



UNIVERSITI PUTRA MALAYSIA

***THE ASSOCIATION BETWEEN LEVEL OF KNOWLEDGE AND
PRACTICE ON THE USAGE OF REPEATEDLY HEATED COOKING
OIL (RHCO) AMONG FOOD PREMISE OPERATORS IN PASIR
PUTEH, KELANTAN***

NUR ANIS SURAYA BINTI AWANG

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(RHCO) AMONG FOOD PREMISE OPERATORS IN PASIR PUTEH,
KELANTAN**

BY

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**Thesis submitted in fulfilment of the requirement for the degree of Bachelor of
Science in Environmental and Occupational Health with Honours from the
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ABSTRACT

THE ASSOCIATION BETWEEN LEVEL OF KNOWLEDGE AND PRACTICE ON THE USAGE OF REPEATEDLY HEATED COOKING OIL (RHCO) AMONG FOOD PREMISE OPERATORS IN PASIR PUTEH, KELANTAN

NUR ANIS SURAYA BINTI AWANG

Introduction: In Malaysia, the general public is prone to eat a significant quantity of deep-fried food which are made available at lower price from night markets, street vendors or restaurants. Normally, oil is the best option for deep frying medium. However, the cost for oil is the most crucial concern in regards to one's economic. This leads to repetitive used of oil until it is no longer can be used in order to maintain business performance. Due to a lack of understanding, the improper practice of reheated cooking oil in their line of business has persisted to this day. As a result, fried food which are made available at food premises may be harmful to consumer's health.

Objective: To determine the level of knowledge and practice on the usage of repeatedly heated cooking oil (RHCO) as well as the association between the variables among food premise operators in Pasir Puteh, Kelantan. **Methodology:** This study recruited 153 food premise operators from five areas in Pasir Puteh, Kelantan during September to December 2021 by using purposive sampling. During a face-to-face interview, a set of structured questionnaires was used to gather data on socio-demographics, knowledge, and practice on the usage of RHCO among the respondents. The data was analyzed using descriptive statistics, chi-square test, and simple logistic regression. **Results:** The findings revealed that majority of food premise operators in Pasir Puteh, Kelantan had moderate level of knowledge (55.6%) and almost half of the respondents (47.7%) had a good level of practice on the usage of repeatedly heated cooking oil (RHCO). Age was found to be significantly associated with the level of knowledge and was the determinant factor of knowledge level (COR=2.732, 95% CI=1.157-6.454, p=0.022). Meanwhile, education level was found to have significant association with level of practice and was the determinant factor of practice (COR=2.838, 95% CI=1.286-6.264, p=0.010). However, the level of knowledge was not significantly associated with the practice of RHCO. **Conclusion:** In conclusion, there should be efforts implemented to improve the level of knowledge in order to increase the good practice towards preparing high quality food among the food operators. The local authority needs to conduct mass public health education and promotion on the RHCO. Further study needs to sample and analyze the oil quality used by the food operators, by assessing several chemical parameters. Besides, the local authority can introduce rapid test on quality of oil which is available at lower price and easier to be used by all level of food premise operators.

Keywords: Knowledge, Practice, Repeatedly Heated Cooking Oil, Food Premise Operator, Kelantan

ABSTRAK

Pengenalan: Di Malaysia, orang ramai cenderung untuk makan makanan bergoreng dalam kuantiti yang banyak kerana harganya yang rendah dan mudah didapati daripada pasar malam, peniaga jalanan atau restoran. Biasanya, minyak adalah pilihan terbaik untuk menggoreng. Walau bagaimanapun, kos minyak adalah kebimbangan yang paling penting dalam hal ekonomi seseorang. Ini membawa kepada penggunaan minyak yang berulang kali sehingga tidak lagi dapat digunakan demi mengekalkan prestasi perniagaan. Disebabkan kekurangan kefahaman, ramai peniaga mengamalkan penggunaan minyak masak yang dipanaskan berulang kali dalam perniagaan mereka dan amalan ini berlarutan sehingga kini. Akibatnya, makanan bergoreng yang boleh didapati di premis makanan mungkin memudaratkan kesihatan pengguna. **Objektif:** Oleh itu, adalah perlu untuk menentukan tahap pengetahuan dan amalan penggunaan minyak masak berulang kali (RHCO) dalam kalangan pengusaha premis makanan di Pasir Puteh, Kelantan. **Kaedah:** Kajian ini melibatkan 153 pengusaha premis makanan yang dipilih dari lima kawasan di Pasir Puteh, Kelantan. Pengumpulan data telah dilalakan antara bulan September dan Disember 2021 dengan menggunakan kaedah persampelan mudah. Temu bual secara bersemuka dengan menggunakan satu set soal selidik berstruktur telah digunakan untuk mengumpul data sosio-demografi, pengetahuan, dan amalan penggunaan RHCO dalam kalangan responden. Data dianalisis menggunakan statistik deskriptif, ujian khi kuasa dua, dan regresi logistik mudah. **Dapatan kajian:** Hasil kajian mendapati majoriti pengusaha premis makanan di Pasir Puteh, Kelantan mempunyai tahap pengetahuan sederhana (55.6%) dan hampir separuh daripada responden (47.7%) mempunyai tahap amalan yang baik mengenai penggunaan minyak masak yang dipanaskan berulang kali (RHCO). Umur didapati mempunyai kaitan yang signifikan dengan tahap pengetahuan dan merupakan faktor penentu kepada tahap pengetahuan ($COR=2.732$, 95% $CI= 1.157-6.454$, $p=0.022$). Manakala, tahap pendidikan didapati mempunyai perkaitan yang signifikan dengan tahap amalan dan merupakan faktor penentu amalan RHCO ($COR=2.838$, 95% $CI=1.286-6.264$, $p=0.010$). Namun, tahap pengetahuan tidak berkait secara signifikan dengan amalan RHCO. **Kesimpulan:** Kesimpulannya, terdapat usaha yang mesti dilakukan untuk meningkatkan tahap pengetahuan supaya amalan baik terhadap penyediaan makanan dalam kalangan pengendali makanan dapat ditingkatkan juga. Pihak berkuasa tempatan perlu mengadakan pendidikan kesihatan awam secara besar-besaran dan promosi mengenai RHCO. Kajian lanjut perlu dilakukan dengan mengambil sampel dan menganalisis kualiti minyak yang digunakan oleh pengendali makanan, dengan menilai beberapa parameter kimia. Selain itu, PBT juga boleh memperkenalkan ujian pantas ke atas kualiti minyak yang boleh didapati pada harga yang lebih rendah dan lebih mudah digunakan oleh semua peringkat pengusaha premis makanan

Kata kunci: Pengetahuan, Amalan, Pemanasan minyak masak berulang, Pengendali makanan, Kelantan

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LIST OF ABBREVIATIONS

CVD	Cardiovascular disease
RHCO	Repeatedly heated cooking oil
PV	Peroxide value
TPC	Total Polar Compound
FSQD	Food Safety and Quality Division
MUFA	Monounsaturated fatty acids
PUFA	Polyunsaturated fatty acids

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

Food frying has been extensively applied as one of the food preparation techniques either in the home kitchen or in the food industry. In frying the food, few methods can be applied to prepare the food at high temperature, which include pan frying, shallow frying or deep frying (Zeb, 2019). In Malaysia, the general public is prone to eat a significant quantity of fried food which are made available at lower price from night markets, street vendors or restaurants. This eating behavior has influenced many food service operators to practice deep frying in preparing their food products, as to fulfil the consumers' demand. Therefore, deep frying is a food preparation method that was studied due to its common practice among food operators in Malaysia.

Deep frying or referred to as deep fat frying was first started in the late 1890s as a free-standing business, mainly in manufacturing snack food and crisps (Banks, 2007). The method was described as a significant method that led to the development of industrial frying, which then successfully soared its achievement into the top sector businesses. The history of deep frying has demonstrated it as one of the oldest methods used in food preparation, and remarkably being used worldwide. The widespread practice is

now being commercially applied among food operators due to its simplicity, convenience, and quickest cooking method.

In addition, deep frying process is only completed with the presence of food and frying medium. The frying medium acts as a crucial element in transferring the heat from its source to the food throughout the process. Lipids which functioned as a medium for the heat movement can be readily found either in the form of solid, semi-solid or liquid at room temperature in the marketplace (Ismail, 2020). Normally, oil is the best option for deep frying medium. This is due to its contribution in providing distinct taste, crispy or crunchy texture, golden appearance, and aromatic scent to the fried food (Fellows, 2009). However, frying oil that acts as the key ingredient has resulted in a crucial concern among the food operators as the price for the oil remains high across the country. Thus, a poor action is taken by many operators where the similar oil is frequently heated until it is no longer can be used in order to maintain their financial performance and as a profit maximization technique (Leong et al., 2015).

Nevertheless, the poor practice by the food operators may exhibit impacts on the quality of the oil. This is due to undesirable chemical reactions that occurred during heating at extreme temperatures. It was described that the reactions could lead to the deterioration of the physical and chemical properties of the oil (Tarmizi et al., 2016). Previously, the physicochemical properties of maize and mustard oil were investigated, where the oil was assessed after three rounds of frying potatoes at two different temperatures of 140 °C and 170 °C (Zahir et al., 2017). Secondary oxidation

compounds were later discovered in mustard oil, indicating that the oil's performance had degraded over time as a result of frequent heating. Another research conducted in Tehran, Iran also presented similar findings where most of the discarded oil gathered from 50 fast food restaurants had over degraded, carrying dangerous secondary oxidative compounds (Esfarjani et al., 2019)

Other than that, deep frying also may alter the nutritional content and sensory properties of the oil (Che Man & Jaswir, 2000). A recent study stated that lipid oxidation provided a detrimental impact on the nutritional content and sensory aspect of oils, as well as producing toxins that can be toxic to humans (Zhang et al., 2021). Oil will become rancid as a result of oxidation, bringing in off-flavors and odours (Karami et al., 2020).

The poor state of the oil may lead to its disposal because it is no longer meets the favor of the food operators. Typically, oil is discarded at food outlets due to its colour and odour, as well as the flavour of the fried food (Sebastian et al., 2014). According to a previous study conducted in Bukit Mertajam, Pulau Pinang, most of food operators believed that similar oil could be recycled numerous times until the colour darkened, before being discarded (Aziz et al., 2018). The quality of the oil, however, cannot be determined only by the naked eye or other sense organs. This is due to several chemical parameters that could greatly affecting the quality of oil. Aziz et al. (2018) also mentioned that most of food operators were unaware regarding the existence of peroxide, which may be identified in frying oil, particularly when it is heated

frequently. In addition, previous study conducted in Kuala Lumpur had revealed that most of the night market had moderate level of knowledge on usage of repeatedly heated cooking oil (RHCO) (Abdullah et al., 2012). They also claimed that repeatedly using cooking oil is not a good practice. Majority of them mentioned that repeatedly heated cooking oil is harmful to health. However, the claim was not in line with their practice where most of them were reported to using the oil repeatedly on a regular basis. Therefore, the extent of knowledge and practice on usage of RHCO among the food premise operators is an important aspect that needs to be addressed to prevent the usage of possibly hazardous oil that can pose significant health risk to the consumers.

1.2 PROBLEM STATEMENT

According to the annual report published by Food Safety and Quality Division (FSQD), the successful registration for the food premises in 2020 was recorded to be in total of 26, 619 of food premises (Food Safety and Quality Division, 2020). From the amount, 22, 334 of it was known to be the food outlets that consist of restaurants, stalls, canteens and others. The increase of food premises in Malaysia is believed due to the growing trend of eating-out among consumers, especially those who are living in urban environments. A study conducted has shown that the urban residents have shifted their preference from eating at home to eating outside (Ali & Abdullah, 2012). They further explained that the driving forces for the eating-out behavior is particularly because of incapable of returning home to eat or inaccessible food at home, which is experienced by the urban workers, students as well as some families. To be added, several aspects such as working far away from home, status as working mothers, and

availability of food choices either local food or international food have greatly promoted the eating-out behavior.

The growing trend of seeking food outside of the household has triggered a public health issue, as the food eaten by the consumers may not be prepared using the best manner. The regular practice among food operators which often exposed the similar frying oil to extreme heat without knowing the consequences may present undesirable hazards to the consumer, where it may lead to the generation of toxic products from the series of reactions during frying. Diop et al. (2014) stated that some of the toxic products, which include volatile chemicals like aldehydes as well as non-volatile compounds, are present in the oil after the frying operations. In addition, the interaction of oxygen and extreme temperature during frying also results in the oxidation of triacylglycerides, and eventually forms its primary product which is hydroperoxides (Sébédio & Juaneda, 2007). Hydroperoxide is known for its characteristic as unstable mediators that can immediately decompose into reactive free radicals, leading to auto-oxidation reaction via three-phase steps (initiation, propagation, and termination) (Leong et al., 2015). They added that the free radicals formed may cause lipid peroxidation, resulting in oxidative stress in lipids of cell membranes. Jaarin et al. (2018) further explained that oxidative stress is associated with few physiological disorders, including cardiovascular disease (CVD), osteoporosis, neurodegenerative diseases, and cancer.

On the other hand, the approach of recycling repeatedly heated cooking oil in preparing the food among food operators seems to be practiced without any consideration to the consumers' health. A previous study has shown that not only the consumers, but also the food operators, are unaware of the harmful consequences to health of consuming food prepared with repeatedly heated vegetable oil (Aziz et al., 2018). Due to a lack of understanding, the incorrect practice of continually heating cooking oil in their line of business has persisted to this day. Therefore, it is necessary to determine the level of knowledge and practice on the usage of repeatedly heated cooking oil (RHCO) among the food premise operators in Pasir Puteh, Kelantan.

1.3 STUDY JUSTIFICATION

This research should be carried out because it can act as a baseline study that provides the findings on knowledge and practice towards the usage of repeatedly heated cooking oil (RHCO) among food premise operators in Pasir Puteh, Kelantan. The findings are very important as it could be associated with the long-term health of the consumers who consumed their food products. This is because the consumption of RHCO were linked with various health effects such as cancer, diabetes, hypertension, cardiovascular disease and others. In addition, this study should be conducted as food premises operated that sold deep-fried food are commonly found in every part of Pasir Puteh, Kelantan such as restaurant, street vendors or stalls, and others, indicating its high in number of food premises. The consumers also could easily purchase the deep-fried food because of its low in price. Besides, the study also provides benefits to the food operators where it acts as a tool to expose them on issues regarding usage of

RHCO. The researchers could conduct a risk communication among respondents where the findings from previous studies is shared through face-to-face interaction. For example, by-products of the reheated oil, health effects due to consumption of the oil, methods to maintain the quality of oil and others. Furthermore, the authorities can use the evidence as reference in formatting guidelines, policies, programs or plans that can help to overcome poor awareness and actions taken among food operators, which eventually can contribute in preventing potential health risks among the consumers.

1.4 RESEARCH QUESTION

The present study has several research questions that need to be answered namely:

1. What is the description of the food operator's socio-demographic characteristics?
2. What is the level of knowledge regarding the usage of repeatedly heating cooking oil among food operators in Pasir Puteh, Kelantan?
3. What is the level of practice of repeatedly heating cooking oil among food operators Pasir Puteh, Kelantan?
4. Is there any significant association between the level of knowledge and practice of repeatedly heating cooking oil among food operators in Pasir Puteh, Kelantan?
5. What is the association between socio-demographic factors (income, education, age, and gender) and the level of knowledge regarding the usage of repeatedly heating cooking oil?

6. What is the association between socio-demographic factors (income, education, age, and gender) and level of practice of repeatedly heating cooking oil the)?
7. What are the factors associated with the level of knowledge regarding the usage of repeatedly heating cooking oil among respondents?
8. What are the factors associated with level of practice of repeatedly heating cooking oil among respondents?

1.5 RESEARCH OBJECTIVES

1.5.1 General Objectives

The main objective of this study is to determine the level of knowledge and level of practice among the food premise operators in Pasir Puteh, Kelantan.

1.5.2 Specific Objectives

The specific objectives are as below:

1. To determine the socio-demographic characteristics of food operators.
2. To assess the level of knowledge regarding the usage of repeatedly heated cooking oil among food operators in Pasir Puteh, Kelantan.
3. To assess the level of practice regarding the usage of repeatedly heated cooking oil among food operators in Pasir Puteh, Kelantan.
4. To determine association between the level of knowledge and practice of repeatedly heated cooking oil among food operators in Pasir Puteh, Kelantan.

5. To determine association between socio-demographic factors (income, education, age, and gender) and the level of knowledge regarding the usage of repeatedly heated cooking oil.
6. To determine association between socio-demographic factors (income, education, age, and gender).and the level of practice of repeatedly heated cooking oil.
7. To determine factors associated with the level of knowledge regarding the usage of repeatedly heating cooking oil among respondents.
8. To determine factors associated with level of practice of repeatedly heating cooking oil among respondents

1.6 RESEARCH HYPOTHESIS

Research hypothesis of the study are as follows:

1. There is a significant association between the level of knowledge and practice of repeatedly heated cooking oil among food operators in Pasir Puteh, Kelantan.
2. There is a significant relationship between socio-demographic factors (income, education, age, and gender) and the level of knowledge regarding the usage of repeatedly heating cooking oil.
3. There is a significant association between socio-demographic factors (income, education, age, and gender) and level of practice on usage of repeatedly heating cooking oil.

4. The level of knowledge on usage of repeatedly heating cooking oil is predicted by socio-demographic factors (income, education, age, and gender).
5. The level of practice on usage of repeatedly heating cooking oil is predicted by socio-demographic factors (income, education, age, and gender) and the level of knowledge of respondents.

1.7 CONCEPTUAL DEFINITIONS

This section will discuss the conceptual and operational definitions of several study variables applied in this study. As for the conceptual definitions, it is obtained through experts of this research field while the operational definitions are applied according to relevant concepts to be used in this context of the study.

1.7.1 Repeatedly heated cooking oil (RHCO)

Conceptual: Repeatedly heated cooking oil (RHCO) is the oil that has been thermally oxidized, especially in repetitive frying, and contains a wide range of compounds, including oxidized monomers, dimers, and polymers (X. Leong et al., 2012)

Operational: Repeatedly heated cooking oil (RHCO) is the oil assessed during the deep-frying process (in-use oil), which has been frequently exposed to extreme temperatures of 160-190°C.

1.7.2 Deep-fried food

Conceptual: Deep-fried food is the food that is fully immersed (or partly immersed, as in donuts) in heated oil with temperatures ranging from 350°F (177°C) to 375°F (191°C) (Schiffmann, 2017).

Operational: French fries, banana fritters, fried tubers such sweet potato, yam or cassava fritters, fish fritters or locally known as '*keropok lekor*', fish cakes, chicken and sausages are among the deep-fried food accessible at food outlets (Azman et al., 2012).

1.7.3 Food premises

Conceptual: The Food Act (1983) defines food premises as premises that are used for the purpose of preparing, preservation, packing, transportation, conveyance, delivery, or selling of any product, as well as relabeling, reprocessing, or reconditioning of any food.

Operational: Food premises selected consist of restaurants, street vendors, and food-trucks that sell deep-fried food.

1.7.4 Food operators

Conceptual: Food operators are known as food handlers which defined in Food Hygiene Regulations (2009) as any person in food premises who directly involved in the preparing the food, comes into contact with food or food contact surfaces, and handles packaged or unpackaged food or food, or appliance.

Operational: Food operators selected are any person in food premises who have the experience in using and handling cooking oil for deep frying.

1.7.5 Quality of cooking oil

Conceptual: Quality of cooking oil is defined as changes in physical nature and chemical composition of cooking oil after several exposure to extreme temperatures.

Operational: Quality of cooking oil is determined through physical parameters such as viscosity, colour and smell.



1.8 CONCEPTUAL FRAMEWORK

Figure 1.8.1 shows all the variables that were included in this study. The population that was studied is food operators of the food premises in Pasir Puteh, Kelantan. Based on Figure 1.8.1, the independent variable is the level of knowledge of food premise operators on the usage of repeatedly heated cooking oil (RHCO). Meanwhile, the dependent variable of this study is the level of practice of food premise operators regarding the usage of RHCO.

It has been a common practice either in food industry settings to repeatedly use cooking oil in deep-frying activity. Few chemical reactions could occur during the repeated heating, mainly hydrolysis, oxidation and polymerization (Choe & Min, 2007). A series of the chemical reaction could generate several harmful products, such as primary products (peroxide, dienes, free fatty acids), secondary products (carbonyls, aldehydes, trienes), and tertiary product (Khabiruddin, 2017). These by-products can act as chemical parameters in determining the quality of oil. However, this study only highlighted the physical parameters such as viscosity, colour and smell in determining of the quality of oil due to its relation to the items listed in questionnaire of this study.

This study also focused on the methods to maintain the quality of oil. There are four methods which are listed in a survey, namely replenishment of new fresh oil, transfer the oil into stainless or dark container, maintain small flame during cooking and perform oil filtration (Abdullah et al., 2012)

Previous studies by (Abdullah et al., 2012), (Aziz et al., 2018) and (Shukor & Rostam, 2020) have studied the socio-demographic factors which may be related with the level

of knowledge and practice regarding the usage of repeatedly heated cooking oil (RHCO), such as age, gender, monthly income, and education level. Even though the findings shown that there are no significant association between socio-demographic factors and level of knowledge and practice, the factors should never be ignored. The factors also can act as confounders in this study.

As for the indicator, pink filled boxes indicate the variables under study while uncolored boxes consider the variables that are not being study.



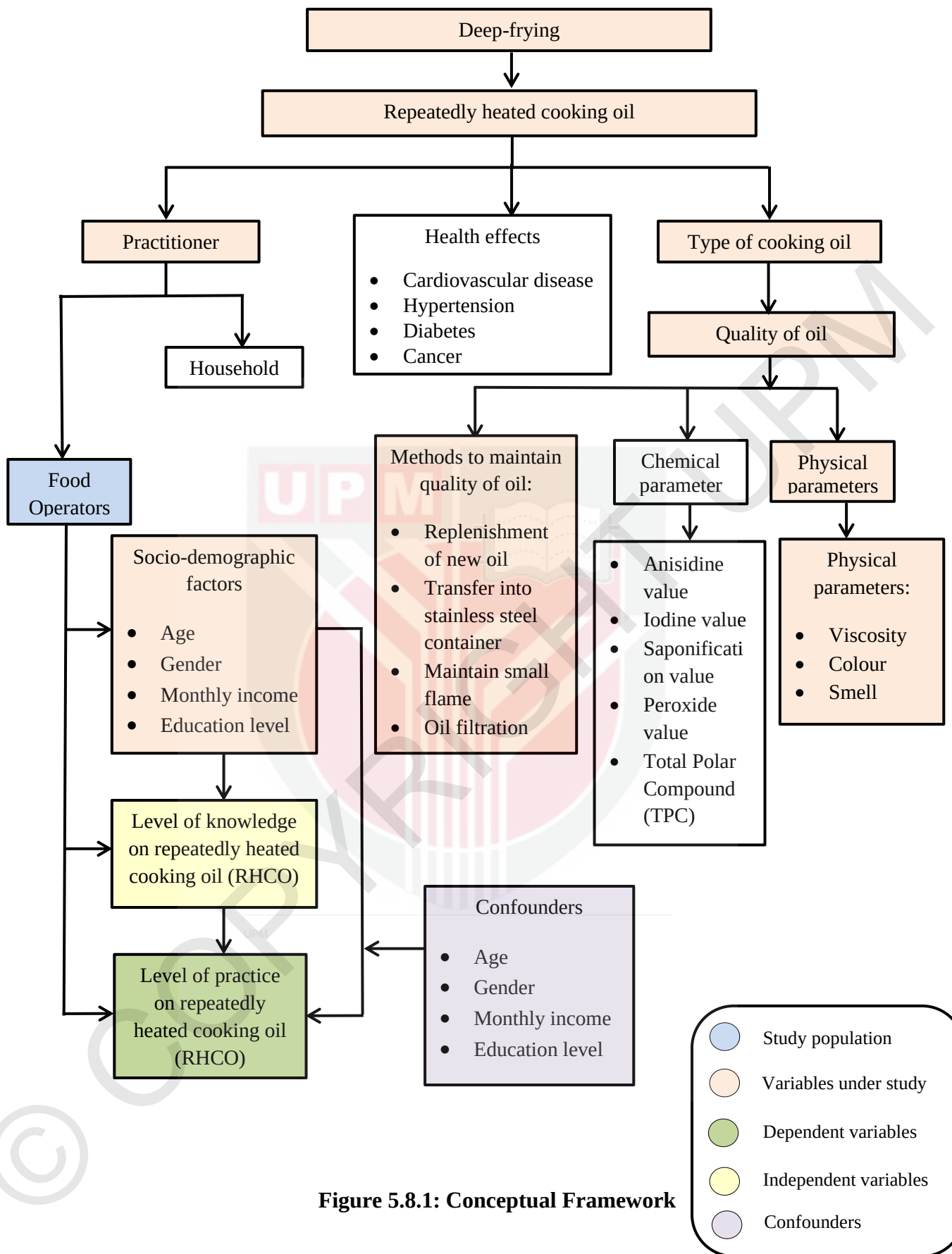


Figure 5.8.1: Conceptual Framework

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter presented a literature review that critically focused on existing studies related to this proposed study. The reviews are completed by referring to other researchers' studies in order to understand and investigate the problem of the study. In this chapter, following sections will further discuss the overview of edible vegetable oil, overview of repeatedly heated cooking oil (RHCO), physical and chemical changes of repeatedly heated cooking oil (RHCO), stability of oil, factors affecting quality of oil, level of knowledge and practice regarding the usage of RHCO, association between socio-demographic factors and knowledge and practice, and conclusion.

2.2 OVERVIEW OF EDIBLE VEGETABLE OIL

Oils of plant origin, also known as vegetable oils have been greatly used in both household and industry settings. Hammond (2003) explained that these oils are usually extracted in seeds, nuts, cereal grains, and fruits. For example, the types of edible oils that can commonly be found, including palm oil, soybean oil, canola oil and sunflower seed oil. In addition, the top three most produced vegetable oils in the world were reported to be soybean oil, palm oil and canola oil (Ghazani & Marangoni, 2016).

Soybean is ranked as the world's first largest source of edible oil, followed by oil palm and rapeseed.

Palm oil is derived from the fruit of the African oil palm, which is either mesocarp or the kernel (Giri & Bhatia, 2020). Palm oil, which is made from the mesocarp, has become a main source of edible oil, while palm kernel oil, which is made from the inedible kernel, is widely used in the oleochemical industry (Sundram et al., 2003). Palm oil is predominantly processed in Malaysia and is widely used as a raw element in food processing industries, which leads to its domination in the domestic edible oil industry (Gan & Li, 2014). Cooking, margarines, spreads, confectionery fats, ice cream, emulsifiers, and other food-based applications are among the most popular uses of the oil (Pande et al., 2012). The oil which possessed strong stability at extreme temperature, typically at 175-180°C, has made it ideal for cooking purposes, especially for the frying process (Berger, 2003). The ability of the oil to withstand extreme heat is said due to the presence of natural antioxidant content, lack of highly unsaturated fatty acids, and moderate linoleic acid content. According to a previous study, palm oil is more stable than other vegetable oils as it is rich with 50% of saturated fatty acids, 40% of monounsaturated fatty acids (MUFA), and 10% polyunsaturated fatty acids (PUFA) (Wattanapenpaiboon & Wahlqvist, 2003). The high content of MUFA has provided an advantage to the palm oil where it helps to reduce the oil's vulnerability towards oxidation during the heating process, whereas the oil with higher accumulation of heavily unsaturated double bonds will become much more vulnerable to oxidation (Kochhar & Henry, 2009). Furthermore, another unique characteristic of

palm oil which makes it suitable to be used as a frying medium is that it contains a high amount of vitamin E, which can contribute to its ability to tolerate with thermal oxidative changes (Kamisah et al., 2012). Despite unique characteristics possessed by palm oil, its quality could be greatly affected if it is handled in an improper manner.

2.3 PHYSICAL AND CHEMICAL PARAMETER CHANGES OF RHCO

Cooking oil plays an important role as a medium of heat transfer in food preparation. There are three factors which are linked to the changes in physicochemical properties of vegetable oils. First, oxidative stability of oil while in use, particularly frying oil must be high, as it is the most significant factor in determining its quality (Tabee, et. al., 2008). Next, changes in hydrolytic because of water vapours from the food fried (Gertz & Klostermann, 2002). Lastly, changes in thermal due to oil heated at high temperatures (Bandyopadhyay et al., 2017). The changing in physical and chemical properties of the oil may lead to deterioration of the oil quality. Therefore, there are several parameters that can be considered in determining the quality of the repeated heating of cooking oil.

A previous study has suggested that the indicators of degradation of edible fats and oils include peroxide value, p-anisidine value, carbonyl value, polar compounds, and polymerized triacylglycerols (Endo, 2018). In the study, the researcher also added that physical criteria of the edible fats and oils could be assessed through the color, specific gravity, refractive index, melting point, congeal point, smoke point, flash point, fire point, and viscosity. Another study also provided a few parameters that can be

considered for the sensory evaluation which are total polar matter (TPM) and polymer triacylglycerols (PTG) (Weisshaar, 2014).

The changes in its chemical composition will occur because the oil will undergo a chain of degradative reactions namely oxidation, hydrolysis and polymerization (Choe & Min, 2007). They further explained that the reactions led to lipid peroxidation, which intensified the oxidative degradation of the lipid, and thus formed nonvolatile and volatile products. At an earlier stage of oxidation, major products from oxidation reactions such as hydroperoxides and aldehydes will be produced, and are eventually absorbed into the fried food (Sivananthan et al., 2013). The effects of extending the heating time from 1 to 7 hours on the physicochemical parameters of soybean oil, palmolein oil, groundnut oil, and palm kernel oil were investigated (Nduka et al., 2021). The findings revealed that according to the peroxide value, soybean oil was the most stable of the four oils investigated, while palm kernel oil was the least stable; however, the stability of palm olein oil was found to be larger than that of groundnut oil.

Furthermore, for the physical appearance, oil will develop higher viscosity and darker colour (Rani et al., 2010). The viscosity and heat transfer coefficient for canola, corn, palm, and soybean oil were studied (Miller et al., 1994). It was reported that corn oil viscosity increased the most over 36 hours and had the strongest relationship with heat transfer coefficient (-0.959) compared to the other oils. Besides, the colour changes in palm olein during frying were found to be faster than those in other oils which are

sunflower oil and cottonseed oil (Suliman et al, 2006). However, investigations have revealed that while palm olein darkens as its colour value increases during frying, it has no effect on the colour of the fried items (Razali et al. 1999). In terms of sensory perception, the odour and taste of the vegetable oil also shifted, resulting in poor quality of food fried using the oil (Orthoefer & List, 2007).

2.4 OXIDATION OF OIL

In deep-fried oil, three types of oxidations occur, namely, autooxidation, thermal oxidation, and photosensitized oxidation (Nayak et al., 2016). Oxidation acts as primary cause of oil degradation where it involves the interaction between unsaturated fatty acids (Tarmizi et al., 2016). The oxidation of the unsaturated fat is accelerated by a chain of reaction, known as free radical auto-oxidation (Syed, 2016). Oil is promptly oxidized even at room temperature (Jiang et al., 2020). Oil becomes rancid as a result of oxidation, which results in off-flavors and odours (Karami et al., 2020). It was added that the storage duration affects the oxidation rate. High lipid oxidation and nutritional loss was also found to be affected by high temperatures (Liu et al., 2019).

Oxidative stability is a key criterion for assessing the quality of oils and fats because it is linked to the ability of oils and fats to withstand oxidative rancidity or oil deterioration during processing and storage (Hu & Jacobsen, 2016). A study conducted which assessed the oxidation level of different vegetable oils such as palm olein, soyabean oil, and corn oil had presented findings where the oxidative stability of palm olein against heat oxidation was found to be the highest, followed by corn oil and soybean oil (Yee et al., 2018). Another study also reported that palm olein was

thermally and oxidatively stable as a cooking oil in a typical cooking environment (Teh et al., 2020). In the study it was revealed that after being heated for up to 2 hours at 80°C and 120°C, palm olein displayed good oxidative stability, with the oil deteriorating beyond that point. In addition, the resistance of palm oil towards thermal oxidation is due to the presence of natural antioxidant such as tocopherols and tocotrienols, and lower amount of linoleic acid (Minal, 2020).

2.5 PEROXIDE VALUE (PV)

From the oxidation reaction, by-product known as hydroperoxide is formed and defined as peroxide value (PV). Peroxide value (PV) is one of the most commonly measured quality indicators in the oil industry, including processing, storing, and marketing (Mariod et al., 2017). The result of the PV determination only indicates the main products of lipid oxidation which is hydroperoxide (Kong & Singh, 2016). In the study, it was described that the PV does not represent the overall degree of lipid oxidation since hydroperoxides are immediately degraded into secondary products, such as aldehyde and ketones. However, PV determination alone is a valuable tool for measuring oxidative deterioration of oils, but it can be used in combination with another method for evaluating secondary oxidation products to provide a more comprehensive view of oxidation development (Gordon, 2004)

Nevertheless, the elevated PV in oil may indicate increased hydroperoxide production or reduction in decomposition (Gordon, 2004). It was further clarified that based on the composition of the oil used, the PV where oxidation can be detected as an off-

flavour differs greatly. The oil is considered to be rancid when the PV exceeds 10 meq kg⁻¹ (Gunstone, 2008). Previous research in Malaysian fast-food restaurants showed that the PV in discarded frying oil is marginally higher than in fresh oil, but none of the values exceeded the cap of 10 meq kg⁻¹ (Ismail, 2020). Another survey conducted in Tehran, Iran, showed that the average PV of oil gathered from 50 fast food restaurants did not cross the limit, with the mean of 3.06 meq kg⁻¹ (Esfarjani et al., 2019). Nonetheless, contrary findings from an Iranian study revealed that the content of peroxide in fast food restaurant oil is found to be high and exceeded the health level (Ghobadi et al., 2018). The findings suggest that the usage of oil in different food premises may exhibit different levels of PV.

2.6 FACTORS AFFECTING QUALITY OF OIL

There are few factors that can affect the quality of the oil other than stability of oil. A previous study had examined the impact of varied frying temperature and time on quality changes of oil (Sunisa et al., 2011). From the study, it had been revealed that the physical and chemical properties of the oil were greatly deteriorated when heated at 170, 180 and 190°C for 15, 18, 21 minutes. The findings generated shown that there were increasing in the colour, viscosity, peroxide value (PV), free fatty acid (FFA), and p-anisdine value (p-AV) of the oil with the frying temperature and time. In terms of repeated heating, the study revealed that 30 cycles of frying in one day produced greater oil degradation than continuous frying for 10 cycles each day for three days. In another study, the physicochemical qualities of sunflower, rapeseed, maize, palm, and coconut oils can be severely impacted by short-term exposure to high temperatures

(Mitrea et al., 2022). Besides, it was revealed that palm olein underwent the least chemical changes during the 32-hour frying process, as evidenced by low acid values (0.99 mg KOH/g) and low polar content (14.4%) (Maszewska et al., 2018).

In another study, Kala et al. (2012) evaluated the effect of heating oils and fats in different types of utensils materials which are stainless steel, aluminium alloy, cast iron and glass utensils. The study reported that the oil heated in cast iron cookware developed greatest TFA content, whereas oil heated in stainless steel and glass cookware had lower TFA content.

From the above studies, it can be concluded that frying temperature, duration of frying, frying method, and types of cookware are among the factors that can deteriorate the quality of vegetable oil used.

2.7 LEVEL OF KNOWLEDGE AND PRACTICE REGARDING THE USAGE OF RHCO

Through the findings of several studies, it was reported that the majority of food operators had a moderate level of awareness regarding the usage of repeatedly heated cooking oil (Aziz et al., 2018). A study conducted in Kuala Lumpur also showed similar results where a significant proportion of the night market food vendors are aware that consuming repeatedly heated cooking oil is unhealthy, despite unclear views regarding the reasons behind it (Abdullah et al., 2012). Another study presented similar outcomes where majority of night market food handlers in Kuantan, Pahang had moderate awareness level, and poor attitude and practice regarding the use of repeatedly heated cooking oil (Shukor & Rostam, 2020). However, a study conducted

in the morning market in Raub, Pahang presented outcomes where most of the food operators are unaware regarding the detrimental effects of the repeatedly heated cooking oil (Sivananthan et al., 2013).

2.8 ASSOCIATION BETWEEN SOCIO-DEMOGRAPHIC FACTORS AND KNOWLEDGE AND PRACTICE

In a study by Shukor & Rostam (2020), it was found that lower education group of food operators had more knowledgeable compared to the higher education group. It was mentioned that the lower group may receive early involvement in handling food with the experienced people in the field. However, it was revealed that the practice on repeatedly heated cooking oil among the food operators was not significantly being contributed by three factors, which are knowledge on repeatedly heated cooking oil, education status, and monthly income. The similar findings also provided in a study by Abdullah et al. (2012) where no significant association was found between the usage of repeatedly heated cooking oil and the knowledge, practice and attitude of the night market food operators.

2.9 CONCLUSION

From the literature, it can be concluded that food operators possess a slight poor in level of knowledge and practice towards the usage of repeatedly heated cooking oil. Even though the above findings shown that there are no significant association between socio-demographic factors and level of knowledge and practice, the factors should never be ignored. Therefore, this study will be carried out to determine the level of knowledge and practice on usage of RHCO among food operators in Pasir Puteh, Kelantan.



CHAPTER 3

METHODOLOGY

3.1 STUDY DESIGN

In this research study, cross-sectional study was used to assess the level of knowledge and practice on the usage of repeatedly heated cooking oil (RHCO) as well as the association between the variables among food premise operators in Pasir Puteh, Kelantan.

3.2 STUDY LOCATION

There are 8 districts which situated in Pasir Puteh, Kelantan. The study was conducted at 5 districts which included Semerak, Bukit Awang, Gong Datok, Limbongan, and Padang Pak Amat. These locations were included due to its high in dense of population and high number of food premises.

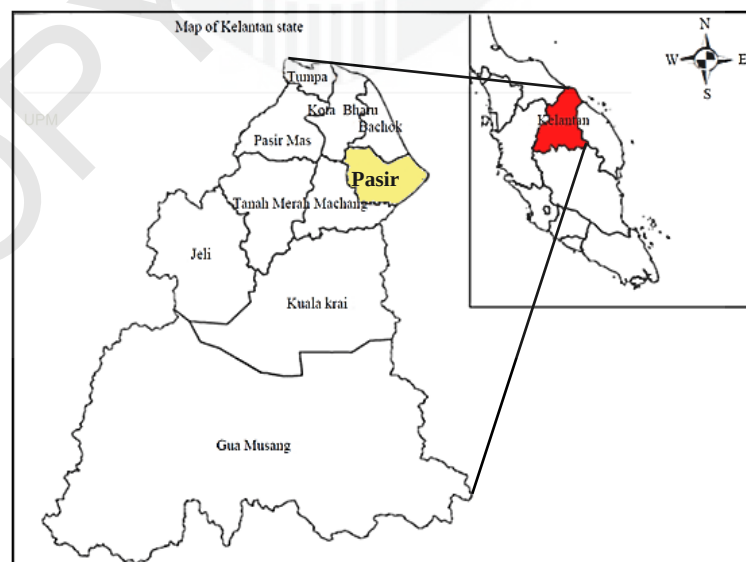


Figure 3.6.2: Map of Kelantan State

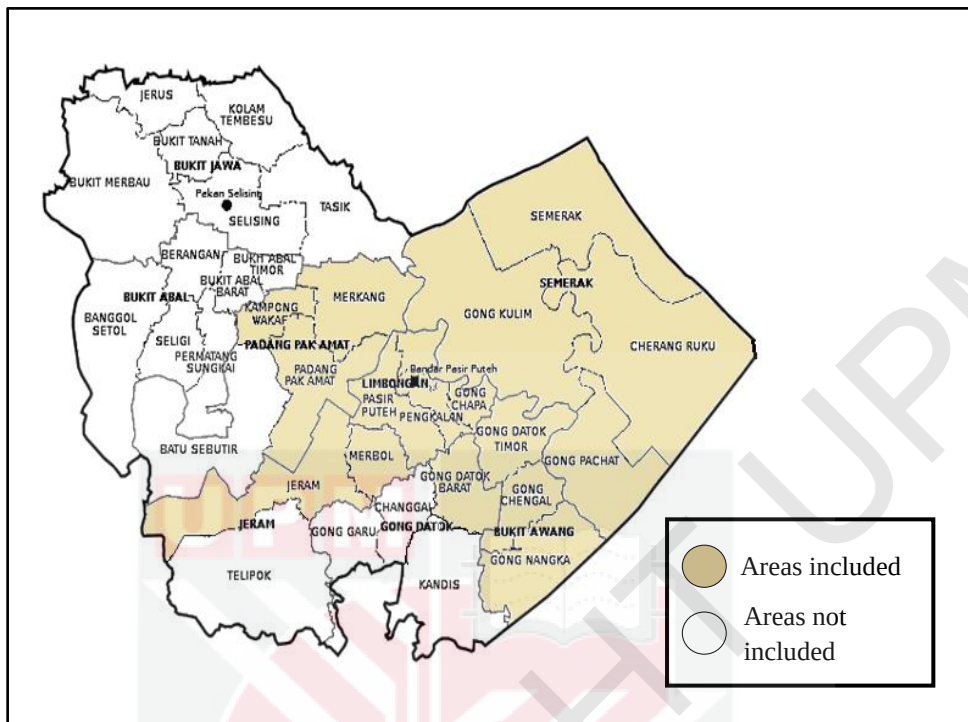


Figure 3.7.2: Map of Study Locations in Pasir Puteh

3.3 STUDY DURATION

The study was conducted from September to December 2021.

3.4 SAMPLING PROCEDURE

This study was conducted after receiving approval from The University Ethics Committee Involving Human Subjects of Universiti Putra Malaysia, JKEUPM, and approval from respective food premises. Then, the following steps of data collection were performed by distributing questionnaires to the food operators that met the criteria. Further process on sampling procedures is illustrated on Figure 3.4.1: Sampling Procedures.

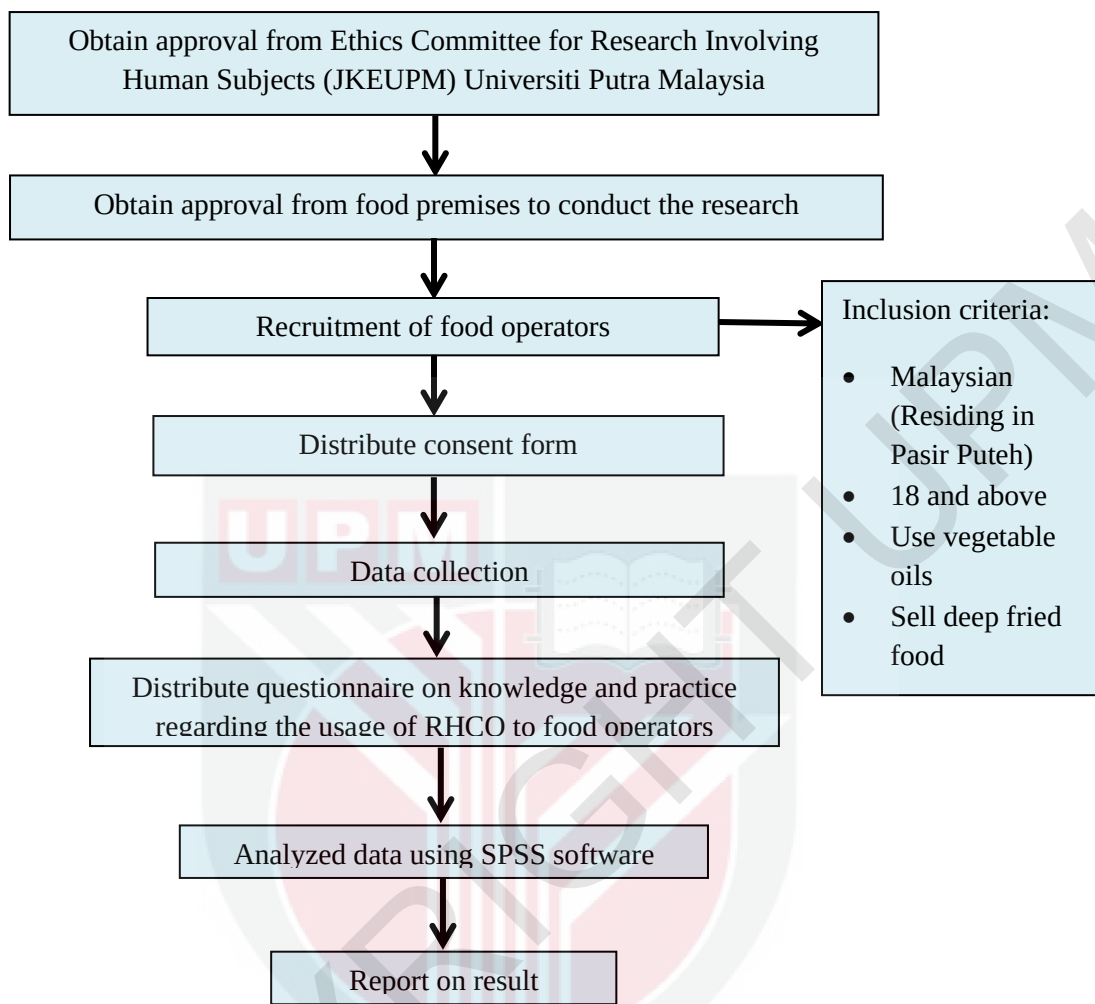


Figure 8.4.1: Flowchart of sampling procedures

3.5 STUDY POPULATION

The targeted population for this study was the food handlers who are operating or working at food premises in Pasir Puteh.

3.6 STUDY SAMPLE

The study samples of this study consisted of the food handlers who are operating or working at food premises in Pasir Puteh, Kelantan.

3.7 SAMPLING UNIT

The sampling unit was a food operator that meet the inclusion criteria as stated below:

The inclusive criteria in this study:

- a) Malaysian, residing in Pasir Puteh
- b) Aged 18 and above
- c) Skilled in using and handling cooking oil for deep frying
- d) Use vegetable oil as frying oil
- e) Sell deep fried-food

The exclusive criteria in this study:

- a) Food operators who reside in Pasir Puteh but work at food premises outside of Pasir Puteh

The inclusive and exclusive criteria of this study as stated above were very crucial to be determined because the respondents' characteristics especially exclusive criteria could affect the result of this study.

3.8 SAMPLING METHOD

This study involved convenience sampling of food premise operators located in 5 districts in Pasir Puteh, Kelantan.

3.9 SAMPLE SIZE

The sample size calculation was determined according to the objectives of the study. The sample size was calculated based on five situations (prevalence of knowledge, prevalence of practice, knowledge with practice, knowledge with socio-demographic factors, and practice with socio-demographic factors) within 5% of the true prevalence with 95% confidence. The sample size for each study objective were calculated according to the outcomes generated by previous studies by Aziz et al. (2018), (Ismail, 2019) and (Zahoor, 2019)

3.9.1 Prevalence of knowledge

According to Aziz et al. (2018), the prevalence of low/moderate knowledge regarding the usage of repeatedly heated cooking oil (RHCO) is $P=0.87$. The sample size for this study was calculated by using formula adopted from Lwanga & Lemeshow (1991) as from below:

$$n = \frac{\left(z_{1-\frac{\alpha}{2}}^2\right) P (1 - P)}{d^2}$$

Where,

n = sample size

$$z_{1-\frac{\alpha}{2}}^2 = 1.96$$

P = Prevalence of low/moderate knowledge regarding the usage of repeatedly heated cooking oil (RHCO) ($P=0.87$), according to study conducted Aziz et al. (2018)

d = precision (in proportion of one; if 5%, $d= 0.05$)

Calculation:

$$n = \frac{(1.96)^2(0.87)(1 - 0.87)}{0.05^2}$$

$$n = 173.79$$

$$n = 174$$

3.9.2 Prevalence of practice

According to Aziz et al. (2018), the prevalence of poor/moderate practice regarding the usage of repeatedly heated cooking oil (RHCO) is $P=0.93$. The sample size for this study was calculated by using formula adopted from Lwanga & Lemeshow (1991) as from below:

$$n = \frac{\left(z_{1-\frac{\alpha}{2}}^2\right) P (1 - P)}{d^2}$$

Where,

n = sample size

$$z_{1-\frac{\alpha}{2}}^2 = 1.96$$

P = Prevalence of poor/moderate practice regarding the usage of repeatedly heated cooking oil (RHCO) ($P=0.93$), according to study conducted by Aziz et al. (2018)

d = precision (in proportion of one; if 5%, $d=0.05$)

Calculation:

$$n = \frac{(1.96)^2(0.93)(1 - 0.93)}{0.05^2}$$

$$n = 100.04$$

$$n = 100$$

3.9.3 Knowledge with practice

The sample size for this study was calculated from the previous study by Zahoor (2019) using Two Proportion formula as from below:

$$n = \frac{\left\{ \left(Z_{1-\frac{\alpha}{2}} \sqrt{2P(1-P)} + Z_{1-\beta} \sqrt{P_1(1-P_1) + P_2(1-P_2)} \right) \right\}^2}{(P_1 - P_2)^2}$$

Where,

$$P = (P_1 + P_2)/2$$

P_1 = estimated proportion of exposed with outcome

P_2 = estimated proportion of unexposed with outcome

$$Z_{1-\frac{\alpha}{2}} = 1.96$$

$$Z_{1-\beta} = 80\% = 0.842$$

Assumption: P was adapted from a previous study Zahoor (2019) concerning the association between knowledge and practice of repeatedly heated cooking oil (RHCO).

Table 3.9.3.1: Knowledge vs. practice

Knowledge	Practice	Total
-----------	----------	-------

	Poor/Moderate	Good	
Low/Moderate	3	9	12
High	85	26	111

P1= proportion of low/moderate knowledge with poor/moderate practice

$$= 3/12$$

$$= 0.25$$

P2= proportion of high knowledge with poor/moderate practice

$$= 85/111$$

$$= 0.77$$

$$P = (0.25+0.77)/2$$

$$= 0.51$$

$$n = \frac{\{(1.96\sqrt{2(0.51)(1-0.51)} + 0.842\sqrt{0.25(1-0.25) + 0.77(1-0.77)})\}^2}{(0.25 - 0.77)^2}$$

$$n = 13.37$$

$$n = 13$$

3.9.4 Knowledge with socio-demographic factors

Assumption: P was adapted from a previous study Ismail (2019) concerning the association between -knowledge and socio-demographic (age), and knowledge and socio-demographic (gender).

Table 3.9.4.1: Knowledge vs. age

Age	Knowledge		Total
	Low	High	
≤35	49	30	79
>35	17	27	44

P1= proportion of age ≤35 with low knowledge

$$= 49/79$$

$$= 0.62$$

P2= proportion of age >35 with low knowledge

$$= 17/44$$

$$= 0.39$$

$$P = (0.62+0.39)/2$$

$$= 0.51$$

$$n = \frac{\{(1.96\sqrt{2(0.55)(1-0.55)} + 0.842\sqrt{0.62(1-0.62) + 0.39(1-0.39)})\}^2}{(0.62 - 0.39)^2}$$

$$n = 79.40$$

$$n = 79$$

Table 3.9.4.2: Knowledge vs. gender

Gender	Knowledge		Total
	Low	High	
Female	41	24	65
Male	25	33	58

P1= proportion of female with low knowledge

$$= 41/55$$

$$= 0.75$$

P2= proportion of male with low knowledge

$$= 25/58$$

$$= 0.43$$

$$P = (0.75+0.43)/2$$

$$= 0.59$$

$$n = \frac{\{(1.96\sqrt{2(0.59)(1-0.59)} + 0.842\sqrt{0.75(1-0.75) + 0.43(1-0.43)})\}^2}{(0.75 - 0.43)^2}$$

$$n = 35.64$$

$$n = 36$$

3.9.5 Practice with socio-demographic factors

Assumption: P was adapted from a previous study Ismail (2019) concerning the association between practice and socio-demographic (age).

Table 3.9.5.1: Practice vs. age

Age	Practice		Total
	Poor	Good	
≤35	54	25	79
>35	20	24	44

P1= proportion of age ≤35 with poor practice

$$= 54/79$$

$$= 0.68$$

P2= proportion of age >35 with poor practice

$$= 20/44$$

$$= 0.45$$

$$P = (0.68+0.45)/2$$

$$= 0.57$$

$$n = \frac{\{(1.96\sqrt{2(0.57)(1-0.57)} + 0.842\sqrt{0.68(1-0.68) + 0.45(1-0.45)})\}^2}{(0.68 - 0.45)^2}$$

$$n = 71.83$$

$$n = 72$$

Assumption: P was adapted from a previous study Zahoor (2019) concerning the association between practice and socio-demographic (gender).

Table 3.9.5.2: Practice vs. gender

Gender	Practice		Total
	Poor/Moderate	Good	
Female	52	21	73
Male	42	8	50

P1= proportion of female with poor/moderate practice

$$= 52/73$$

$$= 0.71$$

P2= proportion of male with poor/moderate practice

$$= 42/50$$

$$= 0.84$$

$$P = (0.71+0.84)/2$$

$$= 0.78$$

$$n = \frac{\{(1.96\sqrt{2(0.78)(1-0.78)} + 0.842\sqrt{0.71(1-0.71)} + 0.84(1-0.84))\}^2}{(0.71 - 0.84)^2}$$

$$n = 159.17$$

$$n = 159$$

3.9.6 Selection of sample size

The highest number of sample size was selected, where, $n=174$. By considering of 5% for non-response, missing data, unavailability of subjects or refusal to participate, the sample size of this study was calculated as below:

$$n = 174 + \left[174 \times \frac{5}{100} \right]$$

$$n = 182.7$$

$$n = 183$$

In conclusion, after considering 5% of dropouts, the sample size of the participants needed in this study was 183 subjects.

3.10 STUDY INSTRUMENT

The study instrument in this study is a self-administered questionnaire. Each item in the questionnaire was developed in accordance with the research objectives of this proposed study to assess the level of knowledge and practice regarding the usage of repeatedly heated cooking oil (RHCO) among food operators in Pasir Puteh, Kelantan.

3.10.1 Questionnaire

A set of questionnaires was adapted from studies conducted by Abdullah et al. (2012) and Aziz et al. (2018), and designed according to the settings of this study. The questionnaire was available in dual language, English and Malay language using back-to-back translation methods. The questionnaire covered four sections, namely; Section A: Socio-demographics; Section B: Knowledge on usage of RHCO; Section C: Practice related to usage of RHCO; and Section D: Recommendation.

3.10.1.1 Questionnaire on socio-demographic information

In this section A, the items included socio-demographic and background information such as age, gender, race, monthly income, and education level.

3.10.1.2 Questionnaire on knowledge regarding the usage of RHCO

These questions were stated in section B which was intended to assess the knowledge on usage of repeatedly heated cooking oil. This section covered questions on whether it is a good practice to use repeatedly heated cooking oil, whether the frying oil's quality remains unchanged after heated for several times, whether the oil that has been reheated over several cycles can be used again after it has turned dark, whether the

different types of oil have an impact on oil's quality, whether there will be nutritional loss in oil after multiple reheating, whether frying with repeatedly heated cooking oil has a harmful impact on human health, and diseases linked to consuming repeatedly heated cooking oil. Correct responses received one (1) mark, while wrong or unsure answers obtained a zero (0) mark. The marks were then added together, and the level of knowledge was divided into three categories based on the mean value: low (0-2), moderate (3-5), and high (6-7) (Abdullah et al., 2012).

3.10.1.3 Questionnaire on practice regarding the usage of RHCO

In section C, respondents were asked about practice of using repeatedly heated cooking oil which included types of cooking oil used, frequency of recycling the oil before discarding it, types of food prepared which used the same repeatedly heated cooking oil, and method attempted to maintain quality of cooking oil. Then, the level of practice of food premise operators in Pasir Puteh, Kelantan, on the usage of repeatedly heated cooking oil (RHCO) was measured based on the number of frying session using RHCO. The level was classified into three groups which are good (below 2 frying sessions), moderate (3 frying sessions), and bad (4 and above frying sessions) (Aziz et al., 2018).

3.10.1.4 Questionnaire on recommendations

In section D, respondents were asked about measure that can be taken by the authorities to increase the level of knowledge, and practice (KP) of repeatedly heated cooking oil among food premise operators.

3.10.2 Quality assurance and quality control of the questionnaire

A pre-test was conducted before data collection. The pre-test was conducted among a total of 15 food outlets operators in Kuala Besut, Terengganu. The pre – test was used to see whether the questionnaire was simple to understand and to rule out any words that were unclear. The questionnaire was subjected to a reliability evaluation using IBM Statistical Package for Social Science (SPSS) version 27, with the Cronbach alpha value being used to determine internal accuracy. The respondents also would be asked if they are willing to exchange their data in a confidential manner in the questionnaire. The respondents involved during pre-test would not be recruited and included in the sample size of this study.

3.11 DATA COLLECTION

3.11.1 Administration of questionnaire

In order to gain the respondents that will actively participate in this study, food premise operators were recruited based by convenience sampling based on single proportion sample size calculation. This study was conducted after received permission and approval from the food premises owners. Next, a brief description of the study, objectives and the declaration of anonymity and confidentiality in a consent form were given to the food premise operators from the selected food premises. The selected food premise operators who met the inclusion criteria of the study were required to proceed with the questionnaire integrated on socio-demographic, and knowledge and practice of using repeatedly heated cooking oil (RHCO). The person face-to-face interviews

were applied to gather relevant information from the respondents, complied exclusively with the questions which were asked in the structured and validated questionnaires. Both the questionnaire and the interview sessions were held in Bahasa Malaysia, with face-to-face meetings taking place at their respective food premises.

3.12 DATA ANALYSIS

The data collected was analyzed by using the statistical computer software (Statistical Package Service and Solution-SPSS Version 27) in accordance with objectives of this study. Table 3.12.1 below shows the summary of statistical analysis with respective objectives in this study. The normality of the data was performed by looking at the Shapiro-Wilk value ($p > 0.05$). In case of the data was not normally distributed, the alternative analysis which is non-parametric tests were chosen and applied.

Table 3.12.1: Summary of statistical analysis with respective objectives in this study

Objectives	Variables	Type of Data	Statistical analysis
a) To determine the socio-demographic characteristics of food operators.	Age Gender Education Income	Categorical	Descriptive Statistic (frequency and percentage)
b) To assess the level of knowledge regarding the usage repeatedly heating of cooking oil among food operators	Level of knowledge	Categorical	Descriptive Statistic (frequency and percentage)
c) To assess the level of practice regarding the usage repeatedly heating of cooking oil among food operators	Level of practice	Categorical	Descriptive Statistic (frequency and percentage)
d) To determine association between level of knowledge regarding the usage of repeatedly heating cooking oil and the socio-demographic factors	Level of knowledge Age Gender Education Income	Categorical Categorical	Chi-square test (non-parametric test) Simple logistic regression
e) To determine association between level of practice of repeatedly heating cooking oil and the socio-demographic factors	Level of practice Age Gender Education Income	Categorical Categorical	Chi-square test (non-parametric test) Simple logistic regression

f) To determine association between the level of knowledge and practice of repeatedly heating cooking oil among food operators	Level of knowledge	Categorical	Chi-square test (non-parametric test)
	Level of practice	Categorical	

3.13 LIMITATIONS OF STUDY

There were few limitations that was experienced throughout the study. (Aziz et al., 2018) mentioned that the findings from a cross-sectional study are only relevant at the time of the study being conducted. It was also mentioned that a high number of respondents are required to yield a good outcome, where the big information can be used to develop clear conclusion about repeatedly heated cooking oil. Other than that, the information acquired via face-to-face interviews may be incorrect since they are fearful of the negative implications to their business if they disclose unfavorable information.

Another study by Abdullah et al. (2012) stated that convenience sampling was integrated due to shortage in the financial and study period. The researchers faced a difficulty in categorizing the races, as most of the respondents were Malay. Besides, they also mentioned that there were few health-related and lifestyle factors that were not considered in the study, which included frequency of physical activity, and confirmed chronic diseases history such as diabetes, hypertension, and smoking activity. These factors, however, could play a significant role in influencing the practice of using repeatedly heated cooking oil among food operators.

CHAPTER 4

RESULT

4.1 RESPONSE RATE

This study involved a total of 153 food premise operators from Pasir Puteh, Kelantan who volunteered to participate in this study. From the total of participation, it can be concluded that the response rate for this study was 83.61%. In this study, respondents who operated or worked in a food premises outside of Pasir Puteh were omitted, as well as those who had no prior experience with cooking oil for deep frying.

4.2 RESPONDENTS' SOCIO-DEMOGRAPHIC DATA

Table 4.2.1 presents information on respondents' background, which include age, gender, race, total monthly income, and level of education. The youngest age of respondents was 19 years old, while the oldest was 68 years old, with the mean age of respondents was 38.28 ± 11.83 years old. Majority of them (66%) falling below 45 years old, and the remaining respondents were between the ages of 45 and 68 (34%). Female group achieved more participation (51.6%) than male group (48.4%). Besides, the study involved 100% of Malay respondents. As for the monthly income, most of the respondents (83.7%) were from B40 group, meanwhile, M40 group had contributed of 16.3% in this study. Majority of the respondent obtained their education

up to secondary school level (57.5%), followed by tertiary level (19.6%), primary school level (15.7%), and those with no formal education (7.2%).

Table 4.2.1 Socio-demographic data of food premise operators in Pasir Puteh, Kelantan (N=153)

Data	Frequency (n)	Percentage (%)	Mean (SD)	Range
Age:				
19-44 years old	101	66.0	38.28	19-68
45 years and above	52	34.0		
Gender:				
Male	74	48.4		
Female	79	51.6		
Race:				
Malay	153	100.0		
Monthly income:				
B40 (< RM3,030)	128	83.7		
M40 ($\geq$ RM3,030-RM6, 619)	25	16.3		
Educational level:				
None	11	7.2		
Primary level (UPSR)	24	15.7		
Secondary level (SRP, PMR, SPM)	88	57.5		
Tertiary level (Diploma, Degree, and above)	30	19.6		

4.3 KNOWLEDGE ON THE USAGE OF RHCO

The evaluation of knowledge on usage of repeatedly heated cooking oil (RHCO) was based on 7 questions that were covered in second section of questionnaire. From the outcomes, majority (76.5%) disagreed that the usage of reheated oil for multiple times to fry the food is a good practice. More than 100 of respondents (77.8%) disagreed that

the quality of reheated frying oil remains unchanged no matter how many times it is used. On top of that, most of the respondents (51%) agreed that the same oil can be reused for many times and discarded when it has darkened. Less than half of the respondents (45.1%) did not agree with the statement that type of cooking oil does not influence the oil's quality. In response to the statement that there will be nutritional loss in oil after numerous times of frying food, the majority of respondents (72.5%) voted for agree. More than half of them (85.6 %) agreed that frying with repeatedly heated cooking oil provide negative health consequences. However, slightly more than half of respondents (51.0%) said they were unsure whether cancer, hypertension, cardiovascular disease, diabetes are the diseases associated with the prolonged consumption of repeatedly heating cooking oil. Table 4.3.1 represented further information on the respondents' knowledge of RHCO usage.

Table 4.3.1 Knowledge of respondents on the usage of RHCO (N=153)

No.	Question	Frequency (n) (%)
1.	Usage of repeatedly heated cooking oil for frying food is a good practice as it saves cost and there is no side effect.	
	Agree	29 (19.0)
	Disagree	117 (76.5)
	Not Sure	7 (4.6)
2.	The quality of oil used for frying will remain the same regardless of how many times the oil is reheated.	
	Agree	28 (18.3)
	Disagree	119 (77.8)
	Not Sure	6 (3.9)

3.	We can still use the same oil for many times and discard it only when it turns dark.	
	Agree	78 (51.0)
	Disagree	67 (43.8)
	Not Sure	8 (5.2)
4.	The type of cooking oil does not influence the quality of cooking oil.	
	Agree	60 (39.2)
	Disagree	69 (45.1)
	Not Sure	24 (15.7)
5.	There will be loss of nutrients in the repeatedly heated cooking oil used for frying.	
	Agree	111 (72.5)
	Disagree	19 (12.4)
	Not Sure	23 (15.0)
6.	Repeatedly heated cooking oil used for frying cause bad effects to human health.	
	Agree	131 (85.6)
	Disagree	7 (4.6)
	Not Sure	15 (9.8)
7.	Cancer, hypertension, cardiovascular disease, and diabetes are the diseases associated with the prolonged consumption of repeatedly heating cooking oil.	
	Agree	69 (45.1)
	Disagree	6 (3.9)
	Not Sure	78 (51.0)

4.4 LEVEL OF KNOWLEDGE ON THE USAGE OF RHCO

The level of knowledge of food premise operators in Pasir Puteh, Kelantan, on the usage of repeatedly heated cooking oil (RHCO) was assessed using the scoring indicated in the methodology section. The scoring value was then grouped into three categories which are low, moderate and high. It was revealed that more than half of respondent (55.6%) had moderate level of knowledge, followed by 27.5% who had high knowledge, and 17% who had low level of knowledge. The details regarding the level of knowledge on usage of RHCO can be found in Table 4.4.1.

Table 4.4.1 Level of knowledge on usage of RHCO (N=153)

Level (Score ranges)	Frequency (n)	Percentage (%)
Low/Poor (0-2)	26	17.0
Moderate (3-5)	85	55.6
High/Good (6-7)	42	27.5

4.5 PRACTICE ON THE USAGE OF RHCO

The evaluation of practice on usage of repeatedly heated cooking oil (RHCO) was based on 10 questions that were covered in third section of questionnaire. Based on the findings, 100% of the respondents were found to use palm oil in their frying activities. More than 100 of respondents (83%) declared that they used oil repeatedly in their frying activities. However, there were 26 respondents (17%) claimed that they did not use oil repeatedly to fry the food. Main reason was voted by 14 respondents where they stated that the practice is harmful to their health. Other 11 respondents claimed that such practice would degrade food, and only one believed that such

practice would result in high cholesterol levels in cooking oil. Of those 127 respondents (83%) who used oil repeatedly in deep-frying activity, majority of them (37%) revealed that they used the oil twice before discarded it. Meanwhile, 37 of respondents (29.1%) claimed to use the oil 3 times, and other 33.9% of respondents admitted that they used the similar oil to fry food up to 4 times and above. Primary reason behind such practice was admitted by 73 respondents (57.5%) where it helped to save cost and time. Majority of the respondents (75.8%) used the repeatedly heated oil to deep-fry meat-based food such as '*keropok lekor*', fish crackers, fried chicken, nuggets, and others. Besides, among 153 respondents that participated in this study, majority of them (43.8%) claimed that they used fresh cooking oil for cooking purpose every time as a technique of attempting to maintain the quality of cooking oil. Filtrated the oil to strain food particles or foreign matters in cooking oil was another technique applied by some of respondents (28.1%). There were respondents (18.3%) who attempted a technique of maintaining small flame while cooking process, meanwhile, only 9.8% of respondents stored oil in stainless steel or glass container after use to retain the oil's quality. Through this survey, it was found out that majority of the respondents (59.5%) did not have prior information associated with repeatedly heated cooking oil. Some of the respondents gained the information through few sources, namely internet (27.5%), family and friends (9.2%), newspaper and magazine (2.6%), and television (1.3%). Table 4.5.1 represents further information on the respondents' practice of RHCO usage.

Table 4.5.1 Practice of respondents on the usage of RHCO (N=153)

No.	Question	Frequency (%)
1.	Type of cooking oil used.	
	Palm oil	153 (100)
2.	Do you use cooking oil repeatedly for frying?	
	Yes	127 (83.0)
	No	26 (17.0)
3.	If choose "No" (question no. 2), what are the reasons for not using repeatedly heated cooking oil for frying?	Total n =26
	Harmful to health	14 (53.8)
	Food will look bad	11 (42.3)
	Increases cooking oil's cholesterol level	1 (3.8)
4.	If choose "Yes" (in Question 2), how many times is the same cooking oil being reused before discarded?	Total n =127
	2 times	47 (37.0)
	3 times	37 (29.1)
	4 times or more	43 (33.9)
5.	If choose "Yes" (in Question 2), what is the main reason of using repeatedly heated cooking oil?	Total n =127
	To save cost and time	73 (57.5)
	Type of food choices	53 (41.7)
	Believe that there is no harmful effect to health	1 (0.8)

6. If choose “Yes” (in Question 2), what is the type of food fried when using repeatedly heated cooking oil?		Total n =127
Plant-based food		31 (24.2)
Meat-based food		97 (75.8)
7. What is the method attempted to maintain quality of cooking oil?		
Use fresh cooking oil for cooking purpose every time		
Maintain small flame while cooking process		67 (43.8)
Transfer oil in stainless steel or glass container after usage		28 (18.3)
Perform oil filtration to strain food particles or foreign matters in cooking oil		15 (9.8)
		43 (28.1)
8. Please state source of information obtained regarding the usage of repeatedly heating cooking.		
Newspaper & Magazine		4 (2.6)
Television		2 (1.3)
Internet		42 (27.5)
Family & Friends		14 (9.2)
No prior information about this issue		91 (59.4)

4.6 LEVEL OF PRACTICE ON THE USAGE OF RHCO

The level of practice of food premise operators in Pasir Puteh, Kelantan, on the usage of repeatedly heated cooking oil (RHCO) was measured based on the number of frying session using RHCO. The level was classified into three groups which are good (below 2 frying sessions), moderate (3 frying sessions), and bad (4 and above frying sessions). The survey has revealed that majority of the respondents (47.7%) had a good level of practice, followed by 28.1% of respondents with poor practice and only 24.2% of respondents had moderate level of practice. Other details can be referred to Table 4.6.1.

Table 4.6.1 Level of practice of respondents on the usage of RHCO (N=153)

Variable	Level	Frequency (%)	Range
Number of frying session in using repeatedly heated cooking oil	Poor	43 (28.1)	4 times and above
	Moderate	37 (24.2)	3 times
	Good	73 (47.7)	Below 2 times

4.7 ASSOCIATION BETWEEN SOCIO-DEMOGRAPHIC FACTORS AND LEVEL OF KNOWLEDGE ON THE USAGE OF RHCO

This study revealed that there was a significant association between age and level of knowledge among respondents ($\chi^2 = 12.068$, P-value = 0.002). It showed that, among those aged between 19 to 44 years old, 65.3% of them had moderate knowledge level as compared to those aged 45 years old and above with 36.5% who had moderate and high knowledge level respectively. Besides, a significant association was also found between gender and level of knowledge ($\chi^2 = 7.046$, P-value = 0.03). The results reported that among males, 63.5% have moderate knowledge level as compared to females with 48.1% have moderate knowledge level. Another significant association was between education level and level of knowledge on usage of RHCO among food premise operators in Pasir Puteh, Kelantan ($\chi^2 = 7.306$, P-value=0.026). 74.3% among lower educated had moderate knowledge level as compared to higher educated with 50% moderate knowledge level. On the other hand, 32.2% among higher educated had good knowledge while only 11.4% among lower educated had good knowledge level. Other details can be found in Table 4.7.1.

Table 4.7.1 Association between sociodemographic factors and level of knowledge on the usage of RHCO (N=153)

On the usage of RMCO (N = 155)						
Variable	Knowledge level				χ^2	p-value
	Low/Poor n (%)	Moderate n (%)	High/Good n (%)	Total n (%)		
Age (Years old)						
19 to 44	12 (11.9)	66 (65.3)	23 (22.8)	101 (100)	12.068	0.002*
45 and above	14 (26.9)	19 (36.5)	19 (36.5)	52 (100)		
Gender						
Male	14 (18.9)	47 (63.5)	13 (17.6)	74 (100)	7.046	0.03*
Female	12 (15.2)	38 (48.1)	29 (36.7)	79 (100)		
Monthly Income						
B40 (<RM3, 030)	21 (16.4)	73 (57)	34 (26.6)	128 (100)	0.691	0.708
M40 ($\geq$ RM3, 030-	5 (20)	12 (48)	8 (32)	25 (100)		
RM6, 619)						
Educational Level						
Primary and below	5 (14.3)	26 (74.3)	4 (11.4)	35 (100)	7.306	0.026*
Secondary and	21 (17.8)	59 (50)	38 (32.2)	118 (100)		
higher						

*Significant at $p < 0.05$

Simple Logistic Regression was performed for three socio-demographic factors which were found to be significantly associated with the level of knowledge on the usage of RHCO, namely, age, gender and educational level by using the enter method. It was performed to determine which factors that predict the level of knowledge among respondents. To perform this analysis, the knowledge level was recategorized into 2 categories, which are good/moderate and poor. The outcomes of the analysis revealed that the greatest contributor on level of knowledge was age (COR = 2.732, 95%CI = 1.157, 6.454, P = 0.022). Further detail is illustrated in the Table 4.7.2.

Table 4.7.2 Socio-demographic factors associated with level of knowledge (N=153)

Predictors	COR	95% CI	P-value
Age (Years old)			
19 to 44	1.000		
45 and above	2.732	1.157-6.454	0.022*
Gender			
Male	1.000		
Female	1.303	0.559-3.036	0.540
Educational level			
Primary and below	1.299	0.451-3.741	0.628
Secondary and higher	1.000		

*Significant at $p < 0.05$

4.8 ASSOCIATION BETWEEN SOCIO-DEMOGRAPHIC FACTORS AND LEVEL OF PRACTICE ON THE USAGE OF RHCO

Table 4.8.1 illustrates the association between level of practice on usage of RHCO and socio-demographic factors among food premise operators in Pasir Puteh, Kelantan. There was a significant association found between educational level and level of practice among respondent ($\chi^2 = 7.411$, $P\text{-value} = 0.025$). It showed that the respondents with lower education level (45.7%) had a poor practice compared to those with higher education level (22.9%). On the other hand, higher percentage (50%) of among higher education level have good practice on usage of RHCO as compared to lower education level (40%). The study also showed that the level of practice among respondent was found not significantly associated with age, gender, and monthly income.

Table 4.8.1 Association between sociodemographic factors and level of practice on the usage of RHCO (N=153)

Variable	Practice level				χ^2	p-value
	Low/Poor	Moderate	High/Good	Total		
	n (%)	n (%)	n (%)	n (%)		
Age (Years old)						
19 to 44	31 (30.7)	23 (22.8)	47 (46.5)	101 (100)	1.039	0.595
45 and above	12 (23.1)	14 (26.9)	26 (50.0)	52 (100)		
Gender						
Male	25 (33.8)	18 (24.3)	31 (41.9)	74 (100)	2.664	0.264
Female	18 (22.8)	19 (24.1)	42 (53.2)	79 (100)		
Monthly Income						
B40 (<RM3, 030)	33 (25.8)	30 (23.4)	65 (50.8)	128 (100)	3.231	0.119
M40 (≥RM3, 030- RM6, 619)	10 (40.0)	7 (28)	8 (32.0)	25 (100)		
Educational Level						
Primary and below	16 (45.7)	5 (14.3)	14 (40.0)	31 (100)	7.411	0.025*
Secondary and higher	27 (22.9)	32 (27.1)	59 (50.0)	118 (100)		

*Significant at $p < 0.05$

Simple Logistic regression was performed for a selected socio-demographic factor which is educational level by using enter method, in order to identify whether it could be a predictor or not for the level of practice on the usage of RHCO. To perform this analysis, the practice level was recategorized into 2 categories, which are good/moderate and poor. The result showed that educational level was a predictor for the level of practice among respondents (COR = 2.838, 95% CI = 1.286, 6.264, P = 0.010). Further details are illustrated in the Table 4.8.2.

Table 4.8.2 Socio-demographic factors associated with level of practice (N=153)*Significant at $p < 0.05$

Predictors	COR	95% CI	P-value
Educational level			
Primary and below	2.838	1.286-6.264	0.010*
Secondary and higher	1.000		

4.9 ASSOCIATION BETWEEN THE LEVEL OF KNOWLEDGE AND PRACTICE ON THE USAGE OF RHCO

The table 4.7.1 illustrates the association between the level of knowledge and level of practice on the usage of RHCO among food premise operators in Pasir Puteh, Kelantan. From the findings, it was reported that there was no significant association between level of knowledge on the usage of RHCO and practice ($\chi^2=4.781$, $p=0.311$). Majority of the respondents had moderate level of knowledge. Out of 85 respondents, 42.4% of respondents who had good practice level, followed by 31.8% of respondents with poor practice level, and only 25.9% of the respondents had moderate practice level. Further details are shown in Table 4.7.1.

Table 4.9.1 Association between level of knowledge and level of practice on usage of RHCO (n=153)

Level of knowledge	Practice				χ^2	P-value
	Poor n (%)	Moderate n (%)	Good n (%)	Total n (%)		
Low	8 (30.8)	7 (26.9)	11 (42.3.)	26 (100)	4.781	0.311
Moderate	27 (31.8)	22 (25.9)	36 (42.4)	85 (100)		
High	8 (19.0)	8 (19.0)	26 (61.9)	42 (100)		

CHAPTER 5

DISCUSSION

5.1 SOCIO-DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

A total of 153 food premise operators were recruited and voluntarily involved in the study. The age of respondents was ranged from 19 to 68 years old, and majority of the respondents (66%) were in 19 to 45 years old group, with their mean age of 38.28 ± 11.83 years old. Young individuals appeared to be more engaged in this study. This could be related to the high unemployment rate, which encourages young people to look for self-employment opportunity. It was mentioned that there was a greater participation of young people in entrepreneurship among individuals under the age of 40 due to encouragement provided by Malaysia government to overcome the rate of unemployment (Ridzwan et al., 2017). These considerations could explain why young people were more likely to participate in this study.

Next, female (51.6%) was slightly more than male respondent (48.4%). Higher involvement of women as workforces in food industry as to gain additional income for the family. A study stated that women are expected to work in order to support their family's financial demands (Salehuddin et al., 2014).

In this study, 100% of respondents were dominated by Malay. It was primarily due to high density of Malay population living in Pasir Puteh which led to the high number of food premise operated by Malay people.

A previous census conducted in 2019 had defined the income threshold by each of household group for Kelantan state where the Bottom 40% (<RM3,030), followed by Middle 40% group (RM3,030-RM6,619), and Top 20 % ($\geq$ RM6,620) (Department of Statistics Malaysia, 2020). From the survey, it was found that the second major monthly household gross income obtained by the population in Pasir Puteh was ranging from RM2,000-RM2,999 (13.4%). The finding was in line with this study where majority of respondents were from B40 group (83.7%). The low income was attributed by many factors. Some of the respondents interviewed mentioned that their income was declining during the pandemic of COVID-19. This was in accordance to a study conducted in Pakistan where it had revealed that one of major impacts of COVID-19 experienced by food premises was dramatic declined in business income (Zeb et al., 2021). Next, low income was associated to food products sold by the food premise. It was explained that varieties of food products sold particularly fried food were limited to avoid food wastage and profit loss in business (Aziz et al., 2018).

From the survey, majority of the respondent (57.5%) had secondary education level which equivalent to *Sijil Rendah Pelajaran, Penilaian Menengah Rendah and Sijil Pelajaran Malaysia*. It was attributable to the fact that education is not a requirement for employment in the food industry, particularly in private food premises (Malhotra et al., 2007). Similar argument also was stated in a study in Raub, Pahang where the respondents mentioned that high level of education is not a perquisite to work at food

premises (Sivananthan et al., 2013). It was added that the sole requirement to work was they were able to solve basic mathematical calculation, especially when it is related to money. This could clarify why the majority of respondents who worked in food premise only had a secondary level of formal education.

5.2 KNOWLEDGE ON REPEATEDLY HEATED COOKING OIL

According to the findings of this study, majority of food premise operators (55.6%) in Pasir Puteh had moderate level of knowledge regarding the usage of repeatedly heated cooking oil (RHCO). The findings were comparable to those of previous studies conducted in Kuala Lumpur, Pulau Pinang, and Pahang, which revealed that the majority of respondents had a moderate level of knowledge (Abdullah et al., 2012; Aziz et al., 2018; Shukor & Rostam, 2020).

In this study, more than half of the respondents (76.5%) knew that the usage of reheated oil for multiple times to fry the food is a poor practice. They (77.8%) also aware that the quality of reheated frying oil degrades with repeated use. However, they could not explain the reasons behind the poor practice. This could be due to a lack of exposure to RHCO from various sources of information (Abdullah, Mohd, et al., 2012). In addition, the respondents are less likely to be exposed to RHCO while attending mandatory courses as food handlers. This is because there was no topic which is related to RHCO that was covered under modules for Food Handling Course (Food Safety and Quality Division, 2020). This was in line with the finding of this study where some of the food operators who were interviewed (59.4%) claimed that they had never been exposed to information about this issue from any sources.

Despite being aware of such poor practice, more than half of the respondents (51%) believed that similar oil can be reused for many times and discarded once it has darkened. The finding was consistent with a study conducted in Kuantan, Pahang (Shukor & Rostam, 2020). Another study conducted in Port Harcourt, River State showed that majority of respondents used the frying oil until the colour turned dark before replenished new fresh oil (Emelike et al., 2020). They highly relied on the physical parameter, mainly the colour of oil in indicating the quality of frying oil as it is clearly visible. Colour is one of the physical parameters used to assess the quality of frying oil, as well as odour and taste of the oil (Sebastian et al., 2014). A previous study conducted in Malawi had revealed that dark colour was selected by majority of the respondents as a criterion in determining the degradation of the oil (Phiri et al., 2006). Nevertheless, the occurrence of physical changes in oil could not be the cutline, as the oil may have exceeded the safe level and should be discarded (Shukor & Rostam, 2020).

Besides, less than half of the respondents (45.1%) believed that type of cooking oil influenced the oil's quality, meanwhile 39.2% of the respondents voted that quality of oil is similar regardless of different types of oil. Few types of edible oils that are commonly be found, including palm oil, soybean oil, canola oil and sunflower seed oil. Malaysians normally opted for palm oil in preparing food. Few studies have been conducted in comparing between palm oil and other oils. It was found that palm oil is more stable than other vegetable oils as it is rich with 50% of saturated fatty acids, 40% of monounsaturated fatty acids (MUFA), and 10% polyunsaturated fatty acids (PUFA) (Wattanapenpaiboon & Wahlqvist, 2003). High content of MUFA will

prevent the oil from being oxidized during heating process (Kochhar & Henry, 2009). Palm oil also was reported to have greater oxidative stability demonstrated by its longer duration of induction as compared to high oleic sunflower oil (Fauziah et al., 2000). The presence of natural antioxidant content, lack of highly unsaturated fatty acids, and moderate linoleic acid content had influenced the strong ability of the oil to withstand extreme heat which made it ideal for cooking purposes, especially for the frying process (Berger, 2003).

Furthermore, majority of respondents (72.5%) voted for agree on occurrence of nutritional loss in oil after numerous times of heating. Similar findings were reported by Azman et al. (2012) and Sivananthan et al. (2013) where majority of respondents knew that repeated heating could result in nutritional loss in oil. Nutritional content such as fat-soluble vitamins A, D, E, and K are carried by the vegetable oils (Jaarin et al., 2011). Major antioxidant in vegetable oil is contributed by the presence of vitamin E isomers which are tocopherols and tocotrienols (Sundram et al., 2003). A previous study had mentioned that vitamin E protected the unsaturated fatty acid against oxidation by having interaction with lipid free-radicals during heating process (Fairoosa et al., 2019). This led to depletion of vitamin E in oil. In the similar study, it was found that oil which was reheated had caused a reduction in the level of α -tocopherol, and by the fourth cycle, 100% of α -tocopherol was already lost.

The present study showed that more than half of them (85.6 %) agreed that frying with repeatedly heated cooking oil provide negative health consequences. However, slightly more than half of respondents (51.0%) said that they were unsure whether cancer, hypertension, cardiovascular disease, diabetes are the diseases associated with

the prolonged consumption of RHCO. Repeated heating was known to cause significant health effects such as increased in the potential of developing various cancers (Venkata & Subramanyam, 2016). In addition, a study on animals showed that thermal oxidation of oil leads to the development of hypertension (Jaarin et al., 2011). Another study reported that health effect includes increased in getting cardiovascular disease (Ganesan et al., 2018). Food fried using RHCO may take up the frying oil and by-products which are released into the oil (Hwang & Winkler-Moser, 2016). This explains that the intake of food among consumers indicates the consumption of the oil. A study conducted among US female and male found that regular eating of fried foods was linked to an increased incidence of type 2 diabetes and coronary artery disease (Cahill et al., 2014).

5.3 PRACTICE ON REPEATEDLY HEATED COOKING OIL

Based on the present study findings, almost half of the respondents (47.7%) had a good level of practice, followed by 28.1% of respondents with poor practice and only 24.2% of respondents had moderate level of practice.

In this study, 100% of the respondents used palm oil as cooking oil in their line of food business. This was expected as Malaysia is currently dominating the production and exportation of palm oil in the world (Basiron, 2007). As a result, palm oil has become the primary choice among the consumers in Malaysia due to its lower price. According to the survey, many respondents said they were more inclined to buy and utilize cooking oil in 1-kilogram (kg) packets than in larger plastic bottled packaging. It could be linked to the subsidy of a 1-kg packet of cooking oil under the Cooking Oil

Stabilization Scheme (COSS), where the oil is only available for RM2.50 per packet. (KPDNHEP Corporate Communication Unit, 2021). Meanwhile, there was no subsidy given for cooking oil packed in plastic bottles and cans.

The findings of this study showed that majority of the respondents (83%) repeatedly used the similar oil more than once in frying their food products. This can be related to the high cooking oil price and limited availability of the affordable oil supply. During the survey, many of respondents expressed dissatisfaction with the limited availability of cooking oil packaged in 1-kilogram (kg) packages. According to the respondents, the purchase of oil was limited up to 2 packets only per consumer. A news article published by Harian Metro reported that the retailers in Kota Bharu, Kelantan are permitted to restrict the purchase of cooking oil up to 3 kg per customer (Hidayatidayu, 2022). Hence, the difficulty in acquiring cooking oil for their food premise could be the driving force for such practice among the respondents. To be added, it could also be attributed to the absence of related regulation in determining the oil's quality, which led to the unrestricted of the duration and frequency in using cooking oil (Abdullah et al., 2012).

On the other hand, there were 26 respondents (17%) who claimed that they did not reuse the oil to fry their food products. Main reason was voted by 14 respondents where they stated that the practice is harmful to their health. Other 11 respondents claimed that such practice would degrade food. Oil will become rancid as a result of oxidation, which results in off-flavors and odours (Karami et al., 2020). A recent study stated that lipid oxidation provided a detrimental impact on the nutritional content and sensory aspect of oils, as well as producing toxins that can be toxic to humans (Zhang et al.,

2021). Only one believed that such practice would result in high cholesterol levels in cooking oil.

Besides, majority of respondents (57.5%) claimed that such practice helped to save their time and money. The finding was similar to a previous study conducted by Shukor & Rostam (2020). It was revealed that oil is frequently heated until it is no longer can be used in order to maintain their financial performance and as a profit maximization technique (Leong et al., 2015) . On top of that, some of the respondents that were interviewed mentioned that oil was reused to save the time taken to heat new fresh oil in frying their food products.

The majority of the respondents (37%) were found to use twice of similar oil before discarded it while 29.1% of respondents claimed to use the oil 3 times. The practice was considered as not bad due to the usage of palm oil that has the ability to tolerate oxidation at extreme temperature (Abdullah et al., 2012). Another 33.9% of respondents admitted that they used the similar oil to fry food up to 4 times and above. The practice was observed to be performed by the food premise that sold fish crackers, and banana fitter as their main food products in business.

Another finding in the present study reported that most of the respondent (43.8%) practiced replenishing new fresh oil into repeatedly heated oil while frying, as a method to maintain the quality of the oil. The method is known as oil turnover, which can increase the lifespan of the oil through dilution effect (Innawong et al., 2019). New oil is added in order to cater for the oil lost due to food absorption. The finding of this study was comparable with previous study conducted in Nairobi, where it found that

all of the food premises which were studied had practiced the replenishment of oil in their line of business (Karimi et al., 2017). The outcome of the study suggested that constant activities in replenishing new oil into in-used cooking oil potentially helped to reduce the development of peroxidative degradation products, due to presence of anti-oxidative in the oil. Another study also indicated that replenishment of vegetable oil had significantly improved the physico-chemical of the oil (Innawong et al., 2019). It was added that, better oil quality was noticed with the greater replenishment of oil applied.

Some of the respondents used other techniques to maintain the quality of RHCO. About 28% respondents filtrated the oil to strain food particles or foreign matters in cooking oil, while other respondents (18.3%) attempted a technique of maintaining small flame while in cooking process. A study stated that filtering, skimming, and maintaining the optimum temperature of vegetable oil on a regular basis, whether manually or automatically, will enhance oil quality and will extend product shelf life (Serna-Saldivar & Chuck-Hernandez, 2019). In addition, another best solution for long-term storage of vegetable oil is to store the oil in stainless steel or dark glass containers (Mailer & Graham, 2009). However, only 9.8% of respondents stored oil in stainless steel or glass container after use to retain the oil's quality. McSavage and Trevisan (2001) recommended for the consumers of cooking oil to avoid copper and its alloys, as well as brass and bronze container, because copper was known to be the catalyst during thermal oxidation (Berger, 2005).

5.4 ASSOCIATION BETWEEN SOCIO-DEMOGRAPHIC FACTORS AND LEVEL OF KNOWLEDGE ON THE USAGE OF RHCO

In this present study, it presented outcomes where there was a significant association between age and level of knowledge among respondents. It can be concluded that those aged between 19 to 44 years old were more informed of the issue related to RHCO compared to those aged 45 years old and above. It is assumed that those between the ages of 19 and 44 were more sophisticated users of social media, resulting in greater exposure to RHCO information than those beyond the age of 44. Besides, a significant association was also found between gender and level of knowledge. In comparison to females, males were found to be more aware of RHCO. Another significant association was found between education level and level of knowledge on usage of RHCO among food premise operators in Pasir Puteh, Kelantan. It was revealed that those with lower educational level were more knowledgeable compared to those who are highly educated. This could be attributed to their experience gained with the help from experienced people due to their early involvement in food industry (Shukor & Rostam, 2020).

On the other hand, some of the findings contradicted to that of a previous study conducted among Kuala Lumpur consumers (Abdullah et al., 2015). In the study, no significant relationship was found between level of knowledge and gender. It was explained that the relationship was difficult to be assessed due to female dominance, and since male and female did not appear as married couples living in the same house. Then, those with greater education level were significantly associated with higher level of knowledge compared to the lower education group. It was stated that those with higher educational level was able to extract more information from the accessible resources compared to lower educational group. Furthermore, individuals who

received RM4,000 or more were shown to have much significant higher knowledge than those who received less than RM4,000. However, in the present study, no significant association was found between the monthly income level and level of knowledge on usage of RHCO among food premise operators in Pasir Puteh, Kelantan.

5.5 ASSOCIATION BETWEEN SOCIO-DEMOGRAPHIC FACTORS AND LEVEL OF PRACTICE ON THE USAGE OF RHCO

There was a significant association found between educational level and level of practice among respondent. It showed that the respondents with lower education level had a poor practice compared to those with higher education level. Meanwhile, higher education level had good practice on usage of RHCO as compared to lower education level. However, no significant association was between level of practice and age, gender, and monthly income.

5.6 ASSOCIATION BETWEEN LEVEL OF KNOWLEDGE AND LEVEL OF PRACTICE ON THE USAGE OF RHCO

From the findings, it was reported that there was no significant association between level of knowledge and practice on the usage of RHCO. The finding was similar to the previous studies conducted among night market operators in Kuala Lumpur, where it showed that there was no significant association found between their knowledge level and attitude and practice concerning the usage of RHCO (Abdullah et al., 2012). In the study, it was recommended to enhance the respondents' knowledge in order to develop good impacts on their practice and attitude. On the other hand, a study conducted in 2015 had found a significant association on the consumer's knowledge with attitude

and practice on the usage of RHCO (Abdullah et al., 2015). The researchers assumed that respondents with sufficient knowledge had a good level of practice since they were more informed of risks associated with consumption of RHCO.



CHAPTER 6

CONCLUSION

6.1 CONCLUSION

In conclusion, the findings of this study have shown that majority of food premise operators in Pasir Puteh, Kelantan had moderate level of knowledge (55.6%) and almost half of the respondents (47.7%) had a good level of practice on the usage of repeatedly heated cooking oil (RHCO). This study also revealed that there is association between the level of knowledge and age, gender and education level. Knowledge was strongly associated with age where older respondents were 2.7 times more likely to have poor knowledge on RHCO. On the other hand, there is only one significant association found between level of practice and education level. Lower educated respondents were 2.8 times likely to practice poorly on RHCO. However, the level of knowledge is not significantly associated with the practice of RHCO. Hence, there should be efforts implemented to improve the level of knowledge as one of the efforts to increase the good practice towards preparing high quality food among the food operators.

6.2 STRENGTH OF THE STUDY

The strength of this study includes its high sample size compared to the previous study, resulting to relevant statistical power. Another strength of this study is it could be used

as a reference to the future studies due to limited number of similar studies, where this study provides data related to knowledge and practice on repeatedly heated cooking oil (RHCO) among food premise operators in Pasir Puteh, Kelantan.

6.3 LIMITATIONS OF THE STUDY

There are few limitations which are related to this study. First, this is a cross-sectional study which only provides the view on conditions at the particular time. From this study, the findings generated could not be used to establish the causal relationship. Besides, there were several biases experienced throughout the study such as selection bias due to convenience sampling and information bias as respondents faced difficulty to recall past information. Then, there is possibility of the information gathered during the face-to-face interview to be inaccurate because of fear to the answers provided which could affect their business performance.

6.4 RECOMMENDATIONS

The issue is very important to be resolved since it may trigger public health threats to the consumers through the consumption of food products sold at their premises. Therefore, few suggestions could be considered and implemented. First, there should be a prospective cohort study conducted in order to assess the pre and post on the respondent's knowledge and practice related to RHCO. Further study needs to sample and analyze the oil quality used by the food operators, by assessing several chemical parameters such as peroxide value (PV), free fatty acid, saponification value, polar compound, p-anisidine value, or iodine value. Besides, the local authority can introduce

rapid test on quality of oil which is available at lower price and easier to be used by all level of food premise operators. For example, a test strip method called the 3M shortening monitor which determines concentration of free fatty acid (FFA). As a result, they can confidently replace the oil when it reaches the acceptable breakdown level.



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APPENDIX I



UPM
UNIVERSITI PUTRA MALAYSIA

**JAWATANKUASA ETIKA UNIVERSITI UNTUK
PENYELIDIKAN MELIBATKAN MANUSIA (JKEUPM)
UNIVERSITI PUTRA MALAYSIA, 43400 UPM SERDANG,
SELANGOR, MALAYSIA**

FORM 2.4: RESPONDENT'S INFORMATION SHEET AND INFORMED CONSENT FORM

Please read the following information carefully and do not hesitate to discuss any questions you may have with the researcher.

1. STUDY TITLE:

Knowledge and Practice on Repeatedly Heated Cooking Oil (RHCO) among Food Premise Operators in Pasir Puteh, Kelantan.

2. INTRODUCTION:

You are invited to participate in this research because you may implement a common practice in which oil is repeatedly recycled during the preparation of food for your business. The practice, however, could lead to the deterioration of the oil quality and may pose significant health risks to the consumers. Therefore, your extent of knowledge and practice regarding repeatedly heated cooking oil (RHCO) is very important to be determined.

Your participation in this research is voluntary. You do not have to participate in this research if you do not want to. You also have the right not to answer any questions you do not want answered. You can also withdraw from this research at any time. If you withdraw, any information obtained prior to your withdrawal will still be utilized in this research. If you choose not to participate or to withdraw from research this, your actions will have no impact on your medical rights as well as your health status.

3. WHAT WILL YOU HAVE TO DO?

You will be given a set of questionnaire form and you will need to complete them in a given period of time and give it back to the researcher. This questionnaire consists of four parts: Section A (Socio demographic; Section B (Knowledge on the usage of repeatedly heated cooking oil); Section C (Practice of the usage of repeatedly heated cooking oil); Section D (Recommendations). The estimated time to complete the questionnaire is about 10 minutes.

4. WHO SHOULD NOT PARTICIPATE IN THE STUDY?

If your food premises do not use vegetable oil and do not sell deep-fried food, you do not have to participate in this research as it will affect the results of the study.

5. WHAT WILL BE THE BENEFITS OF THE STUDY:

(a) TO YOU AS THE SUBJECT?

All participants will have the opportunity to obtain knowledge and increase the awareness towards the usage of repeatedly heated cooking oil in the preparation of food, and promote a better health in the future. However, by participating in this study, you will not be given any compensation throughout the research. Your willingness to participate is highly appreciated.

(b) TO THE INVESTIGATOR?

This research will be beneficial to the researcher. All the information obtained from this research will be used to evaluate the prevalence of knowledge and practice and its association with the socio-demographic of the food operators. This information could also be used as a reference towards other future research related with the repeatedly heated cooking oil, particularly among food operators in Malaysia.

6. WHAT ARE THE POSSIBLE RISKS?

There will be no possible risk by participating in this study as it will only involve surveys and anonymity will be applied.

7. WILL THE INFORMATION THAT YOU PROVIDE AND YOUR IDENTITY REMAIN CONFIDENTIAL?

All your information obtained in this research will be stored and conducted in a confidential manner, in accordance with regulations and / or laws concerned. If the results of this research are published or presented to the public, your identity will not be revealed without your prior permission first. Only the research team is allowed to access and process your information. By signing this consent form, you are agreed to the record review, information storage and data process as per described.

8. WHO SHOULD YOU CONTACT IF YOU HAVE ADDITIONAL QUESTIONS DURING THE COURSE OF THE RESEARCH?

If you have any questions about this study or your rights, please contact:

- a) Miss Nur Anis Suraya binti Awang (Researcher)

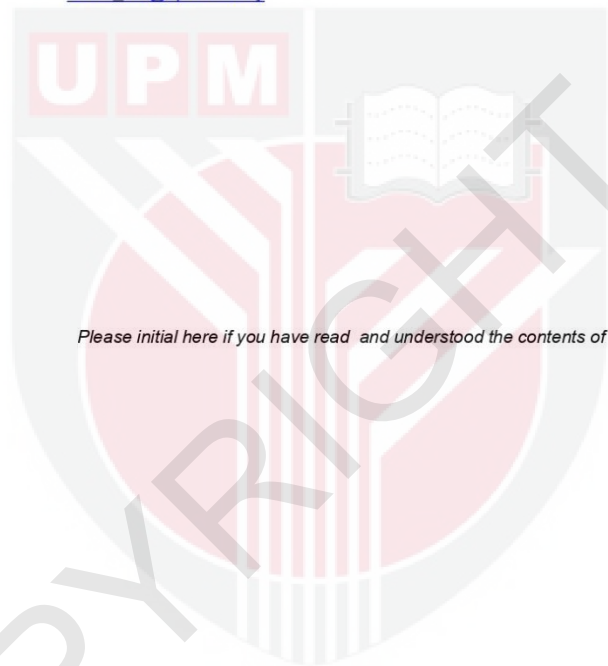
H/p: 0111-7541901

Email: nanissuraya.awang@gmail.com

- b) Dr. Saliza Binti Mohd Elias (Supervisor)

H/p: 016-2213574

Email: saliza_me@upm.edu.my



Please initial here if you have read and understood the contents of this page _____

9. CONSENT

I Identity Card No.
address.....
.....hereby voluntarily agree to take part in the research stated
above *(clinical /drug trial/video recording/ focus group/interview-based/ questionnaire-based).

I have been informed about the nature of the research in terms of methodology, possible adverse effects and complications (as written in the Respondent's Information Sheet). I understand that I have the right to withdraw from this research at any time without giving any reason whatsoever. I also understand that this study is confidential and all information provided with regard to my identity will remain private and confidential.

I* wish / do not wish to know the results related to my participation in the research

I agree/do not agree that the images/photos/video recordings/voice recordings related to me be used in any form of publication or presentation (if applicable)

* delete where necessary

Signature
(Respondent)

Signature
(Witness)

Date :.....

Name :.....

I/C No. :.....

I confirm that I have explained to the respondent the nature and purpose of the above-mentioned research.

Date Signature
(Researcher)



BORANG 2.4: PENERANGAN DAN PERSETUJUAN RESPONDEN

Sila baca maklumat berikut dengan teliti. Sekiranya anda mempunyai sebarang pertanyaan, sila kemukakan kepada penyelidik.

1. TAJUK KAJIAN

Pengetahuan Dan Amalan Terhadap Minyak Memasak Berulang Dalam Kalangan Pengendali Premis Makanan Di Pasir Puteh, Kelantan.

2. PENGENALAN

Anda dijemput untuk mengambil bahagian dalam penyelidikan ini kerana anda mungkin melaksanakan amalan umum di mana minyak berulang kali digunakan semasa penyediaan makanan untuk perniagaan anda. Namun, amalan ini dapat menyebabkan kemerosotan kualiti minyak dan dapat menimbulkan risiko kesihatan yang ketara bagi pengguna. Oleh itu, pengetahuan dan amalan anda terhadap minyak masak yang dipanaskan berulang kali sangat penting untuk dikenalpasti.

Penyertaan anda dalam penyelidikan ini adalah secara sukarela. Anda tidak perlu mengambil bahagian dalam penyelidikan ini jika anda tidak mahu. Anda juga berhak untuk tidak menjawab soalan yang tidak mahu dijawab. Anda juga boleh menarik diri dari penyelidikan ini pada bila-bila masa. Sekiranya anda menarik diri, segala maklumat yang diperolehi sebelum penarikan anda masih akan digunakan dalam penyelidikan ini. Sekiranya anda memilih untuk tidak menyertai atau menarik diri dari penyelidikan ini, tindakan anda tidak akan mempengaruhi hak perubatan anda dan juga status kesihatan anda.

3. APAKAH YANG PERLU ANDA LAKUKAN?

Anda akan diberikan satu set borang soal selidik dan anda perlu melengkapkannya dalam jangka masa tertentu dan mengembalikannya kepada penyelidik. Soal selidik ini terdiri daripada empat bahagian: Bahagian A (Sosio demografi; Bahagian B (Pengetahuan mengenai penggunaan minyak masak yang dipanaskan berulang kali); Bahagian C (Amalan penggunaan minyak masak yang dipanaskan berulang kali); Bahagian D (Cadangan). Masa anggaran untuk menyelesaikan soal selidik adalah lebih kurang 10 minit.

4. SIAPA YANG TIDAK BOLEH MENYERTA KAJIAN INI?

Sekiranya premis makanan anda tidak menggunakan minyak sayuran dan tidak menjual makanan bergoreng, anda tidak perlu mengambil bahagian dalam penyelidikan ini kerana ia akan mempengaruhi hasil kajian.

5. APAKAH FAEDAH MENYERTA KAJIAN INI?

a) KEPADA ANDA SEBAGAI PESERTA?

Semua peserta akan berpeluang memperoleh pengetahuan dan meningkatkan kesedaran mengenai penggunaan minyak masak yang dipanaskan berulang kali dalam penyediaan makanan, dan dapat meningkatkan kesihatan yang lebih baik di masa depan. Walau bagaimanapun, dengan mengikuti kajian ini, anda tidak akan diberi pampasan sepanjang penyelidikan ini. Kerelaan anda untuk mengambil bahagian dalam penyelidikan ini sangat dihargai.

b) KEPADA PENYELIDIK?

Penyelidikan ini akan bermanfaat bagi penyelidik. Semua maklumat yang diperoleh dari penyelidikan ini akan digunakan untuk menilai kelaziman pengetahuan dan amalan dan kaitannya dengan sosio-demografi pengusaha makanan. Maklumat ini juga dapat digunakan sebagai rujukan untuk penyelidikan masa depan lain yang berkaitan dengan minyak masak yang dipanaskan berulang kali, terutama di kalangan pengendali makanan di Malaysia.

6. ADAKAH IA BERISIKO?

Tiada sebarang risiko yang mungkin terjadi dengan mengambil bahagian dalam kajian ini kerana ia hanya akan melibatkan tinjauan dan penyertaan tanpa nama akan dilaksanakan.

7. ADAKAH MAKLUMAT DAN IDENTITI SAYA KEKAL RAHSIA?

Semua maklumat anda yang diperoleh dalam penyelidikan ini akan disimpan dan digunakan secara rahsia, sesuai dengan peraturan dan / atau undang-undang yang berkaitan. Sekiranya hasil penyelidikan ini diterbitkan atau disampaikan kepada umum, identiti anda tidak akan didedahkan tanpa kebenaran anda terlebih dahulu. Hanya pasukan penyelidik yang dibenarkan menggunakan dan memproses maklumat anda. Dengan menandatangani borang persetujuan ini, anda bersetuju untuk tinjauan rekod, penyimpanan maklumat dan proses data seperti yang dijelaskan.

8. SIAPA YANG SAYA PERLU HUBUNGI SEKIRANYA SAYA MEMPUNYAI SOALAN TAMBAHAN SEMASA MENGIKUTI PENYELIDIKAN INI?

Sekiranya anda mempunyai sebarang pertanyaan mengenai kajian ini atau hak anda dalam kajian ini, sila hubungi:

a) Cik Nur Anis Suraya binti Awang (Penyelidik)

H/p: 0111-7541901

Email: nanissuraya.awang@gmail.com

b) Dr. Saliza Binti Mohd Elias (Penyelia)

H/p: 016-2213574

Email: saliza_me@upm.edu.my

Sila tandatangan di sini sekiranya anda telah membaca dan memahami kandungan halaman ini _____

9. PERSETUJUAN

Saya..... No Kad Pengenalan.
beralamat.....
.....dengan ini bersetuju untuk mengambil bahagian secara sukarela dalam
penyelidikan yang tersebut di atas *(kajian klinikal/percubaan ubat-ubatan/rakaman video/kumpulan
sasaran/temuduga/ soal selidik).

Saya telah diberi penjelasan secara menyeluruh mengenai penyelidikan ini dari segi metodologi, risiko
dan komplikasi (seperti tertulis pada Halaian Penerangan Responden). Saya memahami bahawa saya
berhak menarik diri dari penyelidikan ini pada bila-bila masa tanpa memberi sebarang alasan. Saya juga
memahami bahawa sebarang maklumat yang berkaitan identiti saya akan dirahsiakan.

Saya* berminat / tidak berminat untuk mengetahui keputusan kajian yang melibatkan saya.

I setuju/tidak bersetuju untuk imei/gambar/rakaman video/ rakaman suara digunakan dalam apa jua
bentuk penerbitan atau pembentangan. (sekiranya berkaitan).

*potong yang tidak berkenaan

Tandatangan Tandatangan
(Responden) (Saksi)

Tarikh : Nama :
No. K/P:

Saya mengesahkan bahawa saya telah menerangkan kepada responden ini sifat dan tujuan
penyelidikan yang tersebut di atas.

Tarikh Tandatangan
(Penyelidik)

APPENDIX II

Date/Tarikh:

ID No.:



BORANG KAJI SELIDIK

TAJUK KAJIAN:	NAMA PENGKAJI:
PENGETAHUAN DAN AMALAN TERHADAP MINYAK MEMASAK BERULANGAN DALAM KALANGAN PENGENDALI PREMIS MAKANAN DI PASIR PUTEH, KELANTAN	NUR ANIS SURAYA BINTI AWANG

Arahan

Borang kaji selidik ini mengandungi 4 bahagian:

- 1) Bahagian A: Latar belakang sosio-demografik
- 2) Bahagian B: Pengetahuan mengenai penggunaan minyak masak berulang
- 3) Bahagian C: Amalan mengenai penggunaan minyak masak berulang
- 4) Bahagian D: Cadangan

SEMUA MAKLUMAT YANG DIPEROLEHI DI DALAM KAJIAN INI ADALAH SULIT DAN HANYA DIGUNAKAN BAGI TUJUAN PENYELIDIKAN KESIHATAN SAHAJA

Bahagian A: Latarbelakang sosio-demografik

ARAHAN: Sila tandakan jawapan anda dan isi jawapan di ruangan yang disediakan untuk soalan dibawah.

1. Umur:

☐ 18-44 tahun

☐ 45 tahun dan ke atas

2. Jantina:

☐ Lelaki

☐ Perempuan

3. Bangsa:

☐ Melayu

☐ Cina

☐ India

Lain-lain:

4. Pendapatan isi rumah (RM):

☐ B40 (< RM3, 030)

☐ M40 ($\geq$ RM3, 030 - RM6, 619)

☐ T20 ($\geq$ RM6, 620)

5. Taraf pendidikan tertinggi:

☐ Tiada

☐ Tahap Pertama (UPSR)

☐ Tahap Kedua (SRP, PMR, SPM)

☐ Tahap Ketiga (Diploma, Ijazah Sarjana Muda, Ijazah Sarjana, PhD)

Lain-lain:

Bahagian B: Pengetahuan mengenai penggunaan minyak masak berulang

ARAHAN: Sila tandakan jawapan anda untuk soalan di bawah.

1. Penggunaan minyak masak berulang kali adalah praktis yang baik kerana ia adalah menjimatkan dan selamat.
☐ Setuju ☐ Tidak Setuju ☐ Tidak Pasti
2. Kualiti minyak yang digunakan untuk menggoreng kekal sama walaupun dipanaskan semula berulang kali.
☐ Setuju ☐ Tidak Setuju ☐ Tidak Pasti
3. Minyak yang sama masih boleh digunakan semula dan hanya dibuang apabila ia sudah menjadi gelap.
☐ Setuju ☐ Tidak Setuju ☐ Tidak Pasti
4. Jenis minyak masak tidak mempengaruhi kualiti minyak masak.
☐ Setuju ☐ Tidak Setuju ☐ Tidak Pasti
5. Kehilangan nutrisi akan berlaku di dalam minyak masak yang digunakan berulang kali semasa menggoreng.
☐ Setuju ☐ Tidak Setuju ☐ Tidak Pasti
6. Penggunaan minyak masak berulang kali untuk menggoreng akan memberikan kesan tidak baik kepada kesihatan manusia.
☐ Setuju ☐ Tidak Setuju ☐ Tidak Pasti
7. Barah, darah tinggi, penyakit kardiovaskular (penyakit jantung dan strok), dan kencing manis adalah penyakit yang dikaitkan dengan penggunaan berpanjangan minyak masak berulang kali.
☐ Setuju ☐ Tidak Setuju ☐ Tidak Pasti

Bahagian C: Amalan mengenai penggunaan minyak masak berulang

ARAHAN: Sila tandakan jawapan anda dan isi jawapan di ruangan yang disediakan untuk soalan dibawah.

1. Apakah jenis minyak masak yang digunakan?

☐

Minyak sawit

☐

Minyak kelapa

☐

Minyak jagung

☐

Minyak zaitun

Lain-lain:

2. Adakah anda menggunakan minyak masak berulang kali semasa menggoreng?

☐

Ya

☐

Tidak

3. Jika pilih “Tidak” (soalan no. 2), apakah sebab untuk tidak menggunakan minyak masak berulang kali semasa menggoreng?

☐

Membahayakan kesihatan

☐

Makanan kelihatan tidak menyelerakan

☐

Meningkatkan tahap kolesterol di dalam minyak masak

4. Jika pilih “Ya” (soalan no. 2), berapa kali minyak masak yang sama digunakan semula sebelum dibuang?

☐

2 kali

☐

3 kali

☐

4 kali atau lebih

5. Jika pilih “Ya” (soalan no. 2), apakah sebab utama penggunaan minyak masak secara berulang?

☐

Untuk penjimatan kos dan masa

☐

Jenis pilihan makanan (contoh: makanan bergoreng)

☐

Percaya bahawa tiada kesan memudaratkan kepada kesihatan

6. Jika pilih “Ya” (soalan no. 2), apakah jenis makanan yang digoreng semasa menggunakan minyak masak yangtelah digunakan berulang kali?

☐

Makanan berasaskan sayuran (contoh: ubi goreng)

☐

Makanan berasaskan daging (contoh: keropok lekor)

7. Apakah kaedah yang digunakan untuk mengekalkan kualiti minyak masak?

☐

Menggunakan minyak masak yang baru untuk setiap masakan

☐

Mengekalkan api kecil semasa proses memasak

☐

Memindahkan minyak kedalam bekas tahan karat atau kaca selepas penggunaan

☐

Menjalankan penapisan minyak daripada lebihan cebisan makanan atau benda asing

8. Sila nyatakan sumber informasi yang diterima mengenai penggunaan minyak masak berulang.

- ☐ Surat khabar & Majalah
- ☐ Televisyen
- ☐ Internet
- ☐ Keluarga & rakan-rakan
- ☐ Tiada pengetahuan awal tentang isu ini

Bahagian D: Cadangan

ARAHAN: Sila tandakan jawapan anda dan isi jawapan di ruangan yang disediakan untuk soalan dibawah.

1. Apakah cara yang paling sesuai yang anda fikir boleh dilakukan oleh pihak berkuasa untuk meningkatkan tahap pengetahuan, dan praktis (KP) mengenai penggunaan minyak masak berulang di kalangan pengusaha premis makanan?

- ☐ Kempen kesedaran awam.
- ☐ Mempromosikan melalui teknologi media seperti televisyen, internet dan radio.
- ☐ Pendidikan awam mengikut negeri dan daerah terhadap penggunaan minyak masak yang sesuai.
- ☐ Mewujudkan garis panduan penggunaan minyak masak yang sesuai.

Jika terdapat cadangan lain, sila nyatakan

Terima Kasih!

**ETHICS COMMITTEE FOR RESEARCH INVOLVING HUMAN SUBJECTS
(JKEUPM)
UNIVERSITI PUTRA MALAYSIA**

Research title	: Knowledge and Practice on Repeatedly Heated Cooking Oil (RHCO) Among Food Premise Operators in Pasir Puteh, Kelantan.
Study Site	: Pasir Puteh, Kelantan
JKEUPM Ref No.	: JKEUPM-2021-376
Researcher	: Nur Anis Suraya Binti Awang
Supervisor	: Dr. Saliza Binti Mohd Elias

Documents received and reviewed with reference to the above study:

1. Ethics Application Form, Version 2 dated 1/10/2021
2. Respondent Information Sheet & Consent (English), Version 3 dated 1/10/2021
3. Respondent Information Sheet & Consent (Malay), Version 3 dated 1/10/2021
4. Proposal (English), Version 2 dated 1/10/2021
5. Questionnaire/Interviews (English), Version 3 dated 1/10/2021
6. Questionnaire/Interviews (Malay), Version 3 dated 1/10/2021
7. Curriculum Vitae of:
 - a. Dr. Saliza Binti Mohd Elias

The University Research Ethics Committee, Universiti Putra Malaysia (JKEUPM) operates in accordance to the ICH-GCP Guidelines.

Decision by JKEUPM:

- ☒ Approved
- ☒ **Permission MUST BE OBTAINED from the respective hospitals/ institutions before conducting the research**
- ☐ Disapproved

Please note that the approval is **VALID UNTIL 8 OCTOBER 2022**

Researchers should comply with the following:

- I. Complete a Study Final Report upon study completion (Form 3.2).
- II. Ethical approval is required in the case of amendments/ changes to the study documents/ study sites/ study team.
- III. Applicable for Clinical Trial Studies and Clinical interventional Studies only: Progress Report has to be submitted to JKEUPM at every 6 months from the date of approval (Form 3.1). Report occurrences of all Serious Adverse Events (SAEs), Suspected Unexpected Serious Adverse Reaction (SUSARs) and Protocol Deviation/ Violation at all JKEUPM approved sites to JKEUPM. SAEs are to be reported within 15 calendar days from awareness of event by