knowledge and practices in safe and healthy food preparation among food handlers that work in school canteens.

There were interconnection between school canteen as a provider for the school food environment with the risk of foodborne disease, obesity and malnutrition in schoolchildren is closely interrelated. Food contamination could occur throughout the food preparation until consumption, thus, food safety can be improved by targeting towards the school food handlers and canteen environment. The reasons behind the concern with food safety in school canteen involved a well-known association between the poor personal and environmental hygiene by food handlers with cross-contamination of infectious agents in food (Lopez-Quintero *et al.*, 2009; Rodríguez-Caturla *et al.*, 2011; Soon *et al.*, 2011). Similarly, the dietary pattern of

schoolchildren is partly influenced by the school food environment. The association between schoolchildren eating pattern and school food serving was documented by many past studies (Jaime and Lock, 2009; Neumark-Sztainer *et al.*, 2005; O'toole *et al.*, 2007).

Hence, it urges the need for more comprehensive study and development of effective program targeting food handlers in order to improve their knowledge and practices in preparing safe and healthy food. In brief, the existence of interconnection between school food environment and food-related diseases has driven this study to address certain specific issues. This study focused on the knowledge and practice of food handlers in food safety and healthy diet, environmental hygiene and sanitation of the school canteen, competitive food availability in school canteen and students' food choices and perception.

### **1.3 Rationale of the study**

In the face of increasing incidence of foodborne disease and diseases related to food nutrition in schools, there is a need to find effective ways to manage food safety and serving of nutritious food. Apart from regular monitoring and assessment of school canteen hygiene and sanitation level, food safety training is an important component of an effective strategy in food safety management. Though all food handlers including those who are working in the school canteen are legally required to attend the current food handlers' training programme, but their food safety practices, environmental sanitation of their food establishments is still poor and at the same, foodborne disease are still showing an alarming increasing trend especially at

schools and learning institutions. Thus, it is indicating that the available training programme are inconsistent, and rarely evaluated for efficacy as pointed by Chapman *et al.* (2011).

Many studies related to the KAP of food handlers have been conducted worldwide. Previous studies mostly looked at the specific training programme that focuses on certain food safety outcome. For example, Cotterchio *et al.* (1998) only examined the effect of training on sanitary conditions of restaurants, Park *et al.* (2010) delivered an impressive training module, however, did not include a comprehensive personal hygiene or handwashing training in their module and did not assess the microbiological status as the training outcome in the restaurants as well. Whereas, Filion *et al.* (2011) examined the effect of a poster intervention with an accessible hand sanitiser unit on the hand hygiene improvement in the hospital cafeteria and Roberts *et al.* (2008) assessed the knowledge and behaviour related to specific food safety practices (cross-contamination, poor personal hygiene, and temperature abuse) in restaurants with the food safety training.

Very few studies found that conveyed a holistic training programme, used a wide angle of hygienic and microbiology assessment as their studies' outcomes, and carried out at the school canteens. The reported study related to food safety in schools focused only on assessing the KAP (without any intervention) (Aziz and Dahan, 2013; Campos *et al.*, 2009; Kwon *et al.*, 2014; McIntyre *et al.*, 2012; Subratty *et al.*, 2003; Tan *et al.*, 2013c; Veiros *et al.*, 2009), an exploratory descriptive study to identify the risk perception of food safety by school food handlers (Machado *et al.*, 2014) and microbiological status (without intervention)



(Tan *et al.*, 2013b; Yoon *et al.*, 2008). Moreover, there are limited numbers of local studies conducted in schools. Earlier studies found so far were cross-sectional design that assessed microbiological assessment to determine hand hygiene (Tan *et al.*, 2013b), KAP on food safety (Norazmir *et al.*, 2012; Tan *et al.*, 2013a; Tan *et al.*, 2013c) and food handlers' attitude towards safe food handling (Aziz and Dahan, 2013).

To date, many researchers pointed out that the knowledge conveyed by conventional training courses cannot be assumed to translate into the desired changes in behaviour. The impact of pre- and post-training as well as the appropriateness of material conveyed during a course were suggested as factors that influence the extent to which desired behaviour changes take place. In a systematic review of literature from 1974 – 1996, only eight methodologically sound studies reported on the effects of training of food service workers (Campbell *et al.*, 1998). However, the measurable effects were related to inspection score.

It is believed that, food safety and nutrition training could lead to an improvement in food safety and preparation practices if the information and skills conveyed leads to desired changes in behaviour or practice in the workplace. Few thorough evaluations of the effectiveness of training have been carried out. Some evidence links improved the practices with the presence of trained staff (Barrett and Howells, 2008; Chapman *et al.*, 2010; Green, 2008; McIntyre *et al.*, 2012). Such circumstantial evidence is, however, confounded by other factors that might also lead to improved targeted behaviour (e.g. the presence of adequate facilities or management commitment) (Green, 2008), and does not address the effectiveness of

training per se. Similarly, some studies address the immediate transfer of knowledge or change in practice such as pre- and post-test (Park *et al.*, 2010; Roberts *et al.*, 2008), after one week of intervention (York *et al.*, 2009b), 4 weeks following an intervention (Filion *et al.*, 2011) and a limited number of study tested for the sustainability of the training (Wright *et al.*, 2012).

On the other hand, the incremental trend of the child obesity would demand special attention and research to curb this issue as early as possible. Thus, in addition to the food safety issue, specific focus on the improving in the quality of food served in the school canteen should be included in the new health education intervention. On top of that, the development of new intervention should be based on the best theoretical framework, which has been shown to be able to change the behaviour of food handler. By implementing the wider scope of intervention, the multiple angles of assessed outcomes would be able to represent a wider scenario on the improvement that will be documented. As a result, it can narrow the gap lacking in focusing and handling of health related issues amongst primary schoolchildren in Malaysia, especially in relations with foodborne disease and food nutrition and health.

## **1.4 Research question**

This study addresses several research questions as follows.

1. Does Food Safety and Nutrition Training Programme have significant changes in the knowledge on food safety and healthy diet, food safety practices, and handwashing practices among food handlers?
2. Does Food Safety and Nutrition Training Programme bring significant improvement in the environmental hygiene and sanitation?
3. Does Food Safety and Nutrition Training have significant changes on food sold pattern in the primary school canteen?
4. Does Food Safety and Nutrition Training have significant effects on the food choices and perception of hygiene, sanitation and competitive foods in school canteens amongst primary students?

## **1.5 Objectives of the study**

### **1.5.1 General objective**

To conduct an intervention programme for the preparation of safe food and healthy diet among food handlers at primary school canteen in Kota Bharu, Kelantan.

### **1.5.2 Specific objectives**

The specific objectives are:

1. To compare the score of food safety and healthy diet knowledge among food handlers at primary school canteen in Kota Bharu, Kelantan before and after the intervention in the control and intervention groups.
2. To compare the food safety and handwashing practices among food handlers at primary school canteen in Kota Bharu, Kelantan before and after the intervention in the control and intervention group.
3. To determine the change of environmental hygiene and sanitation of school canteen based on observation and indicator bacteria before and after the intervention in the control and intervention groups.
4. To determine the change of competitive foods serving in the primary school canteen before and after the intervention in the control and intervention groups
5. To assess the food choices and perception of hygiene, sanitation, and competitive foods in school canteens amongst primary school students between the control and intervention groups

### **1.6 Null hypotheses**

The following null hypotheses were formulated for this research:

1. There is no statistically significant difference between the trained food handlers and non-trained group in their food safety knowledge and practices.

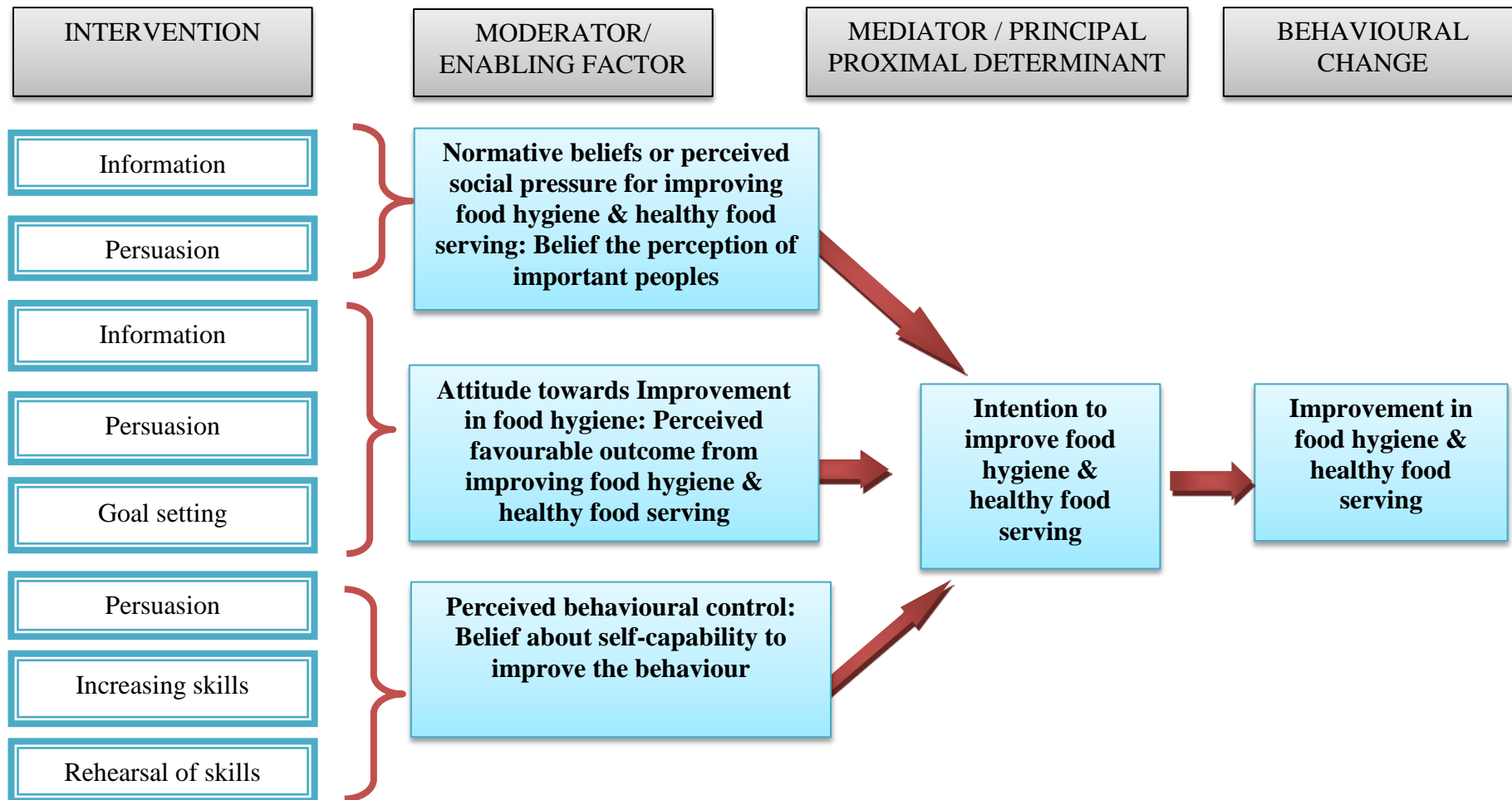
2. There is no statistically significant difference between the trained food handlers and non-trained group in healthy diet knowledge and serving.
3. There is no statistically significant difference of students' food choices and perception between the trained group and non-trained group.

### **1.7 Theoretical framework**

A successful intervention must be based on firm theories and a consideration of all relevant variables, such as personal development, the learning process, communication of messages, and diffusion of innovations (Rennie, 1995). Rennie (1995) also pointed out that the health education theory following the knowledge, attitude and practice (KAP) model predicts a limited effectiveness of formal food hygiene education. This opinion was supported by Green (2008) who stated that, multiple factors not just knowledge, affect humans to engage in any particular behaviour due to the complexity of human behaviour. Thus, providing knowledge alone does not always result in safe food handling behaviour (Roberts *et al.*, 2008; Seaman and Eves, 2006). It can be seen from a well-controlled study which examine the effects of such training programmes on employee's knowledge who documented that, the number of behavioural changes was surprisingly small (Mitchell *et al.*, 2007). This is in agreement with Machado *et al.* (2014) who reported that although food handlers are aware of risky behaviours, such as the use of inadequate temperatures, this awareness does not prevent them from performing tasks in an incorrect manner.

There are several behavioural theories available. The most popular theoretical framework used for the prediction of health related behaviours seems to be the Theory of Planned Behaviour (TPB) (Astr and Rise, 2001; Mullan *et al.*, 2015). York *et al.* (2009b) also claimed that, the TPB offers a framework for identifying and targeting important factors. Using the TPB, the objective to improve safe handling and preparation of foods and the serving of nutritious food amongst food handlers working in school canteens could be achieved by implementing an intervention focusing on behavioural attitude (BA), normative belief (NB), perceived behavioural control (PBC) and behavioural intention (BI). Moreover, past pilot intervention study supports the utility of the TPB as a framework of improving food safety behaviour (Milton and Mullan, 2012). Refer to Figure 1.1.

The TPB consists of three moderators represents the generative mechanism through which the mediator variable is able to influence the dependent variable of interest, which is the behavioural change. The mediator variable or also known as the principal proximal determinant of behaviour is referred to the BI which is regarded as a summary of the motivation needed to implement a specific behaviour (Armitage and Christian, 2003). The stronger the intention to engage in the behaviour, the more likely its performance should be (Armitage and Conner, 1999). The detail about the TPB will be discussed further in the literature review.



(Adapted from Ajzen, 1991; Armitage and Christian, 2003)

Figure 1.1 The proposed research framework based on the Theory of Planned Behaviour

## **1.8 Definition of terms**

### **1.8.1 Operational definition**

*Competitive food:* Foods that are available for purchase in the school canteen, but outside of the sponsored school meals programme (Fox, 2010; Snelling *et al.*, 2007; Story *et al.*, 2008).

*Foodborne disease:* Any illness resulting from the consumption of contaminated food and drinking water (Key Message 14 of Malaysian Dietary Guideline) (MOH, 2010c).

*Food handler:* Refers to those involved in a food business and those who handle or prepare food, whether open (unwrapped) or packaged (food includes drinks and ice).

*Food handling practice:* A practice or behavior during the food preparation processes starting from raw food handling until the serving or keeping the food.

*Handwashing:* Washing hands with plain (contain non-antimicrobial) soap and water (Boyce and Pittet, 2002).

*Healthy Diet:* Diet which is low in fat and sugar and high in fibre (fruits, vegetables and whole wheat bread) and light butter (Astr and Rise, 2001).

*Safe food:* Food that does not make a person ill after consumption in which had been handled properly, prepared on clean and sanitised surface and utensils and



stored and distributed under proper temperature control (Schmidt and Rodrick, 2003).

### **1.8.2 General definition**

*Cross-contamination:* Defined as the transfer of harmful microorganisms either direct transfer from a raw food to a cooked food or from one item of food to another through a non-food surface such as equipment, utensils, and human hands (Key Message 14 of Malaysian Dietary Guideline) (MOH, 2010c).

*Fast foods:* Food that is readily available, use, or consumption with little consideration given to quality or significance. It usually does not require cutlery and includes burgers, nuggets, pizza, sausages, french fries, fish ball, hot chips, pies, pizza, deep fried food and other similar food items (Bell and Swinburn, 2004; Freeman, 2007; Norimah *et al.*, 2014). Under this definition, the fried fish cracker or “keropok ikan” (the main content is fish and starch flour) was included.

*Food not recommended for sale:* Food not recommended for sale in school canteens includes instant noodle, confectioneries, ice-cream, carbonated drink, creamy food, sugar-coated food, chocolate-coated food and fast foods (MOE, 2011).

*Food forbidden for sale:* Forbidden food for sale in school canteen includes candies, chocolate, pickled foods, junk food and food or drink containing alcohol (MOE, 2011).

*Food poisoning:* Refer to a syndromes acquired as a result of ingesting contaminated foods with infectious, toxigenic micro-organisms or noxious elements (Key Message 14 of Malaysian Dietary Guideline) (MOH, 2010c).

*Hand hygiene:* A general condition of hand after performing handwashing (Boyce and Pittet, 2002).

*High-risk food:* Food that supports the survival and multiplication of microorganisms and is being consumed without further treatment. It includes foods high in protein that need refrigeration during storage, raw foods demanding no additional cooking or processing before consumption (e.g., vegetables and fruits), and cooked foods (Ehiri *et al.*, 1997).

*Milk and milk products:* Milk refers to cow, goat and sheep milk (fresh, pasteurised, sterilised and ultra-heat temperature (UHT) milk, and milk powder (full cream, skimmed, and full milk powder). Milk products refer to product prepared from milk, milk shakes, yoghurts, cheese, and ice cream (Key Message 7 of Malaysian Dietary Guideline) (MOH, 2010c).

*Overweight:* For children, it refer to BMI-for-age between the 85<sup>th</sup> and 95<sup>th</sup> percentile (Ogden and Flegal, 2010; Sanchez-Vaznaugh *et al.*, 2010).

*Obesity:* For children, it refer to BMI-for-age at or above the 95<sup>th</sup> percentile (Ogden and Flegal, 2010).

*Ready to eat food:* Referred to food items that are edible without washing, cooking or additional preparation by the customer or by the food establishment (McSwane *et al.*, 2004).

*Vegetables:* It includes green leafy vegetables, carrots and legumes (Bell and Swinburn, 2004).

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Introduction

Safe food is an important component to ensure that the end-food product does not pose any risk to the consumers. Consumers are the last link of the food supply chain, started with production, processing, distribution and end up with food retail and food service businesses. There are multidimensional of consumers with differing age, life experience, knowledge, culture, nutrition needs, purchasing power, family background and media inputs. Thus, the term or definition of food safety would be varied and unique descriptions based on different perspectives. Thus, this research focuses on the specific consumer group, the primary schoolchildren and the safe food represents the food that does not make or pose the schoolchildren to illness after consumption.

In order to prepare safe foods for the schoolchildren consumption, the food handlers and food managers need to follow the food safety practices. The most common reported practices and factors that determine the food safety includes food handling and preparation, food handlers' hygiene and environmental sanitation, food storage and temperature control (Schmidt and Rodrick, 2003). The school food environment refers to school canteens, their workers and surrounding areas including all its facilities and cooking equipment.

The health of the schoolchildren with relation to food is not only determined by the food safety practices. Their healthy growth and development were closely related to the nutritional value of consumed foods. Because of the equal importance of these two issues, certain researchers (Grunert, 2005) defined the food safety in a broader meaning by including the nutritional qualities of food besides the probability of not contracting a disease as a consequence of consuming a certain food. Hence, the information on consumers' perception, food choices and demand are vital in order to determine and finally influence the consumption of nutritious foods.

## **2.2 Safe food preparation**

Food safety is a crucial public health priority all over the world. It has been reported by the Food and Agriculture Organisation of the United Nations and by the World Health Organisation (FAO/WHO, 2002) that more than two million people, mainly infants and children, die every year from diarrhoea caused mainly by food or water. The situation is worse in third world countries where up to one third of their population suffers from foodborne disease every year. The Food and Drug Administration, 2004 and MOH have briefly outlined the commonest factors that determined the safe food preparation (Musa *et al.*, 2010). It includes safe food sources, temperature control of food holding and storing, personal hygiene practice and cross-contamination. To ensure the safe sources of food, the food suppliers or vendors should be reliable. The temperature of chiller to keep the raw food items should be below than 5°C, frozen items should be below than -10°C and dry items

should be kept at room temperature or not exceed 27°C. Cooked food should be served and consumed within not more than four hours with the holding temperature should be above 60°C. In line to this, the sanitary conditions of food premises and food handlers are regulated in the Food Act 1983 and Food Hygiene Regulations 2009 (Food Act, 2009; Ismail, 2011). Part IV of this act and regulations detailed out regarding food handler training, medical examination and health condition of food handler, clothing of food handler, personal hygiene of food handler, handling of food and appliances, preparing, packing and serving of food, and storage of food.

Food-workers in many settings have been responsible for foodborne disease outbreaks by various means for decades (Chapman *et al.*, 2011; Ehiri and Morris, 1996; Greig *et al.*, 2007). Analyses of reported outbreaks throughout the world, including in Malaysia, have confirmed the fact that the majority of foodborne disease outbreaks result from improper food handling the use of leftover chicken, improper food storage and unhygienic practices among food handlers in small food-businesses, canteens, residential homes, and other places (Campos *et al.*, 2009; FAO/WHO, 2013; Hejar *et al.*, 2011; Motarjemi and Käferstein, 1999; Ryu *et al.*, 2011). Cross-contamination may occur directly by food handlers or by added constituents during food preparation (Ryu *et al.*, 2011).

The unhygienic practice amongst food handlers have been observed during food preparation, processing or storage (Greig *et al.*, 2007; Medeiros *et al.*, 2001). Food handlers were also found as carriers of pathogenic microorganism (Chapman *et al.*, 2011; Simonne *et al.*, 2010) such as Hepatitis A, *Salmonella* spp., and *Esherichia coli* O157:H7. The presence of microbial contamination in foods prepared in school

canteen has been proven by the presence of cross-contamination by food handlers (Ryu *et al.*, 2011). Clayton *et al.* (2002) supported the fact that food handlers less frequently practices food safety behaviour. The most frequent contributory factors related to poor food safety practices during food preparation as listed by EFSA (2010) includes inadequate heat treatment, use of unprocessed contaminated ingredients and storage time or temperature abuse.

The lack of safety practices during food preparation among food handlers occurred in all types of food establishments including school canteens. Although food preparation in school canteen is less complex, with fewer items prepared as compared to restaurants, behavioural violations are seen more common involving equipment and facility maintenance (Kwon *et al.*, 2014). Based on the verified outbreaks in Europe which involved a large number of human cases indicated that school canteens was the second most common settings reported following after the restaurants (EFSA, 2010). Moreover, another report based on a national survey of approximately 1,000 United States food establishments stated that amongst institutional food service, the percentage of food handlers with poor personal hygiene practices in school was 16.3% which is the third highest following nursing homes (20.2%) and hospitals (17.5%) (Greig *et al.*, 2007). Hence, unsafe food preparation in school canteens is a neglected issue. Therefore, to reduce the risk of foodborne disease in school, serious attention should be given along the process of food preparation to ensure proper handwashing, adequate cleaning and good sanitation procedures.

The preparation of food must strictly follow the hygienic guideline to ensure the food served is safe for consumption. Schmidt and Rodrick (2003) stated that the food considered to be safe if it had been handled properly, prepared on clean and sanitised surface, utensils or equipment and stored or distributed under proper temperature control. The final outcome is food safe for consumption. In general, food establishment was categorised as institutional food service (such as nursing homes, hospitals, universities, and schools), restaurants and retail food establishments (such as meat and poultry departments and markets) (Greig *et al.*, 2007). School food service in Malaysia is known as school canteen.

### **2.3 Unhygienic food preparation and foodborne disease**

The foodborne disease occurs whenever a person consumes foods that contain enough live germs (bacteria, viruses, or parasites) or their toxins that can affect human health. With every bite, the consumers might expose themselves to illness from either microbial or chemical contamination. Once infected with any enteric pathogen, a person can continue to carry the bacteria/virus in the intestinal tracks and stool for a long period of time without showing symptoms. Based on WHO report, unsafe water used for the cleaning and processing of food, poor hygiene during food preparation and handling and the absence of adequate food storage infrastructure are the known factors which had contributed to a high-risk environment (World Health Organization, 2008). According to Yan (2012), the issues of food safety in China within the last two decades demonstrated a shift in the major causes of food poisoning reported, from easily recognised single source (such as spoiled foods,