CHAPTER 5

DISCUSSION, RECOMMENDATIONS AND CONCLUSIONS

5.1 Introduction

This chapter summarizes the overall finding of the module development and its usability. It begins with the discussion of Phase 1: Need analysis, followed by Phase 2: Design and Development Phase 3: Implementation and Evaluation. The quantitative findings emerged from the analysis are discussed and synthesized with related previous related literatures.

5.2 Summary and Discussion of Findings

5.2.1 Summary

This study was conducted based on the addressed issue and research gaps exist within the food poisoning prevention education especially among the consumers who bought cooked food. Consumers were identified as the final gatekeeper of ensuring the safety of the food consumed and they are more at risk of contracting food poisoning (Milton & Mullan, 2010). WHO emphasized that the safety of the food should be set at the point of consumption rather than the point of purchase (Milton & Mullan, 2010). Therefore, consumers should be alerted to the safety of the food they bought. It is also argued that the

increase of the underreporting of food poisoning cases is due to the misinterpretation of food poisoning symptoms and the negligence of consumers to seek early treatment (Odeyemi et al., 2019; Wahida et al., 2017). This underpinned the need of instilling a good knowledge, attitude and the elements of psychosocial towards food poisoning prevention among the consumers (Ruby et al., 2019b).

Designing a food poisoning prevention intervention requires a good behavioral theory as its framework. This study refers to the Health Belief Model (HBM) as its fundamental theory in developing 'See, Select, Tell' food poisoning prevention educational module. The perceptions and motivation element comprised in this model complement each other to explain the likelihood of engaging recommended behavior of which in this study is the food poisoning preventive behavior. On the other hand, the design and development of the study is adhered to the Design and Development Research approach. With this approach, the development of the module undergoes three phases namely (1) Need Analysis; (2) Design and Development; and (3) Implementation and Evaluation (Saedah et al., 2013; Richie & Klein, 2007). The first phase of need analysis is conducted in order to identify areas of food poisoning prevention that include the consumers' knowledge, attitude, preventive behavior and risk perceptions toward food poisoning prevention. In addition, the researcher also inquires information on food poisoning education gaps from the perspective of healthcare educators. To achieve this, a set of questionnaires was developed as the instrument to gather the information and it has been tested for its validity and reliability.

The second phase involved the design and development of the 'See, Select, Tell' Module. For this purpose, a Sequential Iterative Model (SIM) was adhered whereby a module should consist of aim and objectives, key topics, training flow, resources and evaluation (Milano & Ullius, 1998). Next, literature and document analysis from CDC outline as well as Ministry of Health, Malaysia guidelines was referred to identify the element and module scope. With this regard, four module scopes were identified and embedded in the module content. Activities were designed according to the unit objectives and evaluations were conducted to determine the achievement of the said objectives. All the module units were developed to be delivered in 12 hours of training. The module draft was then validated by experts and piloted to determine the suitability of the module content and language used. The module was improvised according to the feedback before its implementation in the field.

The module implementation in Phase 3 involved two different localities which were Gemas and Kuala Pilah. A total of 60 eligible residents were recruited and allocated into intervention (Gemas) and control (Kuala Pilah) groups with 30 respondents in each group using control – matched procedure. Respondents were briefed about the study and consented prior to the study conduct. Both control and intervention groups went through 4 weeks pre-and post-intervention. Only the intervention group implemented the See, Select, Tell module whilst the control group received food safety infographics via 'whatsapp' application throughout the intervention period. The intervention group involved in the 12 hours module activities delivered by the facilitators who were appointed among the health

inspectors from Tampin district health office. Pre and post tests were conducted before and after intervention for both control and intervention groups. The effectiveness and usability of the module were evaluated. The module effectiveness was ascertained according to the food poisoning prevention knowledge, attitude and risk perceptions mean scores within the pre- and post- test in the intervention group and subsequently compared between the control group. For this purpose, independent T-tests and paired T-tests were employed using SPSS.

An independent T-test was employed to evaluate any significant mean difference between control group and intervention group. On the other hand, paired T-test was used to determine any significant of the mean score of the pre-test and post-test for both control and intervention group. Respondents and facilitators were asked to evaluate the usability of the module content by completing the feedback survey.

5.2.2 Discussion

The following paragraph elaborated on the major findings of the current study with respect to research objectives which were formulated based on the three phases of DDR. The finding was subsequently discussed and critically analyzed from the previous literature which led to the new knowledge of contribution.

5.2.2a The Need Analysis of 'See, Select, Tell' (SST) food poisoning prevention module development

Food away from home can be obtained either from the food premises or online food delivery services that have become a trend due to rapid urbanization and recent COVID outbreak. Food prepared outside is prone to be contaminated from mishandling and insanitary premise, hence this might put consumer at the risk of food poisoning (Zarina & Faisal, 2012; Hong et al., 2021). These were supported by previous finding that buying outside food triggers the highest incidence of food poisoning in Malaysia (Mohd. Firdaus et al., 2015; Mahmood et al., 2018). In addition, food safety risk perceptions did not reflect in the intention of buying outside food (Hong et al., 2021). As such, inculcating food safety knowledge and risk may help to minimize the risk of contracting food poisoning (Ali et al., 2018; Ruby et al., 2019a; Odeyemi et al., 2019).

The SST food poisoning prevention module developed in this study was targeting the consumers who consumed food away from home. The initial phase of the SST module development involved need analysis of which the researcher gathered information from a survey conducted among the consumers. In addition to this phase, an open – ended questionnaire was distributed among the four experts who were involved in food safety education. The objective of Phase 1 is to determine the need of food poisoning intervention module. This need underpinned the areas of concern pertaining to food safety education of which include consumer's level of knowledge, attitude, food poisoning preventive behavior and risk perceptions. Most of the respondents in this study were identified as

having a 'Good knowledge,' 'Good attitude' towards food poisoning prevention and practicing food poisoning prevention (77.2%, 85.6% and 92.3% respectively). Nonetheless, 36.0% of them had negative perceptions towards food poisoning prevention. Self-reported behavior used in this study may not reflect the actual practice of food safety behavior due to respondent bias (Bou-Mitri et al., 2018). Thus, behavioral enablers such as knowledge, attitude and risk perceptions were assessed in order to identify the area of concern that underpinning the need to develop the SST module.

Previous literature agreed that low level of knowledge and attitude level on food poisoning prevention were the factors of poor food poisoning preventive behavior (Lim et al., 2016; Ruby et al., 2019a; Soon et al., 2020). This was supported from the current finding whereby knowledgeeas shown to have a positive relationship with food poisoning preventive behavior ($\beta = 0.257$, $p = 0.004$). Knowledge was the frequent element being investigated behavioral determinant in the previous studies and a lot of them reported that consumers were lacking specific recommended food handling practices (Burke et al., 2016; Mullan et al., 2015 and Lum et al., 2013). For instance, Burke et al. (2016) identified the common foodborne illness knowledge that was poor among the consumers was falsely identified the unsafe holding temperature. On the other hand, a survey among the adolescents in Australia and United Kingdom revealed that most of them were least knowledgeable on common food sources of foodborne illness pathogens (Mullan et al., 2015). The current finding reveals knowledge was significantly associated with food preventive behavior. Previous studies demonstrate that there was consistent relationship of

knowledge and behaviors related to prevention of cross – contamination and personal hygiene practice (Young et al., 2017). Nonetheless, the current finding adds two more significant knowledge elements associated with food poisoning preventive behavior of bought food that are pest control and spoilt food detection.

Controlling pest invasion is crucial in preventing food poisoning as pests are known to be the animal carrier that allows pathogens to enter the food supply. Major groups that affect food products are rodents, insects, lizards, and birds (Hamidi, 2018). They usually infest the food supply due to the existence of harborage, food, and water. Rodents have the capability to spread food borne illness pathogens on their skin and digestive system such as *Campylobacter spp*., *Escherichia coli*, *Salmonella spp*., *Staphylococcus aureus* and *Yersinia pestis* (Hamidi et al., 2016; Hamidi et al., 2015; Morayvej et al., 2015). Hamidi (2018) suggested that to effectively control pest infestation, food operators should be able to eliminate the pest – conducive condition that includes water, food, and shelter. This can be done by inspecting the potential entry points (example: windows, drain ventilation inlet), storage and disposal of food waste (Loven, 2010; Hamdi, 2018). Although the responsibility of ensuring the pest – free food premise is on the food operators, consumers themselves should be able to make decision on choosing a clean food premise by looking out for the signs of infestation such as urine stain, droppings, musty smell, evidence of gnawed holes, roaches egg cases or dead carcasses (MOH, 2020b).

Another preventive measure of food poisoning is food spoilage detection by smelling, observing, and tasting. Food spoilage can occur as a result of microorganism

contamination that can change the food color, odor, flavor and texture (Lorenzo et al., 2018). Although taste and smell may not be reliable indicators of food spoilage that caused by microorganism metabolism associated to off – flavors such as *Clostridium botulinum* and *Staphylococcus*, yet it still provides a significant preventive measure for food poisoning (WHO, 2015). However, consumers should be reminded that apart from sense detection, temperature and time control are the most crucial elements in ensuring the safety of the food consumed (WHO, 2015).

This study also aimed to determine the relationships within the behavior enablers of knowledge, attitude and risk perceptions. Attitude was also found to be the strongest predictor associated with food poisoning preventive behavior ($\beta = 0.381$, $p < 0.001$). Attitude was known to influence consumer's food handling practices depending on individual interest, social identification and values (Howe & Krosnick, 2017). For instance, Abdul Mutalib et al. (2012) observed that consumers with positive attitude were keen to practice safe food storage and correct food handling. Similarly, Ruby et al., (2019b) demonstrate positive attitude towards the harm of leaving food at room temperature. The previous studies conducted were observing attitudes related to safe food handling at home. The current finding adds value to which it identified significant attitude that is associated with food preventive behavior of bought food. These include looking at the food premise grade, choosing a clean food premise, lodging complaints to authorities regarding food mishandling and insanitary food premise and seeking treatment for food poisoning. The finding was similar to Zaujan et al. (2021) in which more than 80% of its respondents were

reported to have positive attitude towards choosing a clean food premise, complain lodge to authorities regarding unhygienic food preparation in food premise and seeking treatment for food poisoning. Nonetheless, the later study was conducted in rural areas in Terengganu and may not reflect those in urban areas.

The current study utilized the Health Belief Model (HBM) to determine the risk perceptions of food poisoning prevention among the consumers. Risk perceptions was observed to be a significant predictor that was positively related to food poisoning preventive behavior in this study ($\beta = 0.242$, $p < 0.001$). Previous findings agreed that consumers often underestimate their chances of becoming ill due to food poisoning (Nesbitt et al., 2014; Young et al., 2017), and this is known as 'optimism bias' (Weinstein, 1989). This is similar to the finding that 36% of the respondents negatively perceived their chances of getting food poisoning and practicing food poisoning preventive behavior as hard. This raised a concern whereby it reflected the probability of consumers to adopt food poisoning preventive behavior was low due to the feeling of less empowered to protect themselves from food poisoning (Hanson et al., 2015; Shahkolai et al., 2019). In addition, Ruby et al. (2019a) argued that consumers with higher education background were more aware of food poisoning risk and more concerned on the occurrence of contracting food poisoning. The study did not examine the relationship of educational background with risk perceptions. However, more than half of the respondents in this phase obtained secondary education and this could be the reason for the contribution of negative perception percentage.

Information on food poisoning prevention challenges was also investigated among the experts involved in food safety education. Most experts agreed that the food handler's attitude and behavior is the most challenging in ensuring the food sold was safe. To add, the Food Handler Training course which is compulsory for the food handler, especially the kitchen operators, was most of the time attended by the food premise owner. This imposes an issue as the information on safe food handling might not be disseminated to the kitchen operators. The Food Handler Training is part of education intervention designed to promote safe food handling and practices with an ultimate aim to reduce foodborne illness (Young et al., 2020). Young et al. (2020) in their meta – analysis work have concluded that Food Handler Training did not significantly improve the attitude of the food handlers, yet it did improve the food safety knowledge. This is agreeable with the concern raised by the experts that current module on food poisoning prevention lacks attitude element of which is crucial to improve food safety behavior.

5.2.2a(i) Relationship of food poisoning knowledge, attitude, risk perceptions and preventive behavior – Structural model analysis

The study illustrated a food poisoning preventive model that incorporated all constructs discussed previously. Furthermore, the structural model analysis able to determine the relationship of the constructs with the food poisoning preventive behavior. To summarize, the knowledge, attitude and risk perceptions variables had successfully explained 22.1% of the variance of food poisoning preventive behavior. Among the

constructs, attitude (β = 0.381) had the strongest effect on food preventive behavior. This is consistent with previous literature (Lim et al., 2016, Ruby et al., 2019b; Soon et al., 2020). Soon et al. (2020) describes attitude as a crucial mediator between knowledge and behavior. Positive attitude also indicates the level of motivation required to practice food safety behavior (Soon et al., 2020). Nevertheless, inappropriate belief and underestimation of food poisoning can lead to negligence of food preventive behavior (Redmond & Griffith, 2003). For instance, consumers may not find using thermometer was effective in reducing food poisoning as they perceived this method might be a waste of money and time (Porticella et al, 2008). Therefore, positive attitude can be only instilled when a person believes specific behavior can reduce chance of food poisoning, then only good food handling behavior can be exercised (Shapiro et al., 2011).

The pathway evaluation exhibited that food poisoning knowledge was positively affecting food poisoning preventive behavior (β = 0.257). The finding was contravened from the previous studies of which the knowledge did not affect the food safety handling practices (Baser et al., 2017; Soon, 2019; Soon et al., 2020). Nonetheless, it was demonstrated that consumers with good knowledge on food poisoning will not conducting any risky behaviors that include eating raw or partially cooked food and they are more willing to improve their knowledge (Talaei et al., 2015; Vadlamani et al., 2015). This could be further explained from the finding that knowledge positively impacted attitude (β = 0.321) although it only explains 5% of the variance. Buccheri et al. (2010) and Quick et al. (2013) agreed that although knowledge is an important factor that develop consumer's

attitude, it requires more enhancement to strengthen its position. This is necessary for the consumers to be more positive in protecting themselves and be more aware on what they consumed. As highlighted by Omari et al. (2018), consumers with positive attitude able to handle the food safely as the result of their concern towards preventing food poisoning.

Risk perceptions were identified as the weakest predictor in this study ($\beta = 0.242$). This can be as a result of the various preventive behaviors assessed as a whole rather than specific behaviors that may reduce the explanatory power (Wang et al., 2021). Although risk perception was the weakest predictor among other constructs, it remains the significant predictor towards food poisoning preventive behavior. In contrast with McArthur et al. (2006) who found the HBM model as the poor predictor of food handling practices (variance percentage <1%), current research supports the finding that risk perception promotes the preventive behavior (McArthur et al., 2006; Ungku Fatimah et al., 2011; Vainio et al., 2020, Wang et al., 2021). For example, consumers who perceived to be susceptible to get food poisoning were more decisive not to eat or buy food from a restaurant with poor grade (Vainio et al., 2020). In addition, Wang et al. (2021) demonstrated that the HBM model has successfully explained 60% of the food-handling intention namely handwashing and food waste handling. Furthermore, having known consumers' risk perception may assist in strategizing an effective intervention method that is more targeted to specific perception (Orji et al., 2012).

It is clearly demonstrated that knowledge and attitude were the strongest predictors towards food poisoning preventive behavior and a lot of studies supported that by

empowering the consumer's knowledge and attitude on food safety may improve food safety behavior. However, these studies were among those who prepared and handled food at home (Mihalache et al., 2021; Ruby et al., 2019b; Lim et al., 2016). Very little of the research investigated these elements on consumers' food safety behavior on food away from home.

Finding from Phase1 had higlighted the need areas of food poisoning prevention that include knowledge, attitude and risk perceptions. In addition, this phase incorporated structural model analysis of which underpinned the relationships within the knowledge, attitude and risk perceptions towards food preventive behaviors. As such, this analysis provides an insight and foundation to the development of the module content that took into the account of the knowledge, attitude and risk perceptions elements. This will be discussed in the following sub- section.

5.2.2b The Design and Development of 'See, Select, Tell' (SST) food poisoning prevention module

Development of food poisoning prevention module involved the design and development phase. In the design phase, the study adheres to the Sequential Iterative Model (SIM) framework of which it consists of five module components: (i) aim and objectives; (ii) key topics; (iii) training flow; (iv) training resources; and (v) training evaluation. Subsequently, document analysis was conducted in order to identify the key topics to be included in the module. Documents such past literature and guidelines from MOH as well

as CDC were referred and five key topics were determined that include: (i) introduction to food poisoning; (ii) choosing a safe – to – consume food; (iii) food poisoning and mishandling complaint channel; (iv) getting prompt food poisoning treatment. The topics were chosen related to food safety practices of buying food away from home either from the street vendor or at other food premises.

Numerous food safety interventions previously were focusing on proper handwashing (Gautam et al., 2017; Milton & Mullan, 2010; Diplock et al., 2018), proper food storage (Gautam et al., 2017; Milton & Mullan, 2010), adequate cooking (Gautam et al., 2017; Milton & Mullan, 2010; Roy et al., 2016), cleanliness and cross-contamination (Milton & Mullan, 2010; Diplock et al., 2018; Henley et al., 2016). There were differences between this study and the previous one, of which two key topics were embedded namely: (i) food mishandling and complaint channel, and (ii) getting prompt food poisoning treatment. It is assumed that the food poisoning cases is increasing annually in Malaysia as a lot of cases were under – reported (Wahida et al., 2017). This was supported by Chan et al. (2014) of which most of the consumers' complaints regarding product –related failures in restaurants were from food sensory quality rather than food safety quality. Ensuring hygiene practices among the food vendors have becoming increasingly crucial along the food chain from the production to food preparation and serving (Suwaidi et al., 2015). Hence, apart from educating the food vendors of food safety practices, it is suggested that by empowering consumers on their right to lodge food mishandling and unhygienic

premises complaint may have a positive impact on food safety practices promotion among the food vendors (Nor Azizi & Pakir Mohamed, 2021; Bass et al., 2022).

Additionally, the incorporation of 'Getting prompt treatment for food poisoning' topic in SST module provides a unique approach to the consumers in educating them to seek immediate treatment for food poisoning. The improvement of food poisoning treatment seeking behavior will eventually enhance the reporting of food poisoning cases and efficient treatment and medical attention especially among the high – risk community such as children, elderly and those with immunocompromised diseases (Lamine et al., 2020). Food poisoning is frequently misunderstood as transient discomfort rather than a symptom of a disease and consequently causes delay in seeking early treatment (Wahida et al, 2017; Soon et al., 2011). Similar finding was observed in Lamine et al. (2020) of which more than 60% of adolescents did not seek treatment prior to food intoxication. Moreover, most of them sought doctors' consultation after presenting clinical symptoms of bloody diarrhea, abdominal pain and red spots of which (Lamine et al., 2020; Al-Mohaithef, 2021). This explains that individuals are inclined to seek treatment when they possessed higher perceived severity (Al-Mohaithef, 2021; Brainard et al., 2020).

Food safety education is a combination of learning strategies that is developed to promote safe food consumption as well as to cultivate related food safety behavior. It was delivered through activities from individual level, community, or authorities' policies implementation (Contento, 2008). The efficiency of food poisoning prevention module is consolidation from various activities grounded by CDC - Food Safety and Eating Out

(CDC, 2022) and MOH Malaysia – Sanitary Guidelines for Food Premises and Restaurants (MOH 2001). The educational resources and materials were systematically arranged according to food poisoning prevention topics whilst the module design was adhered to SIM model. The educational materials were carefully chosen based on the learning outcomes. In addition, the usage of web – based platform during the COVID-19 epidemic can be an alternative to deliver food poisoning prevention education. The incorporation of short videos substituting the food premise visit to indicate food premises and food handler cleanliness may enhance consumers' view and perception on food premises sanitary that encompasses few aspects; merely not only on the aesthetic values. Facilitators led the discussion in each topic activities and used pre – recorded slides to demonstrate the food safety concept. Furthermore, the paperless activities provide new experience to the consumers to understand the food safety concept guided by activities instructions and topic evaluation.

The module content was evaluated by seven experts using a set of validation questionnaires that comprised of seven components. Each item in the component was ascertained on a 5 – point Likert scale. The validity assessment revealed that most of the experts agreed that the module content meets its learning objectives; the module scopes were suitable; learning resources, delivery strategies and topic assessments were appropriate; as well as module scope arrangement and time allocation for all activities were considered acceptable. In addition, the researcher piloted the module content among the

consumers in Kajang and positive feedback was obtained on the content wordings and delivery used in the module.

In order to determine the SST module usability, a quasi experimental study was conducted in Phase 3. The SST module was implemented among the selected consumers and the module effectiveness was compared with the control group from the different loacality. Detail of the module implementation was discussed in the following sub sections

5.2.2c The Implementation of 'See, Select, Tell' (SST) food poisoning prevention module

The SST module was implemented in two different localities in Negeri Sembilan using purposive sampling. Respondents from both localities were recruited voluntarily based on a set of recruitment criteria. This is to ensure the sampling bias can be minimized by reducing the 'Hawthorne effect'. Each of the localities was allocated into the intervention group and control group of which the intervention group implemented the module content whilst the control group received food safety electronic posters (infographics). The SST module was implemented for four (4) weeks. All respondents were briefed on the research aim and objectives and consented prior to the study implementation. Pre and posttest on knowledge, attitude and risk perceptions were measured using a set of validated questionnaires. The module activities were conducted at home, led by facilitators using Google meet as the platform.

The strategy to involve healthcare practitioners to deliver the module content is in line with the aim of the food poisoning educational module to empower the community in effort to prevent food poisoning. Hence, the involvement of health inspectors in this study supports the premise that the efficiency of food poisoning prevention education depends on the qualified executor who are well-versed on the food safety context (Tiozzo et al., 2018). The finding in Phase 1: Need Analysis also supports the eligibility of individual to deliver the module content; in which most consumers perceived healthcare personnel as credible individual to disseminate food safety education. In addition, the respondents strongly agreed that they are capable of achieving the topic objectives with the guidance from the facilitators who were the health inspectors. This reflects that the module content is effective and efficient, provided that it is delivered by the relevant healthcare educators or practitioners.

One of the unique features of this food poisoning prevention module is that the content is flexible and can be conducted virtually using available online platforms. This is an important feature whereby it can be an alternative to face – to – face food safety education programme especially during the pandemic of COVID- 19. The module was implemented during the early outbreak of COVID-19 and in – person activities were prohibited in order to minimize social contact. With this respect, the module content was delivered virtually using Google classroom platform with a few modifications to the delivery strategies. The incorporation of video demonstration and online worksheet activities as substitutes to face – to – face activities and field visit have been shown to

improve the consumers' knowledge and attitude on food poisoning preventive practices. The finding was consistent with Yeung et al. (2019) that online food safety module could be as effective as the in – person programme. Furthermore, Archila-Godinez et al. (2022) demonstrated that virtual food safety programme was shown to enhance food safety knowledge and change the attitude and perceptions among the low – income family in the United States; provide a path to develop and ascertain more online food safety programmes in the future especially to those niche groups. Nonetheless, it was argued that face – to – face programmes provided more opportunities for the facilitators to deliberate and delve into more details on a specific topic, and consequently attracted interest among the respondents to dig more on the information (Yeung et al., 2019). This was true for hands – on activities such as field visit and cross – contamination experiments, which most of the respondents and facilitators in this study proposed to have face – to – face practical activities to enable better knowledge grasp. Hence, the effectiveness of the module and its usability will be discussed in the subsequent sections.

5.2.2c (i) The effect of 'See, Select, Tell' (SST) food poisoning prevention module on consumers' knowledge

The effect of SST module on consumers' food poisoning and prevention knowledge was measured using a paired T-test (pre and post module intervention) and independent T-test for mean differences between control and intervention group. The

finding revealed the mean knowledge scores were higher among the module intervention group as compared to the control group after 4 weeks of intervention (36.53 (2.29) and 30.17 (3.87) respectively with $p<0.001$). In addition, the knowledge mean scores among the module intervention group were significantly increased after 4 weeks of intervention with effect size of knowledge exceed Cohen's convention for a large size effect ($d = 3.79$). The larger size effect suggests that the SST module is capable of improving consumers' knowledge on food poisoning and its prevention. In addition, the knowledge mean scores in control group also improve significantly with a large size effect of $d=1.82$. The finding suggests that the usage of food safety infographics in the control group may affect knowledge among the control group members, but not as much as in the module intervention group. Current finding used food safety infographics from the Malaysia Ministry of Health as a standard intervention or known as placebo. Respondents were free to go through the infographics and the acquired knowledge may be limited to the information given in the pamphlets. Rather than not introducing any intervention to the control group, researcher chose to impose food safety infographics as the placebo to the control group in order to reduce the interactive effects (Johnson & Christensen, 2014). Interactive effect indicates that the threats to validity can produce a bias in the study which may threaten the ability to conclude that the independent variable (pre and post) is the causes of the differences between groups on the dependent variable (knowledge, attitude and risk perceptions) (Johnson & Christensen, 2014).

In addition to the pre and post quasi experimental design employed in this study, a controlled – matched technique was used to ensure both control and module intervention group members were selected based on a similar characteristic that is the knowledge baseline scores. Respondents were matched and recruited based on the knowledge baseline scores of which scores below than 60 (Talaei, 2015; Ruby et al., 2019a). Those who scored below 60 were regarded as having poor knowledge of food safety; hence this explains the consideration into the groups. Piaw (2014) describes that it is important to ensure both respondents in control and intervention groups possess a similar characteristic since quasi experimental design lacks randomization elements. Although most studies would prefer to match according to specific characteristics such as age, gender or educational background (Yeung et al., 2019; White et al., 2018; Feng et al., 2019; Archila – Godinez et al., 2022), the current opted knowledge baseline score as the matching characteristics to minimize the risk of maturation that may occur among the respondents due to their existing food safety knowledge. Maturation bias commonly happens in quasi experimental design; hence this method helps to reduce the threat to the study internal validity. Consequently, this technique allows researcher to rule out whether the differences between the groups are due to the intervention, not the maturation effect (Johnson & Christensen, 2014).

It is demonstrated that the primary aim of food safety education is to enhance food safety knowledge that subsequently can improve consumers' attitude which resulted in food poisoning preventive behavior (Lim *et al.*, 2016; Ruby et al., 2019b; Mihalache et al., 2021). The current study was consistent with previous findings that food poisoning

prevention educational module successfully improve consumers' knowledge (Majowicz et al., 2017; Albert and Stevenson, 2017; White et al., 2018; Feng et al., 2019; Archila – Godinez et al., 2022). To be specific, the improvement was noted on food poisoning etiologic agent, high-risk food, sign and symptoms, complications, spoilt food detection, and preventive measures constructs. In addition, large score differences were observed on high – risk food, sign and symptoms, and preventive measures ($t(29) = 17.503$, $p<0.001$; $t(29) = 9.54$, $p<0.001$; and $t(29) = 7.49$, $p<0.001$ respectively). To the best of search, this is the only study that includes high – risk foods as one of the important food safety element in the module. High – risk foods are prone to be contaminated with pathogenic microorganisms due to its high content of protein and moisture (CDC, 2019). The high – risk food include ready – to – eat food and raw food (CDC, 2019). The key to ensure the safety of high – risk foods consumptions are safe food handling and storage that emphasize on time and temperature control (CDC, 2019). Respondents were introduced on the time and temperature control concept and subsequently relate with safe food handling and storage.

5.2.2c (ii) The effect of 'See, Select, Tell' (SST) food poisoning prevention module on consumers' attitude and risk perceptions

Similar to knowledge, the effect of SST module on consumers' food poisoning and prevention attitude was measured using a paired T-test (pre and post module intervention) and independent T-test for mean differences between control and intervention group. The attitude scores was significantly improved among the module intervention group with an

increase of 4.5 point (t (29) = 2.475, p= <0.001, d = 0.45) as to compare to the control group that did not show any significant improvement (t (29) = 1.139, p = <0.264, d = 0.21). Cohen convention for the attitude score in module intervention group was identified as small effect, proposed that the module intervention may have impact on consumers' attitude. As suggested by previous finding, attitude act as the mediator between knowledge and food safety behavior (Lim et al., 2016; Ruby et al., 2019b; Mihalache et al., 2021). It is believed that the high knowledge score attainment in the module intervention group after 4 weeks intervention might be resulted from the positive attitude possessed among the module – trained respondents. This was consistent with previous finding that positive attitude mediates the food safety behavior (Kuo & Weng, 2021; Sayuti et al., 2020). On the other hand, high knowledge and good food safety behavior may result in positive food safety attitude (Soon et al., 2020).

Consumers' risk perceptions towards food poisoning prevention were assessed summative on four constructs that include: (i) perceived barriers; (ii) perceived susceptibility; (iii) perceived severity; and (iv) perceived benefit. It is postulated that risk perception can change individual's food safety behavior. However, the module intervention did not significantly improve respondents risk perceptions (t (29) = 0.471, p = 0.641, d = 0.09). Similarly, when compared to the control group, no significant difference was observed. Slovic et al. (2005) argued that food poisoning risk perceptions can be enhanced if the consumers feel that they are lacking of control. In addition, to heighten this feeling, strong messaging strategies and appropriate risk communication strategies can be

applied. For instance, a message that evokes emotional respond or elicits disgust was found to increase intended and actual food safety behavior (Nauta et al., 2008). Furthermore, consumers were likely to choose food vendor who communicate food poisoning risk reduction through food safety certification or food safety attributes (Chalak et al., 2019; Lagerkvist et al., 2015).

The incorporation of perceived risk of food poisoning prevention was communicated through two module scopes namely: (i) choosing safe – to – eat food; and (ii) getting prompt treatment for food poisoning. The use of pre – recorded video demonstration and short – film for this scope may not be able to trigger respondents' perceived risk on food poisoning as it may lack of the element of emotional and disgust. Initial delivery strategies include role – play and experimental demonstration are believed to improve respondents' risk perception, however these activities requires face – to – face activities. With this respect, it is proposed that if the module is to be conducted online, the delivery strategies should incorporate the element that evoke emotional and disgust in order to improve risk perceptions that subsequently facilitate the behavioral change.

5.2.2c (iii) Users feedback on 'See, Select, Tell' (SST) food poisoning prevention module

Module usability was investigated based on users' satisfaction on the module implementation. Both feedbacks from the respondents and facilitators were gathered using a 5 –point Likert scale and open ended questions that allow them to express their satisfaction on the module. The finding revealed that more than half of the respondents

strongly agreed that they were able to achieve each of the module scope objectives through the activities conducted. Furthermore, most respondents personally thought that this module was not only taught them to choose safe food and clean food premise, but it also impacted them on the domestic food safety practice. The current study specifically educate the consumer on food safety for food away from home that emphasized on the finding a safe-to eat food encompassing the high risk food, cross – contamination, time and temperature control, spoilt food detection and clean food premises. It is believed that some of the component such as cross-contamination as well as time and temperature control learnt from this module may be applicable for domestic environment (Woldt & Moy, 2015; Ovca et al., 2016; Henley et al., 2016; Diplock et al., 2018).

Additionally, a few respondents expressed that the module have changed their perceptions and awareness on the environment that affect the safety of the food consumed. On the other hand, some of the respondents felt that the module can be benefited in creating awareness among the consumers, food handlers and food vendors to avoid food poisoning, reducing the food poisoning risks and together to ensure the cleanliness of the food premises. The feedback supports the premise that consumers – food vendors' relationship on food safety practices assurance can be an advantage to encourage food safety practices among the food vendors (Bass et al., 2022; Chalak et al., 2019). In addition, the inclusion of 'Food mishandling and insanitary food premises complaint' scope may reinforce this relationship of which consumers are empowered to ensure the safety of the food sold by

lodging complaints on food mishandling behaviors and insanitary food premises via appropriate complaint channels.

The delivery strategies and learning materials used in this module were found to be appropriate and aids in achieving the module scope objectives. Nonetheless, both respondents and facilitators proposed to conduct food premise visit and hands-on experiments in the future to gain more insight on topic such as food cross – contamination and choosing clean food premises. It is demonstrated that hands – on activities such as experiments and practical provide more insight and impact of which it allows individual to relate what they observed to the food safety concept (Yeung et al., 2019; Ovca et al., 2016).

5.3 Implications of the study

The 'See, Select, Tell' food poisoning prevention educational module have shown to improve consumers' knowledge, attitude and risk perceptions towards food poisoning prevention. The activities conducted enable the consumers to learn and explore the concept of food safety designated for boughtfood or food taking away from home in an interactive ways. The synergistic involvement between the community members and healthcare personnel in module implementation was found to be beneficial in delivering food safety education. Hence, through this study, a few implications especially in food safety education are identified. The study implications are divided into theoretical implications and practical implications.

5.3.1 Theoretical implications

The ‘See, Select, Tell’ (SST) module consists activities that are community – centered which aims to educate consumers in selecting safe and clean food as well as empower the consumers to report any food mishandling or insanitary food premises. This educational module focus on consumers’ ability to grasp fundamental areas of food poisoning together with environmental factors identification that contributes to food poisoning. The combination of cognitive (food poisoning knowledge) and skills (food poisoning preventive measures) in this module helps consumers in safe and clean food decision making. In addition, the incorporation of affective aspects of attitude and risk perceptions is aimed to facilitate the food poisoning preventive behavior. With this respect, a Health Belief Model was adhered in the development of SST module. It is believed that consumers will engage to a certain behavior based on the weight of threat perceptions and behavioral evaluations. Although the finding exhibits that risk perceptions were slightly improved, it still exhibits the significant predictor towards food poisoning preventive behavior.

The usage of HBM as the theoretical framework in food safety study was scarce as to compare to other theories such as Theory of Planned Behavior (TPB), Health Action Process Approach (HAPA) and Protection Motivation Theory. Only one study adhered to HBM in investigating specific food handling intention (Wang et al., 2021). Nonetheless, Wang et al. (2021) solely evaluate the components of HBM that were perceived susceptibility, perceived barriers, perceived severity, perceived benefits, and self –

efficacy. The current study adds value by incorporating attitude and knowledge that can be directly and indirectly impact consumers' food preventive behavior. Moreover, the inclusion of HBM, knowledge and attitude has explained 22.1% of the preventive behavior, suggestive that these elements have a high predictive value towards food poisoning preventive behavior. Hence, the utilization of HBM framework with incorporation of knowledge and attitude can be an alternative in food safety intervention to promote desired food preventive behavior.

5.3.2 Practical implications

The impact of the SST module were elaborated into two distinctive areas namely policy implications and consumers food safety education implications. This will be elaborated in the subsequent subheadings.

5.3.2a Policy implications

The findings from this study have provided fundamental information not only on the theoretical aspect but opportunities for the policy makers and other stakeholders to improve on existing food safety educational programme. The finding also implicates the Health Ministry of Health Malaysia (MOH) to intensify efforts in educating food safety among the consumers. As important as nutritional education programme, food safety

programme deemed to be pivotal as a result of the occurrence of food poisoning incidences. This is true especially during the COVID-19 pandemic where a lot of consumers were engaged in high – risk food poisoning behavior (Faour-Klingbeil et al., 2021). In addition, the accessibility to food purchase via online may put consumers on the risk of contracting food poisoning as a result of food mishandling during the food preparation and transporting (Mihalache et al., 2021).

The finding on the SST module development reveals that the need for food safety education among the consumers is crucial due to the premise that community – targeted intervention programme were very scant. Although food safety training among the food handlers is made mandatory and serve as part of food poisoning preventive measures, its efficacy is questionable due to high kitchen staff turnover and very little of kitchen operators attended the course. Hence, consumers – food safety – oriented programme is demonstrated to be beneficial in educating consumers finding safe – to –consume food and clean food premises.

Besides that, the SST module efficacy demonstrated in this study serves as a potential food safety education tool in combination with other existing materials prepared by the MOH. The community – oriented strategies and comprehensive educational materials used in this module can be assimilated with existing food safety education to produce a holistic food safety education and effective module deliveries. Therefore, it is proposed that future healthcare personnel to be upskilled on the food safety education

deliveries to the community as community – oriented education may provide a huge impact to the food supply chain.

5.3.2b Consumers food safety education implications

The finding from this study suggests that food safety education for the consumers is effective to be conducted in community – oriented rather than individual basis. The involvement of the community members in food safety educational programme may provide 'trickle down' effect to the overall food safety education of which the food safety information can be indirectly disseminated to the family members. In addition, the involvement of community representatives such as KOSPEN can be promoted to educate other residents as well and this method can be an effective way in food safety intervention deliveries. With this respect, the SST module content was designed to be community – friendly with appropriate activities, teaching deliveries and materials that can be implemented by the community representatives.

In addition, the finding from the experts' concern food safety education for consumers clearly reflected that there was no specific food safety programmes targeted to the consumers. Indeed, a lot of the food safety guidelines are developed to serve the purpose of food handling in the kitchen, canteen, dormitories and ceremonies. Furthermore, the experts concern on the lack of attitude element in food handlers training as well as other food safety programmes indicated that the existing food safety module may not be effective to tackle the behavior. Therefore, this module can be utilized by the

healthcare staff to educate the consumers in different aspect of attitude, risk perceptions as well as knowledge on food poisoning prevention.

To update, there are no reliable instruments to evaluate consumers' food poisoning knowledge, attitude and risk perceptions in Malaysia context. Hence, the SST module is developed together with reliable and validated evaluation tools to measure the outcome of the module efficacy (Mamot et al., 2021). Although there might be a few food safety programmes are currently conducted for the consumers, its efficiency and efficacy are not reported elsewhere. Hence, from the module efficacy findings, it is suggested that the SST module is a validated and reliable intervention tool that can be used for food poisoning prevention education among the consumers.

5.4 Limitations of the study

Despite the number of strength and promising findings of the module efficacy reported in this study, there are some limitations that need to be addressed. Firstly, the employment of open – ended questionnaire in Phase 1 to acquire information on food safety education challenges may produce unquantifiable information that cannot be statistically analyzed. It is suggested that focus group discussion would provide in –depth information of which the information produced can be analyzed thematically (Creswell & Creswell, 2018).

In addition, the quasi experimental design of this study may lead to a degree of selection bias. The lack of randomization process in this design may hinder the

generalizability aspect of the study. A randomized – controlled trial (RCT) can be used to reduce this bias and provides a rigorous tool to examine the cause – effect relationships between intervention and outcome (Piaw, 2014).

The recruitment of residents and KOSPEN members in Phase 3 of this study of which is known to be actively in community programme may not reflect the real community engagement especially those from the unreachable population (eg: the rural areas, the younger group, housewives etc.). Therefore, an effort to promote to the programme to consumers from different sociodemographic background is needed to observe the extensive impact of the module.

Furthermore, this study only assessed the behavioral enablers of attitude and risk perceptions towards food poisoning prevention; of which it may not reflect the actual behavior. In addition to this, the use of self – reported preventive behavior in PLS-SEM analysis may lead to potential bias such as social desirability bias. Hence, actual behavioral assessment such as the observation or behavior checklist can be employed to overcome such bias.

Finally, the study outcome was only measured at one point of time (pre and post) and this may not reflect the real changes of the behavioral enablers. Previous studies suggest that a longitudinal study can be applied to observe the consistency of the behavioral change (Wang et al., 2021; Majowicz et al., 2017).

5.5 Recommendations of the study

The Need Analysis finding clearly indicate that consumer – oriented food safety module in Malaysia is scarce and most food poisoning preventive education is tailored to food handlers. Despite of the good food poisoning knowledge exhibits, consumers were reported to have negative perceptions towards food poisoning prevention and this is a 'red flag' in food safety education. It is demonstrated that consumers with negative perception will perceive themselves as less susceptible to food poisoning and perceived food poisoning as less severe. Therefore, the policy makers and Ministry of Health should take initiatives to include food safety intervention programme among the consumers that are not only knowledge- oriented, but also incorporate attitude and risk perceptions.

Expert panels in module validation have agreed that the entire food poisoning module scopes incorporated in this module is sufficient and can be used as a guideline for health educator to educate consumers. Moreover, the inclusion scope of 'Food mishandling and insanitary complaint lodge' and 'Getting prompt food poisoning treatment' can be considered as crucial in food poisoning prevention as these two are often neglected by the consumers. Therefore, it is suggested that these scopes to be taught to the consumers for them to be aware of the available complaint channels and to be able to seek immediate treatment for food poisoning.

Since this module is designed to impact on the behavioral enablers (knowledge, attitude and risk perceptions), it is proposed that an improvement on module activities to be made to tackle actual food poisoning preventive behavior. Food premises visit to assess

cleanliness of the premises for instance can be an initial step to promote clean food premises seeking behavior. A portable application of food premise cleanliness evaluation can be used to ascertain consumers' frequencies of food premises assessment for every premises visit. Consequently, this action can develop into habits and improve food poisoning preventive behavior. In addition, it is proposed that other food preventive behavior enablers such as self – efficacy and health consciousness to be included in the food poisoning preventive behavior framework. Previous research has manifested that self-efficacy can significantly and positively influence proper food – handling intention (Chow & Mullan, 2010; Wang et al., 2021). The health conscious on the other hand can affect food handling intention through mediators (Wang et al., 2021). Thus, adding these variables may help to increase the model's explanatory power (Wang et al., 2021).

Apart from its use among the community in general, it is recommended that the SST module to be implemented in other setting and population such as school children, healthcare professionals and food handlers in order to determine its effectiveness on other communities. For instance, a food safety learning scope (eg: washing hand, choosing clean premise, getting food poisoning treatment) can be embedded in the school curriculum to to improve students' attitude and food poisoning preventive behavior. On the other hand, the SST module can be a handy tool for the healthcare professionals to advocate patients on getting prompt treatment for food poisoning beside the food poisoning prevention education. It was reported by the expert that the current MOH food safety module for the food handlers in the canteen and dormitory kitchens are lacking of food safety element

such as food contamination source, handling high risk food and spoilt food detection. Hence, the SST module can be used to complement the existing food safety module.

It is hoped that these recommendations and suggestions can be seen in a positive perspective in order to improve consumers' food poisoning preventive behaviors. The recommendations should be refined and considered critical in order to improve consumer – centered educational approach. It is anticipated that this study is not only to trigger new ideas and open new path of discoveries for other researchers; but also provide opportunities to the health educators to explore other approaches in consumers – oriented food safety education.

5.5 Conclusions

This chapter encompasses of critical discussion of the research finding, proposed theoretical and practical implications, study limitations and recommendations of the study. In summary, the aim of this study is to develop food safety educational module for the consumers to enhance food poisoning knowledge, attitude and risk perceptions. The 'See, Select, Tell' module was designed and developed based on the empirical research on food poisoning prevention measures, evaluation and instructional practice. The systematic weekly educational module and instruments to measure knowledge, attitude and risk perceptions were developed based on theoretical framework and empirical research.

The process involved in this study is inductive of which conclusions were ruled out from the data collection. The efficacy assessment of the module was conducted using quasi

experimental design by measuring the food poisoning knowledge, attitude and risk perceptions using pre and posttests. Quantitative analysis revealed significant effect of module implementation on knowledge and attitude in comparison to the control group that use infographics. These findings were subsequently triangulated with a set of rating items and open – ended questions to measure the module usability. The finding exhibits that the module has a potential to improve food poisoning prevention knowledge, attitude and risk perceptions among the consumers. In addition, both respondents and facilitators strongly agreed that the module consisted of appropriate material and delivery strategies in order to achieve the objectives.

In summary, this research has successfully achieve its objective in identifying the need of the food poisoning intervention module, desgining and developing the module and determining the module usability in terms of effectiveness and user's satisfaction. Furthermore, the important features of the 'See, Select, Tell' module is its design and development that it takes into account psychosocial aspects and related theoretical framework. The positive finding from this module contributes to the body of knowledge with an emphasis to equip the consumers with related food poisoning knowledge and food poisoning prevention skills and subsequently empower them to make a right decision in selecting safe and clean food.