



UNIVERSITI PUTRA MALAYSIA

***APPLICATION OF EXTENDED THEORY OF PLANNED BEHAVIOR TO
PREDICT INTENTION IN FOOD SAFETY PRACTICES AMONG ADULT
CONSUMERS IN SIBU, SARAWAK, MALAYSIA***

GENEVIE ELEANOR ANAK RUBY

FSTM 2020 20



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By

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**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in
Fulfilment of the Requirements for the Degree of Doctor of Philosophy**

August 2020

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

APPLICATION OF EXTENDED THEORY OF PLANNED BEHAVIOR TO PREDICT INTENTION IN FOOD SAFETY PRACTICES AMONG ADULT CONSUMERS IN SIBU, SARAWAK, MALAYSIA

By

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August 2020

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Foodborne disease (FBD) is a global problem that also occurred in Malaysia. Despite various efforts, food poisoning cases continue to show an increment. This case is not only occurred at food premises but also reported at home. Recognizing this, adult consumers who handle food at home should even know and adhere to the practice of food safety. It was also essential to examine the relationship between a socio-demographic profile and factors that influence the level of food safety knowledge and self-reported practices. In this study, the incorporation of food safety knowledge to extend the Theory of Planned Behavior (TPB) was attempted to explain the factors affecting intention on safe food handling. The moderating effect of gender and educational level on the relationship between TPB factors and intention was also determined. The cross-sectional survey by using self-administered questionnaires was carried out for hypothesis testing. A total of 623 adult consumers aged 20 and above participated in this study and were selected using convenience sampling. The descriptive analysis showed that food safety knowledge was good even though the self-reported practices had been unsatisfactory. The analysis using one-way ANOVA and independent sample t-test showed that both food safety knowledge and self-reported practices were significantly different based on gender, education level, number of children in the family, and frequency of food preparation at home. Meanwhile, the result of logistic regression indicated that education level ($p = 0.00$) were the most reliable predictor for food safety knowledge level while gender ($p = 0.00$) is the main contributor to self-reported practices. The Partial Least Squares Structural Equation Modeling (PLS-SEM) was used to evaluate the measurement model and structural model of extended TPB. The assessment of measurement model was meet the requirement for convergent (Overall factor loading >0.60 , AVE >0.5 , CR >0.7) and discriminant validity (HTMT ratio <0.850). The result structural model revealed that attitude, subjective norm, and perceived behavior control had a positive and significant effect towards intention on safe food handling. Moreover, the subjective norm was the main predictor of consumer safe food handling intention ($\beta = 0.418$, $R^2 = 0.337$, $Q^2 =$

0.252, $p < .05$). As such, the role of the family to promote safe food handling at home is evident. Food safety knowledge also had a positive impact on consumer's attitude ($\beta = 0.107$, $R^2 = 0.012$, $Q^2 = 0.004$, $p < .05$). Based on the result of multi-group analysis it indicated that only educational level significantly moderates the relationship between perceived behavior control and intention of safe food handling ($p = 0.02$). However, there was no significant moderating effect of attitude ($p = 0.286$) and subjective norm ($p = 0.070$). The results attained from the analyses produced a model that predicts the intention of safe food handling among consumers including the factor that moderate it. Several implications were also depicted from the findings of this study. Therefore, this study has contributed to the existing knowledge in food safety and facilitates the exploration of future research focusing on consumers that handle food at home.



Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

**APLIKASI TEORI LANJUTAN TINGKAH LAKU YANG DIRANCANG BAGI
MERAMAL AMALAN KESELAMATAN MAKANAN DALAM KALANGAN
PENGGUNA DEWASA DI SIBU, SARAWAK, MALAYSIA**

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Penyakit bawaan makanan (FBD) menjadi isu global termasuk di Malaysia. Walaupun pelbagai usaha telah dilaksanakan, namun kes keracunan makanan terus menunjukkan peningkatan. Kes ini bukan sahaja berlaku di premis makanan tetapi juga dilaporkan berlaku di rumah. Sehubungan dengan ini, pengguna dewasa yang mengendalikan makanan di rumah harus mematuhi amalan keselamatan makanan. Ia juga penting untuk mengkaji hubungan antara profil sosiodemografi dan faktor-faktor yang mempengaruhi tahap pengetahuan keselamatan makanan dan amalan sendiri. Kajian ini menekankan pengetahuan keselamatan makanan dengan melanjutkan Teori Tingkahlaku Terancang (TPB) bagi menjelaskan faktor-faktor yang dapat mempengaruhi niat pengendalian makanan yang selamat. Kesan jantungina dan tahap pelajaran sebagai moderator diantara faktor TPB dan niat juga ditentukan. Penyelidikan keratan rentas yang menggunakan soal selidik telah dilakukan untuk menguji hipotesis. Seramai 623 pengguna dewasa yang terlibat dalam kajian ini berumur 20 tahun ke atas telah dipilih melalui kaedah pensampelan mudah. Analisis deskriptif mendapati pengetahuan mengenai keselamatan makanan adalah baik walaupun amalan sendiri kurang memuaskan. Analisis menggunakan ANOVA sehala dan uji t sampel bebas membuktikan pengetahuan keselamatan makanan dan amalan sendiri berbeza secara signifikan berasaskan jantungina, tahap pendidikan, bilangan anak dalam keluarga dan kekerapan penyediaan makanan di rumah. Manakala, analisis regresi logistik mendapati tahap pendidikan ($p = 0.00$) sebagai peramal yang paling dipercayai bagi tahap pengetahuan keselamatan makanan, manakala jantungina ($p = 0.00$) sebagai penyumbang utama kepada amalan sendiri. *Partial Least Squares Structural Equation Modeling (PLS-SEM)* telah digunakan bagi menilai model pengukuran dan struktur TPB yang dilanjutkan. Penilaian model pengukuran telah memenuhi keperluan konvergen (faktor bebanan keseluruhan > 0.60 , AVE > 0.5 , CR > 0.7) dan kesahan diskriminasi (nisbah HTMT < 0.850). Keputusan yang diperolehi daripada model struktur menunjukkan bahawa sikap, norma subjektif dan kawalan tingkah laku memberikan kesan positif dan signifikan terhadap niat pengendalian makanan yang

selamat. Selain itu, norma subjektif menjadi peramal utama bagi niat pengendalian makanan yang selamat ($\beta = 0.418$, $R^2 = 0.337$, $Q^2 = 0.252$, $p < .05$). Ini membuktikan keluarga memainkan peranan penting untuk menggalakkan pengendalian makanan yang selamat di rumah. Pengetahuan keselamatan makanan juga memberikan kesan positif terhadap sikap pengguna ($\beta = 0.107$, $R^2 = 0.012$, $Q^2 = 0.004$, $p < .05$). Berdasarkan analisis pelbagai kumpulan menunjukkan hanya tahap pendidikan menjadi moderator yang signifikan bagi hubungan antara kawalan tingkah laku dan niat pengendalian makanan yang selamat ($p = 0.02$). Walaubagaimanapun, sikap ($p = 0.286$) dan norma subjektif ($p = 0.070$) tidak mempunyai kesan moderator yang signifikan. Keputusan diperolehi dari analisis telah menghasilkan model yang meramalkan niat untuk pengendalian makanan yang selamat dalam kalangan pengguna termasuk faktor yang menjadi moderator. Beberapa implikasi telah diperolehi daripada hasil kajian ini. Oleh yang demikian, kajian ini telah menyumbang kepada pengetahuan sedia ada mengenai keselamatan makanan dan menjadi panduan untuk kajian masa akan datang dengan memfokuskan pengguna yang mengendalikan makanan di rumah.

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LIST OF ABBREVIATIONS

ANOVA	Analysis of variance
AVE	Average Variance Extracted
CI	Confidence interval
CR	Composite Reliability
FAO	Food and Agriculture Organization
FBD	Foodborne disease
FSMS	Food Safety Management System
FSQD	Food Safety and Quality Division
HACCP	Hazard Analysis Critical Control Point
HAPA	Health Action Process Approach
HBM	Health Belief Model
HTMT	Heterotrait-Monotrait
HUS	Hemolytic uremic syndrome
ICMSF	International Commission on Microbiological Specifications for Foods
IT	Information technology
KAP	Knowledge, attitude and practice
MeSTI	Makanan Selamat Tanggungjawab Industri
MGA	Multi group analysis
OR	Odd ratio
PBC	Perceived behavior control
PLS-SEM	Partial Least Squares Structural Equation Modelling
PMT	Protection Motivation Theory
SPSS	Statistical Package for the Social Sciences
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
UHT	Ultra high temperature
VIF	Variance inflation factor
WHO	World Health Organization

CHAPTER 1

INTRODUCTION

1.1 Research background

In 2016, the total population in Malaysia was estimated at 31.7 million, which slightly exceeded the figure reported in the previous year (31.2 million; increment by approximately 0.5 million). The same year also recorded 1.5% population growth rate (Department of Statistics Malaysia, 2016). Upon scrutiny, these figures suggest an increase in food consumption among the population, primarily because food is a fundamental human need. Besides, one can say that in almost every society, food has always had a significant role in supplying both nutrients and energy that are essential for the development of human growth.

According to Floros et al. (2010), rapid evolvement had been noted in food production mainly to meet the escalating demand of the growing population. This evolvement is aimed at supplying food adequately and catalyzed by cutting-edge agriculture, as well as food, science and technology. In reckoning the significance of food for sustenance, food contamination as a result of exposure to water, air, dust, equipment or negligence by food handlers has always been a concern worldwide (Mendagudali et al., 2016).

Food hazards can be categorized as microbiological, physical, and chemical substances, in which they have the potential to contaminate foods at any stage of the food supply chain (Desmarchelier, 2014; Soman and Raman, 2016). Use of pesticides and chemicals in agriculture or food processing is a source of chemical hazards, while physical hazards are found in the form of glass, metal, rubber, plastic or any object larger than 2.0 mm. Meanwhile, the culprit in microbiological hazards refers to microorganisms, such as bacteria, viruses, and parasites, which are commonly associated to infection of foodborne diseases (FBDs). Table 1.1 displays the groups of foodborne hazards.

Table 1.1: List of foodborne hazards

Etiologic agents	Hazard
Bacteria	<i>Bacillus cereus</i> , <i>Brucella</i> , <i>Campylobacter</i> (thermophilic), <i>Cronobacter</i> , <i>Clostridium botulinum</i> (proteolytic strains), <i>Clostridium botulinum</i> (non-proteolytic strains), <i>Clostridium perfringens</i> , <i>Escherichia coli</i> (pathogenic), <i>Listeria monocytogenes</i> , <i>Mycobacterium bovis</i> , <i>Salmonella</i> (non-typoid), <i>Salmonella typhi</i> , <i>Shigella</i> , <i>Staphylococcus aureus</i> , <i>Vibrio cholerae</i> , <i>Vibrio parahaemolyticus</i> , <i>Vibrio vulnificus</i> , <i>Yersinia enterocolitica</i>
Viruses	Hepatitis A, Norovirus
Parasites	<i>Trichinella spiralis</i> , <i>Toxoplasma gondii</i>
Toxicogenic fungi	<i>Aspergillus</i> , <i>Fusarium</i> , <i>Penicillium</i>
Seafood toxins	Ciguatera, Scombroid poisoning, Shellfish intoxication

[Source: International Commission on Microbiological Specifications for Foods (2018)]

Food contamination is bound to cause FBDs, which then can lead to a range of health issues including death due to consumption of toxins generated by pathogens, in which amongst the common one is pathogenic *Escherichia coli* (Seward, 2003). Within the industrial context, the food supply process incorporates several stages; beginning with production, followed by processing, and ending with distribution for the food products to reach consumers as the end user. Food contamination often occurs due to mishandling during food preparing process or failing to adhere to food safety procedures certified by World Health Organization (WHO) and Food and Agriculture Organization (FAO) of the United Nations Codex Alimentarius Commission (Miller and Notermans, 2014). For instance, a surface sensor study conducted by Ripolles-Avila et al. (2019) verified that floor and cabinet for storage of tools in a meat processing plant may be a significant contributor to the contamination of *Listeria monocytogenes*.

Ingestion of food products contaminated by bacteria, viruses, parasites, and chemical substances inevitably results in FBDs. These are real infectious diseases that are toxic in nature that may lead to long-term disability and even death (World Health Organization, 2015a). Consumption of food contaminated by hazardous substances is bound to harm the consumer's health, which would eventually lead to FBD, as revealed based on the number of cases reported annually or measured by the Disability Adjusted Life Year. Hazardous substances can be derived from biological, chemical, and physical agents, which should be made noteworthy to consumers as control measures (Grace, 2017).

Amidst the many detected agents, Toyofuku (2014) found that the most significant number of FBD outbreaks were caused by biological hazards, particularly pathogens (e.g., bacteria and viruses), followed by natural toxins, and chemical substances. In fact, several foodborne pathogens, such as *Salmonella* spp., pathogenic *Escherichia coli*, and *Shigella* spp., were earlier found abundantly in meat, dairy products, water, and vegetables, before being attributed to eggs, grains, and beans (Pires et al., 2012; Vemula and Kumar, 2012). Since the listed foods are commonly found at home, they can increase the possibility of exposure to foodborne pathogens if improperly handled by those preparing the food.

1.2 Problem statement

As stipulated in the Prevention and Control of Infectious Diseases Act 1988 (Act 342), food and water-borne diseases in Malaysia have been classified into cholera, dysentery, food poisoning, Hepatitis A, and typhoid (Ministry of Health Malaysia, 2017).

Figure 1.1 illustrates the decrease of reported cases for cholera, typhoid, dysentery, and Hepatitis A between 2000 and 2014. On the contrary, the incidence rate of food poisoning escalated to 10.86 per 10,000 population, despite the slump in mortality rate from 12 cases in 2013 to 3 cases in 2014 (Ministry of Health Malaysia, 2014).

FBD and food poisoning are often used interchangeably, however, there is a difference between both terms. FBD can be defined as a disease caused by consuming food contaminated with pathogens (van Seventer and Hamer, 2017). Meanwhile, food poisoning which is also known as foodborne intoxication is caused by ingestion of toxins produced by pathogens (Miller and Notermans, 2014).

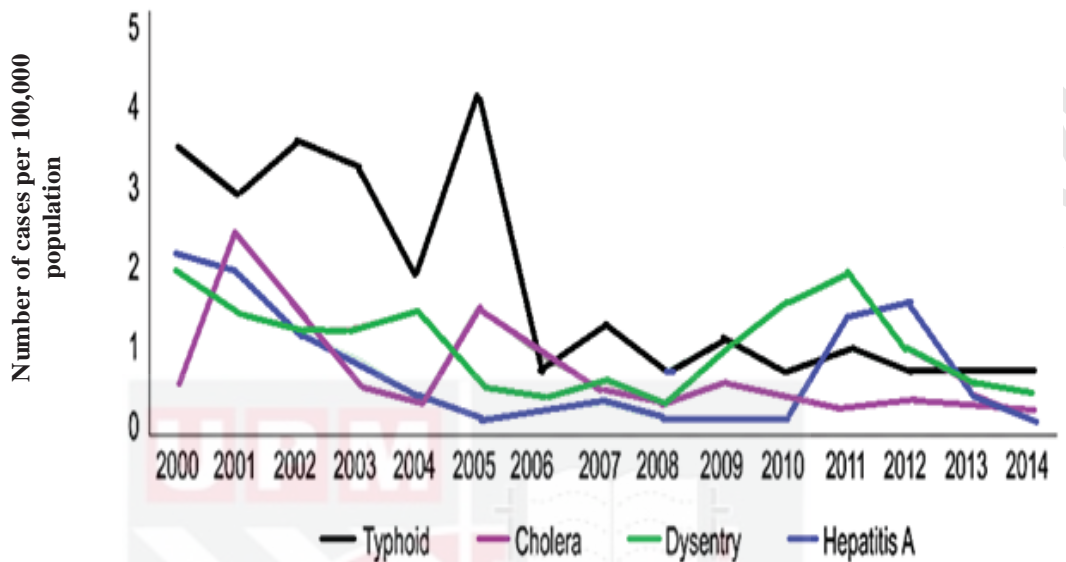


Figure 1.1: Incidence rate of cholera, typhoid, Hepatitis A and dysentery (Source: Ministry of Health Malaysia, 2014)

Table 1.2 presents the incidence and mortality rates of food and water-borne diseases between year 2015 and 2016. Both the incidence and mortality rates for cholera, dysentery, hepatitis A, and typhoid decreased in 2016, when compared to those reported for year 2015. Nevertheless, as for the case of food poisoning, increment of 7.87 and 0.01 per 100,000 population had been recorded for incidence and mortality rates, respectively. Since the incidence rate of food poisoning appears to be exceedingly high when compared to other outbreaks, it definitely demands serious attention to address this scenario by involving all related agencies (Ministry of Health Malaysia, 2016; 2017).

Table 1.2: Comparison rate of incidence and mortality in Malaysia (per 100,000 population)

Food and water	Incidence rate		Mortality rate	
	2015	2016	2015	2016
borne diseases				
Cholera	0.80	0.54	0.01	-
Dysentery	0.41	0.40	-	-
Food poisoning	47.34	55.21	0.01	0.02
Hepatitis A	0.36	0.27	-	-
Typhoid	1.42	0.57	0.03	0.01

[Source: Ministry of Health Malaysia (2016; 2017)]

The cases of food poisoning not only occur at food premises but also at home environment. For instance, in year 2014 showed that a total of 98 cases of food poisoning took place at home (Ministry of Health Malaysia, 2014). Therefore, as a main food preparer at home, adult consumers should be knowledgeable and practice safe food handling to minimize the risk of food poisoning. However, study regarding food safety knowledge and practice among home food preparer in Malaysia is still limited. In addition, previous studies reported that the intention to perform a particular behavior can be influenced by one's attitude, perceived behavior control (PBC) and subjective norm (Maichum et al., 2016; (Sullman, Hill, & Stephens, 2018).

1.3 Objectives of the study

This study extended the theoretical model by incorporating knowledge, attitude, PBC, and subjective norm of consumers to predict their intention on food safety. The specific objectives of this study are listed in the following:

- (1) To assess the level of food safety knowledge and self-reported practices among adult consumers in Sibul, Sarawak.
- (2) To study the relationships of sociodemographic profiles with level of food safety knowledge and self-reported practices among adult consumers in Sibul, Sarawak.

(3) To determine the effect of sociodemographic profiles on the level of food safety knowledge and self-reported practices among adult consumers in Sibul, Sarawak.

(4) To examine the effects of food safety knowledge, attitude, PBC, and subjective norm on consumers' intention in handling food safely among adult consumers in Sibul, Sarawak.

(5) To explore the moderating effect of sociodemographic profile between consumers' food safety knowledge and their intention in handling food safely.

1.4 Significance of the study

This study contributes to the literature by providing information on the level of food safety knowledge and self-reported practices among adult consumers that is rarely studied in Malaysia. The findings contribute to the need for greater emphasis on food safety education, especially among adult consumers who handle food at home as a measure to prevent FBD outbreaks. Psychologically, it is vital for consumers to have the intention to practice food safety prior to execution as an act. Thus, determining the factors that affect food safety practices is integral as they can influence the intentions of consumers. These factors may further encourage consumers to adopt proper and hygienic food safety behavior in their daily food handling at home. Knowledge about food safety is likely to reinforce these factors in influencing the consumers' intention that may serve as guidance for those concerned to address issues linked with food safety, especially those involving consumers.

Adults, being the primary food handlers at home, should be equipped with knowledge on food safety and hygienic practices of food handling. Improper food handling at home may lead to FBD outbreaks and even death, particularly to the most vulnerable groups such as children, the elderly, and pregnant women (Lund, 2015; Cassini et al., 2016; Food Standards Agency, 2016; Cook et al., 2018). The role that adults play in safe food handling practices cannot be underrated, particularly parents, considering that they have the responsibility to educate their children about food safety (Awang Teh et al., 2016; Lange et al., 2018). Along with multiple available measures in the effort to improve food safety practices among adult consumers, analyzing the fundamental factors that drive their intention to handle food safely is essential.

Intention is an important feature in behavior study, since some of the most commonly studied model suggested it as a close predictor for consumer behavior. Therefore, psychological theory is applied to predict the consumer intention towards safe food handling. Even though various theories has been applied to predict the safe food handling behavior including the Health Action Process Approach (HAPA) and Health Belief Model (HBM), Theory of Planned Behavior (TPB) have contributed the most significance variance in safe food handling behavior study (Mullan et al., 2015). However, the original TPB construct only able to predict the behavioral intention of food safety within foodservice sector with an explained variance of 22% (Lin and Roberts, 2020). Therefore, it was recommended to develop the more comprehensive TPB model by consult new independent variables in order to increase the variance.

Due to the fact that limited study has been done on food safety knowledge and practices among consumers that handle food at home, it is important for this study to provide empirical data regarding this aspect. Furthermore, at the end of this study, the TPB model will be extended by embedding food safety knowledge can be used to predict the consumer intention in safe food handling at home. Likewise, the extended TPB model in this study may benefit educational institutions and local authorities to develop strategies in educating consumers regarding safe food handling.

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LIST OF PUBLICATIONS

Ruby, G. E., Ungku Zainal Abidin, U. F., Lihan, S., Jambari, N. N. and Radu, S. (2019). A cross sectional study on food safety knowledge among adult consumers. *Food Control*, 99, 98–105.

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