UNIVERSITI PUTRA MALAYSIA

THE ASSOCIATION LEVEL OF KNOWLEDGE AND PRACTICE OF REPEATEDLY HEATED COOKING OIL AMONG HOUSEHOLDS IN PUTRAJAYA, MALAYSIA

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BY

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ABSTRACT

THE ASSOCIATION LEVEL OF KNOWLEDGE AND PRACTICE OF REPEATEDLY HEATED COOKING OIL AMONG HOUSEHOLDS IN PUTRAJAYA, MALAYSIA

MOHAMAD HAFIZ IQBAL BIN MAZUAN

Objective: The study was conducted to assess the association between the level of knowledge and the level of practice regarding repeatedly heated cooking oil (RHCO) among households in Putrajaya, Malaysia. **Method**: A total of 176 residents that reside in the Federal Territory of Putrajaya participated in this research. A set of structured questionnaires was distributed via online platform for data collection to obtain socio-demographics information, level of knowledge, and level of practice regarding RHCO. The data collected were analyzed using SPSS. **Result:** The result showed majority of the respondents that reside in Putrajaya had moderate level of knowledge (67.7%) regarding RHCO. Meanwhile, most of the respondents have a good level of practice (67.6%) RHCO usage. On the other hand, this study showed that there is a significant association between knowledge level of RHCO and practice level of RHCO usage (COR= 3.361, 95% CI=1.507,7.493, P= 0.003). **Conclusion**: Appropriate actions should be executed by the local authorities to address this issue in order to ensure public to practice a good practice regarding RHCO and enhance the health quality. Other than that, an awareness campaign should be implemented to increase the level of knowledge and practice regarding RHCO. There is a need for further study to analyze the oil quality of the Putrajaya households directly.

Keywords: *Knowledge, Practice, Repeatedly Heated Cooking Oil, Households*

ABSTRAK

HUBUNGAN TAHAP PENGETAHUAN DAN PRAKTIS PEMANASAN MINYAK MASAK BERULANGAN DALAM KALANGAN ISI RUMAH DI PUTRAJAYA, MALAYSIA

MOHAMAD HAFIZ IQBAL BIN MAZUAN

Objective: Kajian ini dijalankan untuk menilai hubungan antara tahap pengetahuan dan tahap praktis berkaitan minyak masak yang dipanaskan berulang kali (RHCO) dalam kalangan isi rumah di Putrajaya, Malaysia. **Method**: Seramai 176 orang penduduk yang menetap di Wilayah Persekutuan Putrajaya telah menyertai penyelidikan ini. Satu set soal selidik berstruktur telah diedarkan melalui platform atas talian untuk pengumpulan data bagi mendapatkan maklumat sosio-demografi, tahap pengetahuan, dan tahap praktis mengenai RHCO. Data yang dikumpul dianalisis menggunakan SPSS. **Result:** Hasil kajian menunjukkan majoriti responden yang menetap di Putrajaya mempunyai tahap pengetahuan sederhana (67.7%) mengenai RHCO. Manakala, kebanyakan responden mempunyai tahap praktis yang baik (67.6%) penggunaan RHCO. Selain itu kajian ini menunjukkan terdapat hubugan yang signifikan antara tahap pengetahuan RHCO dan tahap praktis penggunaan RHCO (COR= 3.361, 95% CI=1.507,7.493, P= 0.003). **Conclusion**: Tindakan sewajarnya perlu dilaksanakan oleh pihak berkuasa tempatan untuk menangani isu ini bagi memastikan orang ramai mengamalkan praktis yang baik berkenaan RHCO dan seterusnya meningkatkan kualiti kesihatan. Selain itu, kempen kesedaran perlu dilaksanakan untuk meningkatkan tahap pengetahuan dan praktis berkaitan RHCO. Akhir sekali, terdapat keperluan untuk kajian lanjut untuk menganalisis kualiti minyak isi rumah Putrajaya secara langsung.

Kata Kunci: *Tahap Pengetahuan, Tahap Praktis, Pemanasan Minyak Masak Berulangan, Isi Rumah*

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CHAPTER 1

INTRODUCTION

1.1. BACKGROUND OF STUDY

Deep fat frying is a method of food processing that entails simultaneous heat and mass transfers by immersing the food in hot oil at a temperature of around or greater than 180°C (Debnath et al., 2003). Deep frying is one of the most widely used food processing techniques, both by consumers and in the food industry. Cooking deep fried foods at high temperatures enhances their sensorial qualities, which include an exquisite fried taste, crispiness, and a noticeable golden-brown colour (Nayak et al., 2015).

Frying food is not a problem unless people are using the same oil in preparing meal. Repeatedly heated cooking oil (RHCO) is the main issue that will be discussed here. Usage of repeatedly heated cooking oil (RHCO) has been a common practice by Malaysian. People have less awareness of the potential dangers. The current study is predicated on the hypothesis that heating edible oils to their boiling points generates free radicals that cause oxidative stress and cause cell and molecular damage (Venkata & Subramaryam, 2016).

If the cooking oil is heated repeatedly, the oil's physical appearance will undergo several changes, such as increased viscosity and colour darkening, which may alter the oil's fatty acid content. Throughout the process, water vapour is transferred in reverse from the food to the oil and finally to the atmosphere (Farid, 2001). This process involves a variety of chemical processes, including heat oxidation, polymerization, and hydrolysis. These are the interactions that resulting in the

formation of insoluble, non-volatile matter, which increases the viscosity, darkens the colour, increases foaming, and decreases the smoke point of the oil (Kalogeropoulos et al., 2007).

Deep fry or frying food is the most regular way for the people in Malaysia to serve it. It is the basic and most used in any region in the country. It come to concern when the deep fry method is using the same oil. Repeatedly heated cooking oil is being practiced in Malaysia via various ways of cooking. One of the reason people using the same oil in preparing meal is to save cost as the price of cooking oil in the market now is costly.

1.2. PROBLEM STATEMENT

As the world's second-largest producer of the commodity after Indonesia, most of Malaysian use palm oil in their daily life for preparing meals (Sulaiman et al., 2011).. The usage of palm oil can be seen around the country among households, stalls, restaurants, and catering. The problem arise is when people using the same oil for preparing meal. The practice of repeatedly heated cooking oil is still widely practiced until now. In fact, Malaysians eat a variety of fried food from roadside vendors, night market vendors, and restaurants. A study in 2012 stated that food frying using repeatedly heated cooking oil would have a significant impact on the general health of the Malaysian population (Azman et al., 2012).

The heating process of oil will alter the composition of the oil. During the heat exposure when cooking, palm oil will enter an oxidised state. Repeatedly heating of the oil will lead to lipid oxidation. This may degrade the advantages of vegetable oil. The consistency of nutritional oils and fats has been well known to be interconnected with the pathogenesis of multiple adverse health effects. In addition, thermally oxidised lipids improve the peroxidation of macromolecules in membranes which could contribute to carcinogenesis, leading to their mutagens and genotoxicity (Venkata & Subramaryam, 2016).

Base on several studies that had been conducted, RHCO have a serious health effect to human. Consumption of repeatedly heated oil for an extended period of time can

result in increase of blood pressure and necrosis of cardiac tissue (Leong et al.,2008). Other than that, Consumption of RHCO increases the presence of reactive oxygen species (ROS), resulting in reduced radical scavenging activity and, consequently, oxidative stress. In fact, it is well known that the use of RHCO causes genotoxicity and, consequently, carcinogenicity. In addition, Increased blood pressure, risk of cardiovascular disease, endothelial dysfunction, impaired vasorelaxation responses, hypertension, increased lipid peroxidation and LDL, and atherosclerosis are all known of adverse health effects of RHCO intake (Venkata & Subramaryam, 2016).

1.3. STUDY JUSTIFICATION

This study is being conducted to measure the knowledge and practice while promoting awareness regarding the use of repeatedly heated cooking oil (RHCO) among people in Putrajaya. This study focuses only on households that are living in Putrajaya. In Malaysia, cooking oil is a common ingredient that being used in food preparation. Fried food is a type of food that being consumed regularly by most of Malaysian. In addition, using the same oil to cook is a common practice in Malaysian community. The burden of disease on non-communicable disease cases such as cardiovascular disease and hypertension will increase if everyone neglects this kind of problems. Yet. the health problems of households arising from food consumption using used cooking oil are frequently overlooked.

In conducting this study, more evidence will be provided regarding the current level of knowledge (awareness regarding the use of RHCO and exposure towards peroxide) and practice (using RHCO frequently) among people that live in Putrajaya are good, intermediate, or low level. Other than that, the level of community awareness can be improvised by giving more attention and exposure to these less-known health issues. In fact, local authorities can use this study to develop their own standard guidelines and policies on the safe use of cooking oil in Malaysia.

1.4. DEFINITION OF TERMS

1.4.1 CONCEPTUAL DEFINITION

I. Repeatedly heated cooking oil

Repeatedly heated cooking oil (RHCO) is a technique in which consumers reheat the same cooking oil numerous times while making food. Repeated heating of oil can cause physical changes in the oil, such as increased viscosity, darkening of the colour, greater foaming, and a decrease in the smoke point of the oil.

II. Knowledge

The knowledge, comprehension, and abilities acquired via education or experience (Oxford Dictionary, 2020).

III. Practice

Participating in an activity or training session on a consistent basis in order to develop one's skills; the time spent doing so (Oxford Dictionary, 2020).

IV. Household

Everyone who lives in the same house or flat together (Oxford Dictionary, 2020).

1.4.2 OPERATIONAL DEFINITION

I. Repeatedly heated cooking oil

The usage of the same oil that is heated a few times before it will be discarded by the household. The usage of RHCO were determined in this study.

II. Knowledge

Knowledge is defined as the respondent's level of awareness regarding the use of RHCO and exposure towards peroxide when food frying. The level of knowledge was determined by participants responding to the provided questionnaires. For every correctly answered of the questions, a score of one was

given and zero score for partially agree and disagree. Then, the level of knowledge was categorized into poor (score 0 – 2), moderate (3-5) good (6-7).

III. Practice

Practice is the described doing or performing something that is habitually which is cooking using RHCO regularly. The practice of households was assessed via their practice on using repeatedly heated cooking oil in this study. The questionnaires would assess including the type of oil used, their practice of using cooking oil, the frequency of using the same oil, the type of frying technique frequently used, the method used to preserve the quality of cooking oil, and waste cooking oil management.

IV. Household

A group of people that live together in their house that using RHCO.

1.5. OBJECTIVES

1.5.1 MAIN OBJECTIVE

To find the association of the knowledge level and practice level of repeatedly heated cooking oil (RHCO) among households in Putrajaya.

1.5.2 SPECIFIC OBJECTIVES

I. To obtain the socio-demographic background of the households.

II. To determine level of knowledge of repeatedly heated cooking oil among respondents.

III. To determine level of practice of repeatedly heated cooking oil among respondents.

IV. To associate between knowledge level and practice level of repeatedly heated cooking oil among respondents.

V. To associate sociodemographic characteristics and knowledge level of repeatedly heated cooking oil among respondents.

1.6. HYPOTHESIS

I. There is a significant association between the level of knowledge and sociodemographic status among households in Putrajaya.

II. The practice of repeatedly heating cooking oil is associated with the level of knowledge and sociodemographic status of respondents.

1.7. VARIABLES

Independent variables: The level of knowledge of the usage of RHCO among households

Dependent variables: The level of practice of the usage of RHCO among households.

1.8. CONCEPTUAL FRAMEWORK

The conceptual framework of this study is presented in figure 1.8.1. below. The framework summarizes about the study concept. Sociodemographic factors are the factors that affect the knowledge of the respondents. The knowledge level of RHCO usage is the independent variable that influence the practice level of RHCO usage outcome. Their income, education, the type of oil they use, their cooking techniques, the frequency with which they use the same cooking oil, and the method they employ to keep cooking oil were investigated further.

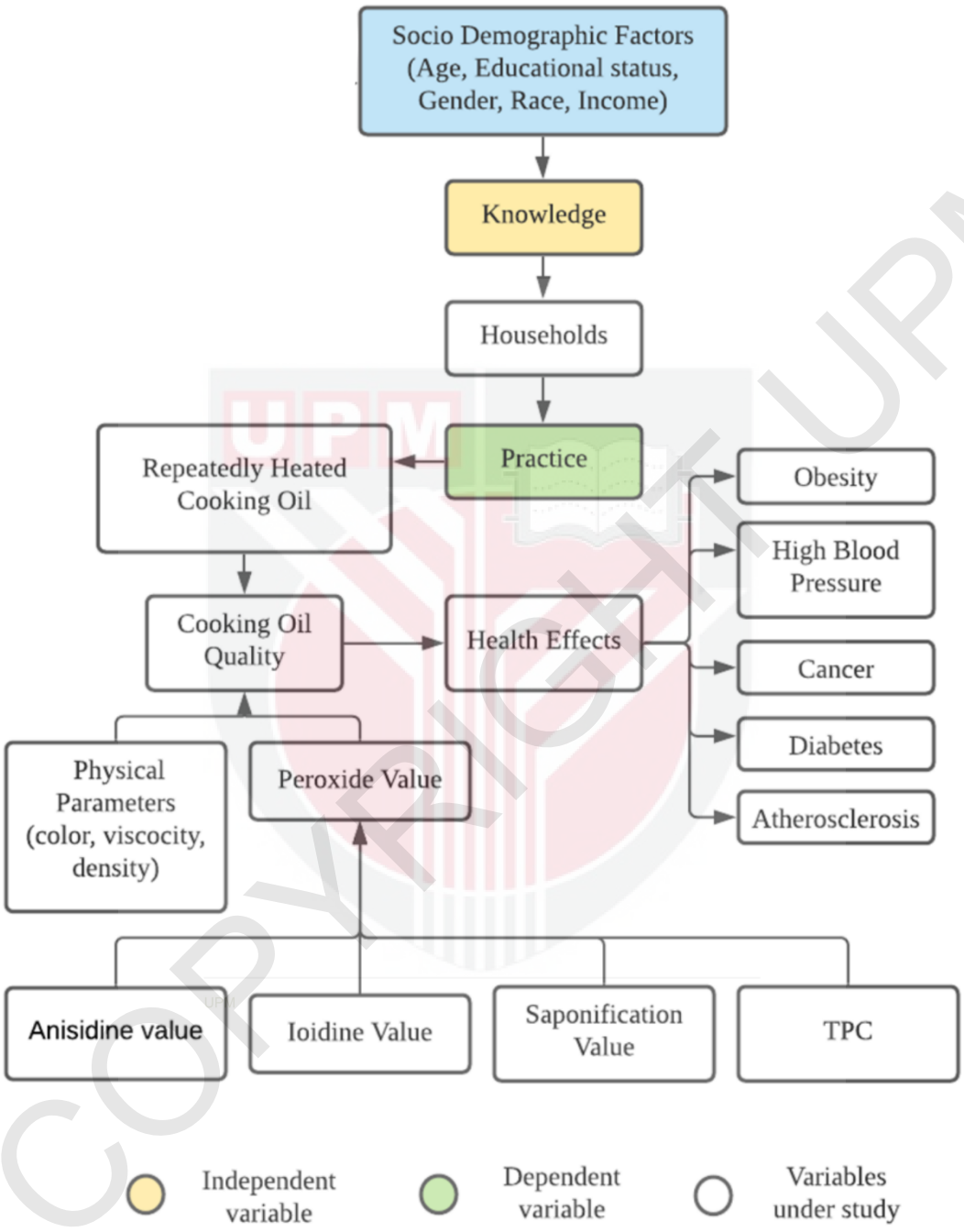

Figure 1.8.1.: Conceptual framework for the study

CHAPTER 2

LITERATURE REVIEW

2.1. INTRODUCTION

In Malaysia, the practice of using the same cooking oil in preparing food is a normal practise in both the domestic and commercial sectors. The same cooking oil will be used for several times in preparing food until the physical appearance of the oil changed. There is no resolution that been made to increase the awareness of the public regarding these matters (Azman et al., 2012). The problem that come in question is it is safe to practice the usage repeatedly heated cooking oil (RHCO).

2.2. COOKING OIL

Edible or cooking oil is a fat derived from plants, animals, or microorganisms that is liquid at room temperature and ideal for use in food. Olive oil, palm oil, soybean oil, canola oil, pumpkin seed oil, corn oil, sunflower oil, safflower oil, peanut oil, grape seed oil, sesame oil, argan oil, and rice bran oil are just a few of the numerous edible vegetable oils available. There are also other vegetable oils in the market other than this. The word "vegetable oil" is a common term.

Oils and fats are derived from edible vegetable oils that are found in a wide variety of foods and serve for critical organoleptic and nutritional functions. A healthy ratio of fatty acyl chains in the diet is critical for human health, as these fatty acids have been associated with both beneficial and detrimental properties. It depends primarily on their degree of unsaturation and chain length. For instance, the consumption of oils and fats high in oleic and linolenic acid has been linked to adverse health effects

(Andersson et al., 2010). In Malaysia, most of the consumers use palm oil as their cooking oil.

What elements can influence the quality of cooking oil while it is being heated? According to a group of researchers, numerous aspects such as ventilation, temperature and heating time during the frying process, oil type, oil saturation ratio, and the presence of a catalyst/antioxidant can be considered. When oil is heated repeatedly, particularly at a high temperature (180°C), this circumstance results in a change in the fatty acid isomer from cis to trans. (Jaarin et al., 2011).

2.3. PALM OIL

The oil palm tree is a member of the Elaeis flora. Palm oil is extracted from the fleshy mesocarp of the palm fruit, and palm kernel oil is extracted from the seed of the palm fruit. Palm oil that derived from the mesocarp of the palm tree is the most common cooking oil in use today. Palm oil is mostly made up of triacylglycerols, which are the major fatty acids in the oil. Glycerol is esterified with three fatty acids. During the extraction of palm oil from the fruit's mesocarp, triacylglycerols attract other fat-soluble cellular components. There are several instances of these compounds in the form of phosphates, sterols, pigments, free fatty acids, monoglycerols, diglycerols, and tocopherols and tocotrienols (FFAs). Aliphatic acids such as myristic, palmitic, stearic, and linoleic acid comprise the fatty acids. Additionally, palm oil includes vitamins, antioxidants, and phytonutrients (Sambanthamurthy, Sundram & Tan, 2000).

As the largest commodity producer in the world after Indonesia, most of Malaysian use palm oil as their cooking oil (Sulaiman et al., 2011). There is a study being conducted in Malaysia showing that all of the participants who are the food operators in the morning market use palm oil as their cooking oil. This was unsurprising for the data given Malaysia's role as the world's second largest producer and exporter of palm oil. Additionally, palm oil was chosen as the main source of oil since it is less expensive than other forms of oil and is widely available in Malaysia. In comparison to soy and corn oil, which are rarely used due to their high cost. The situation is quite

different in Costa Rica, where maize, sunflower, and soy oils are favoured, while palm oil remains more affordable (Azman et al., 2012).

In general, dietary palm oil has a lot of benefits to human health. Palm oil reduces blood cholesterol, low density lipoprotein (LDL) cholesterol, and triglycerides while high density lipoprotein (HDL) cholesterol in healthy diets. Palm oil diets have improved lipoprotein(a) and apo-A1 levels. An additional advantage is the reduction of blood triglycerides or decreased fat storage as opposed to other polyunsaturated fat diets (Ong & Goh, 2002).

2.4. REPEATEDLY HEATED COOKING OIL (RHCO)

Repeatedly heated cooking oil (RHCO) is a kind of practice where the consumers use the same cooking oil in preparing food several times. Repeated heating of oil can result in physical changes to the oil, such as darkening of the colour, increased in viscosity, a reduction in the oil's smoke point, and increased foaming. Using and practice RHCO is a common practice in Malaysian households and businesses. One of the reasons for it is to save money. Only when the oil foams, develops an objectionable odour, or darkens in colour is it deemed unusable (Azman et al., 2012).

Malaysians use a variety of culinary methods to repeatedly heat their cooking oil. Deep-frying is the most popular method of reusing cooking oil. Using a deep fryer, food can be cooked at temperatures between 160- and 190-degrees Fahrenheit in the presence of air and moisture while submerged in the oil. Chemical reactions such as oxidation, hydrolysis, and thermal polymerization occur when cooking oil is heated during the deep-frying process. Repetitive heating of cooking oil causes it to become more susceptible to lipid peroxidation (Jaarin et al., 2011).

The faster development of oxidised and polymerized lipid species in the frying medium caused by increased frying time affects the oil's consistency. What goes into the fryer, the oil used, and the meal being fried all influence how quickly oil breakdown products form. Between 15 and 49 mg a-tocopherol equivalents/100 g of cooking oils derived from plants contain vitamin E. The oxidation of unsaturated fatty acids results in the loss of vitamin E when they are heated. In the process of

being cooked, the food takes up the frying oil's flavour and nutrients. The quality of the oil used in the cooking process determines the amount of oil absorbed by food, and this in turn affects the net intake of vitamin E (Ghidurus et al., 2010).

2.5. DETERMINATION OF QUALITY COOKING OIL

2.5.1. PHYSICAL PARAMETERS

We can determine the quality of the oil visually by looking at the chemical and physical properties of the oil. Repeated heating of oil can result in physical changes to the oil, such as increased viscosity, darkening of the colour, increased foaming, and a reduction in the oil's smoke point (Azman et al., 2012). When heated repeatedly, the oil's physical appearance changes which may alter the oil's fatty acid content. Throughout the process, water vapour is transferred in reverse from the food to the oil and finally to the atmosphere (Farid, 2001). This process involves a variety of chemical processes, including heat oxidation, polymerization, and hydrolysis. These interactions result in the formation of insoluble, non-volatile matter, which increases the viscosity, darkens the colour, increases foaming, and decreases the smoke point of the oil (Kalogeropoulos et al., 2007). Deep fat frying degrades the oil's quality. There are numerous techniques for measuring these changes. Visual inspection can be used to assess qualitative changes by observing the viscosity, colour, foam height and odour. Even non-experts can easily identify the physical changes, which may aid in making the decision to discard the frying oil used by food handlers. (Aziz et al., 2018).

2.5.1.1. COLOUR

The darkening colour of the oil is based on the oxidation of phenolic antioxidants that consisted in the oil while heating (Nor et al., 2008). Next, the Maillard reaction was attributed for the increase in colour of Repeatedly heated cooking oil (RHCO) refers to the practise of repeatedly heating the same frying oil in order to prepare food.

Increased viscosity, darkening of colour, and an increase in foaming are all physical changes that can occur when heating oil over and over again. The practise of using the same frying oil repeatedly in Malaysian households and businesses is popular. After it foams, develops an obnoxious odour, or darkens in colour, the oil will be discarded (Azman et al., 2012).

In Malaysia, the technique of cooking with oil that has been heated repeatedly is common. It is a normal practice to deep fry with oil that has been reheated several times. Using a deep fryer, food can be cooked at temperatures between 160- and 190-degrees Fahrenheit in the presence of air and moisture while submerged in frying oil. Deep-frying causes chemical reactions such oxidation, hydrolysis, and thermal polymerization in the cooking oil. Lipid peroxidation is more likely to occur when cooking oil is frequently heated (Jaarin et al., 2011).

Other than that, adding more time to the frying process causes the oil to become more oxidised and polymerized, resulting in a decrease in its viscosity. Depending on the type of food fried, the type of oil used, and the design of the fryer, the rate at which cooking oil breakdown products are created can vary. A-tocopherol equivalents in cooking oils generated from vegetables range from 15 to 49 mg/100 g. Unsaturated fatty acids are destroyed by heating and lose their vitamin E content. The frying oil is absorbed by the food while it cooks. The net intake of vitamin E is influenced by the quality of the oil used in the cooking process, which determines the amount of oil absorbed by the meal (Ghidurus et al., 2010).

A previous study conducted a preliminary comparative investigation on the antiradical performance and physicochemical features of vegetable oil during the frying of French fries. They found a gradual increase in darkness during the frying duration (Sulieman et al., 2006). Darkening color of palm oil can be concluded from a finding of a group of researchers in 2015. The darkening of the oil's colour is caused by an increase in the oil's linolenic concentration. It was noticed that palm olein changed colour more rapidly than the other oils during frying. 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 foods. Thus, the data suggested that darkening is a beneficial phenomenon since it prevents the continued use of edible oil that has deteriorated excessively (Nayak et al., 2016).

2.5.1.2. VISCOCITY

The other physical properties that can be studied visually is viscosity of edible oil. It is depending on molecular weight, density, degree of unsaturation, melting point, and temperature (Sharova & Ramadan, 2012). Viscosity will be increases when the chain length of triglyceride fatty acids grows during hydrogenation and reduces as fatty acids become unsaturated (Santos et al., 2004). Polymerization of oil results in the development of lighter, polymer products with a molecular weight of between 690 and 1,600 Da, which raises the viscosity of oil (Choe and Min 2007). Next, Linoleic acid-rich oils polymerize more easily than oleic acid-rich oils during deep fat frying (Valdes & Garcia, 2006). Other than that, viscosity of oil also depends on the unsaturated oil as mustard oil have higher viscosity than corn oil due to the degree of unsaturation of oil at 35 C (Zahir et al., 2014). When exposed to higher temperatures, air, and a greater number of frying cycles, viscosity is significantly reduced, which promotes the development of oxidative and polymeric compounds and increases the likelihood to foam during frying (Samah and Fyka 2002). This happens because of the rise in kinetic energy, which promotes molecular movement and weakens intermolecular interactions (Nayak et al., 2016).

2.5.2. PEROXIDE VALUE (PV) AND OTHER LAB ANALYSIS

The oil quality can be determined by doing lab analysis. This is the most accurate option. There are several lab analyses tests that can be run to determine the oil. Some of them do the lab analysis by measuring the peroxide value (PV) in the oil to determine its quality. The analytical methods of measuring peroxide values mentioned are the official AOCS iodometric titration, the Near Infrared analytical (NIR) method, the PeroxySafe™ kit, and a ferrous xylenol orange (FOX) method. Furthermore, there are other several parameters that can be used to assess oil quality which are measuring anisidine value, saponification value, iodine value and total polar compound (TPC) (Aziz et al., 2018).

Peroxide value can be defined as the amount of peroxide oxygen per 1 kilogram of fat or oil (Chakrabarty M., 2003). It is one of the ways to measure the quality of the oil by measuring how much hydroperoxide exists in the fat and oil. Index of peroxide value will increase by heating the oil at the starting of cooking to the highest value until it decreases again. In addition, unsaturated oil is more easily oxidised than less unsaturated oil (Parker et al., 2003). Hydroperoxides are the main products of the reaction between unsaturated fatty acids that react with oxygens. Hydroperoxides do not have flavor and odor. Nevertheless, it breaks down easily to form aldehydes that are known to have an uneasy flavor and odor. Peroxide value is commonly known as peroxide concentration and is a parameter to measure the oxidation and rancidity in its starting stages (Richard, 2008) Hydroperoxides and aldehydes will be formed during deep frying in the starting phase of oxidation. After that, these two main products are absorbed into the food, which is then deep fried. According to experts, the extent of oxidation can be determined by using the peroxidase value of the oil that is used in the frying process. (Kamisah et al. 2012)

2.5.2.1. PEROXIDE VALUE (PV) MEASUREMENT

There are several analytical methods of PV measurement. It is the most common technique that is being used more than others. PV is most used as an indicator of the early stages of oxidation in fats and oil. Early evidence of rancidity in oils and unsaturated fats can be identified by the detection of peroxide. The technique can help to determine and measure the oil sample that has already done the primary oxidation. For secondary oxidation, it can be determined using the p-anisidine test (Chakrabarty M., 2003). According to many reports, secondary oxidised oil products are typically toxic. Even, at just 100 mequiv/kg of PV which is weakly oxidised fat and oil also are neurotoxic (Gotoh & Wada, 2006). There was a study that was conducted in 2003 comparing four types of peroxide value analytical methods which are the official AOCS iodometric titration, the NIR method, the PeroxySafe™ kit, and a ferrous xylenol orange (FOX) method. All of the methods are reliable to determine the PV to assess the oil. PV method is widely used because of its advantage that it directly quantifies lipid peroxides, also known as the major products of lipid

oxidation. On the other hand, a significant disadvantage is the sensitivity to molecular oxygen interference, as well as the reactivity of released iodine with other system components (Yildiz et al., 2003).

2.5.2.1. DIFFERENCE BETWEEN COOKING OIL

Palm oil always accused to be unhealthy and a poor choice for type of cooking oil in certain region because it contains saturated fatty acids which can increase unhealthy LDL cholesterol levels. However, palm oil is actually a better and healthy choice for cooking. There are four types of fatty acids mainly in fat, polyunsaturated fatty acids (PUFA), monounsaturated fatty acids (MUFA), saturated fatty acids (SAFA) and trans fatty acid (TFA). Palm oil, as opposed to hydrogenated vegetable oils, is a better source of solid fats. Unlike soybean or rapeseed oils, which must be hydrogenated to become solid or semi-solid, palm oil is solid at room temperature, and it is less susceptible to oxidation. It is a process of partial hydrogenation that artificial trans fatty acids are created (Shimizu & Desrochers, 2012)

Trans fat consumption has been related to heart disease, elevated levels of harmful LDL (low density lipoprotein) cholesterol, and decreased levels of beneficial HDL (high density lipoprotein) cholesterol. As a result, palm oil is a valuable substitute for various animal fats such as tallow or other partly hydrogenated vegetable oils because it is "trans-fat free.". In general, zero trans fatty acids, less saturated, and more mono and polyunsaturated fatty acids in oil are healthier options

2.6. LEVEL OF KNOWLEDGE

A study in Kuala Lumpur in 2012 conducted regarding the knowledge about RHCO among 100 respondents who were food handlers stated more than half (67.0 percent) of the 100 respondents disagreed that repeatedly heating cooking oil is a good practise. 70% among those respondents disagreed that frying oil quality remains unchanged no matter how many times it is reused. In addition, 71.0 percent of respondents also disagreed that cooking oil should not be re-used for frying and should only be disposed of after dark. Approximately 45.0 percent of those surveyed

believe that frequent heating of cooking oil results in a decrease in nutritional content. Less than half of respondents felt that the type of cooking oil used had no effect on the form of by-products formed when cooking oil is heated over and over again. Reheated cooking oil was found to be hazardous to health by a majority of respondents (69.0 percent). According to 43 respondents who agreed that regular use of RHCO is unhealthy, this practice can lead to cancer growth. (Azman et al.,2012).

2.7. LEVEL OF PRACTICE

This practice is not limited to roadside food stalls, renowned food restaurants in Malaysia's major cities also employ this strategy to minimise costs. The study in Kuala Lumpur of 100 respondents who were food handlers stated over 50 operators of night market food outlets (63.0 percent) admitted to using RHCO for deep frying food. Then, out of 37 operators of the night market who did not practice RHCO, 20 indicated that kind of practice is making the food unattractive, while only 13 claimed that kind of practice would be damaging to their health. Next, about four respondents who did not practice RHCO believed that doing so would raise the cholesterol content of the oil. Among the 63 night market operators who acknowledged practice RHCO for deep frying, over half (33 individuals) said to never using the oil over two times. While seven admitted to practice RHCO up to four times or more. Lastly, there is no of the night market operators interviewed have the idea or know to comply with any official or unofficial rules, directives, or instructions about the correct use of cooking oil for deep frying food (Azman et al., 2012).

A study in 2018 stated that 124 food handlers working in food premises/ establishments in Bukit Mertajam, Penang were approached and voluntarily engaged in the study. Almost half of respondents indicated that they practiced at a moderate level. Surprisingly, 43% of respondents had a poor habit of continuously heating cooking oil, while just 7% had a good practice (Aziz et al., 2018).

2.9. VALIDATED QUESTIONNAIRES

Azman et al. (2012) developed a set of validated standardised questionnaires in two languages, English and Malay, which were distributed to respondents directly via interview. It was similarly divided into the same three sections, with questions about age, gender, and educational level. The following section discusses the proper use of RHCO. The questions include whether it is a good practice to use RHCO, whether the quality of the oil used for frying remains constant regardless of how many times it is reheated, whether there is nutrient depletion in repeatedly heated cooking oil, whether different types of cooking oil produce varying by-products when repeatedly heated, and whether consumption of fried food prepared using RHCO. Finally, in the final section, the attitudes and practises regarding the use of repeatedly heated frying oil were determined. Another improvised questionnaire from Abdullah et al. was used to collect data from respondents. It consisted of three sections: (A) sociodemographic information; (B) awareness of repeatedly heating cooking oil, and (C) practice of repeatedly heating cooking oil, as well as the type and brand of cooking oil used in their business in two languages as well which are English and Malay (Aziz et al., 2018).

2.10. LIMITATION

There are some limitations regarding the knowledge and practice research of RHCO among households. First, the method of cross-sectional itself. The method is time and cost effective but its ability to make a causal inference is weaker than the interview method. Plus, the questionnaire will be distributed and explained via online in this research due to the outbreak of disease. the respondent's understanding may be weaker than when distributing it in physical form.

CHAPTER 3

METHODOLOGY

3.1. STUDY DESIGN

This is a cross-sectional study that were conducted at Putrajaya, Malaysia. The study population consisted of households that live in Putrajaya. This study assessed household's knowledge and practice regarding RHCO, as people often reuse and recycle cooking oil in the preparation of food to save money without knowing the health risk of doing so. The study design will analyse data from a population among households in Putrajaya at a specific time point.

3.2. STUDY LOCATION

This study was conducted among residents that live in the Federal Territory of Putrajaya which is one of the federal territories in Malaysia. The people that live in Putrajaya are under the Putrajaya Corporation as their local government. The population of Putrajaya is estimated to be 91,900 people (DOSM, 2018). Putrajaya is chosen as the place for study because of the location itself. Putrajaya is a strategic place as it is located near to our base of operation Universiti Putra Malaysia. Since the pandemic COVID-19 cases are still going up every day, the movement is quite restricted. Plus, the situation is unpredictable. Putrajaya is chosen considering the distance between UPM and the residential area.

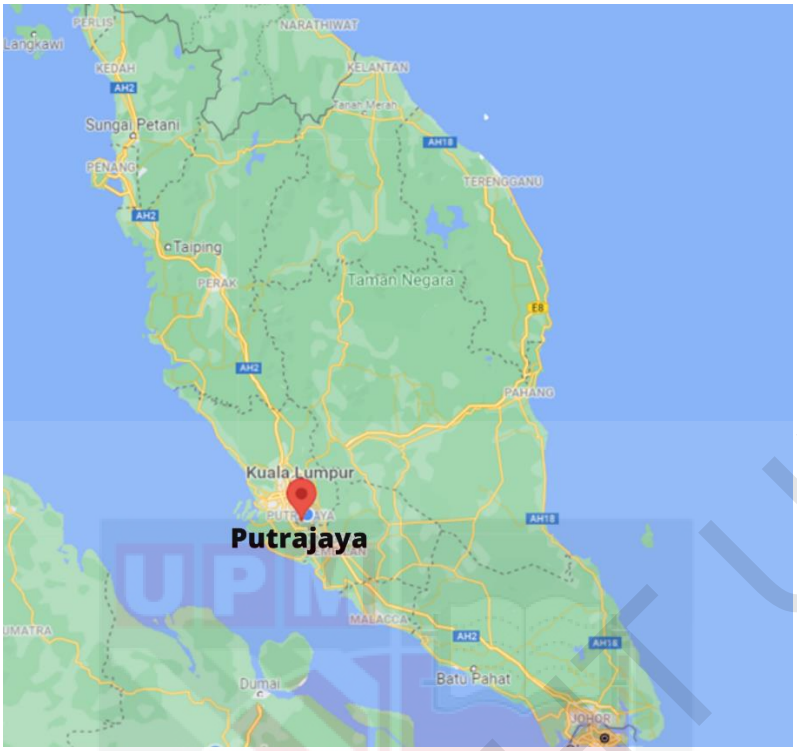

Figure 3.2.1: Maps from Google Map of Peninsular, Malaysia

Figure 3.2.2: Maps from Google Map of Putrajaya, Malaysia

3.3. STUDY DURATION

This study was conducted from 5th April 2021 until 30th January 2022.

3.4. SAMPLING PROCEDURES

This study was conducted upon obtaining the approval from the Ethic Committee for Research Involving Human Subjects of Universiti Putra Malaysia (JKEPUPM) and after receiving permission from the head of the residents. Then, the data collection will be conducted by distributing a set of questionnaires. Figure 3.4.1. below shall present the following process of sampling procedure.

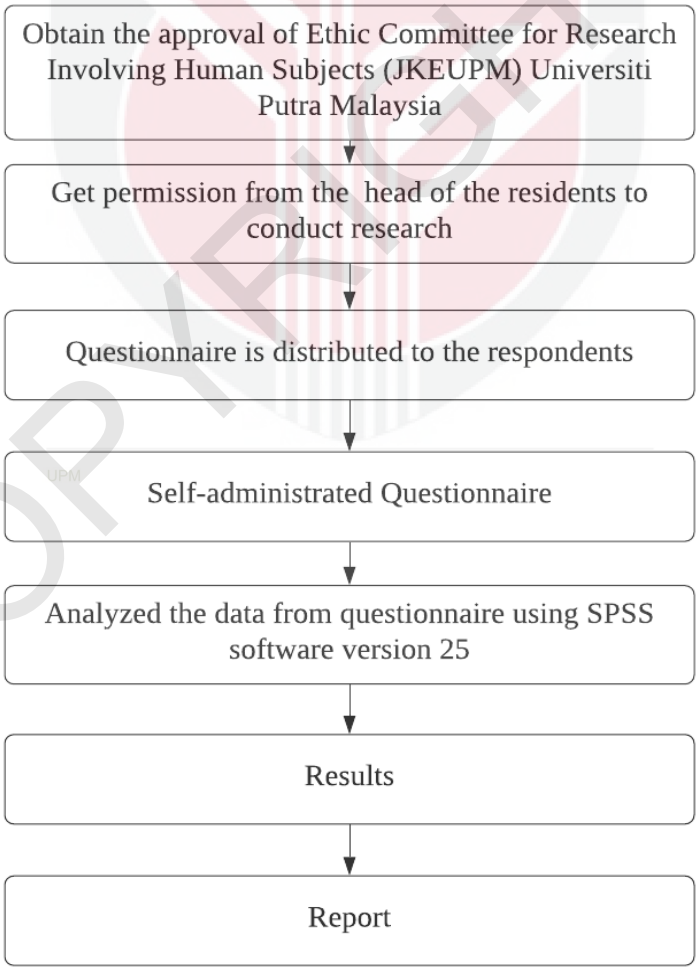

Figure 3.4.1.: Flowchart of the sampling procedure

3.5. STUDY POPULATION

The study population of this research are the households that live in Putrajaya. It is estimated to be 105,400 people (DOSM, 2019).

3.5.1. STUDY SAMPLE

The respondents in this study will be picked at random from the residents of Putrajaya and will be subjected to the following inclusion and exclusion criteria:

A) Inclusion criteria

- Malaysian that lives in Putrajaya
- Aged at least 18-60 years old
- Only using vegetable-based oil as cooking oil (Example: palm oil, olive oil, and sunflower oil).

B) Exclusion criteria

- Individuals who refused to get involved in the study
- Individuals who are food vendors that cooked their food at home

3.5.2. SAMPLING UNIT

The sampling unit of this research is the people that use vegetable oil as their cooking oil.

3.5.3. SAMPLING METHOD

Sampling method in this research is random sampling. The study will get the respondents from a step which begin with listing the residential areas around

Putrajaya. Then, the sampling will be conducted to the place that have the approval to execute it. The selection of respondents was based on convenient sampling. Then, questionnaires were given to the residents of Putrajaya via online platform such as Facebook, WhatsApp, Twitter, and LinkedIn. Respondents that fit into the inclusion criteria set were given the opportunity to participate in this study. Respondents that did not meet the criteria were excluded.

3.6. SAMPLE SIZE CALCULATION

The sample size calculation was determined following the objectives of the study.

3.6.1. Determination level of knowledge of repeatedly heated cooking oil among respondents.

The sample size of this study is calculated from a study by (Lemeshow et al., 1990) as shown below:

Equation

$$n = \frac{Z^2_{1-\frac{a}{2}} P(1-P)}{d^2}$$

n = Sample size

$Z^2_{1-\frac{a}{2}}$ = z-score (1.96 for 95% confident interval)

P = Prevalence of estimated proportion (94.2% according to Ismail, 2019)

d =Desired precision (margin of error is 0.05)

Calculation of estimated sample size:

$$n = \frac{(1.96)^2(0.942)(1-0.942)}{(0.05)^2} = 83.95$$

$$n = 84 \text{ respondents}$$

3.6.2. Determination level of practice of repeatedly heated cooking oil among respondents.

The sample size of this study is calculated from a study by (Lemeshow et al., 1990) as shown below:

Equation:

$$n = \frac{Z^2{}_{1-\frac{a}{2}} P(1-P)}{d^2}$$

n = Sample size

$Z^2{}_{1-\frac{a}{2}}$ = z-score (1.96 for 95% confident interval)

P = Prevalence of estimated proportion (86.6% according to Sivananthat et al., 2019)

d = Desired precision (margin of error is 0.05)

Calculation of estimated sample size:

$$n = \frac{(1.96)^2(0.866)(1-0.866)}{(0.05)^2} = 178.32$$

$$n = 179\, r\text{espondents}$$

3.6.3. Association between knowledge and practice

The sample size for this study is calculated using two proportion formula as below:

Equation:

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

$P = (P_1 + P_2)/2$

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 of (zahoor, 2019) concerning the association between knowledge and practice of repeatedly heated cooking oil (RHCO).

Knowledge	**Practice**		**Total**
	Low	Moderate/High	
Low	3	9	12
Moderate/High	85	26	111

Table 3.6.3.: Finding of Zahoor (2019) regarding level of knowledge and level of practice

P1= proportion of low knowledge with low practice

= 3/12

= 0.25

P2= proportion of good knowledge with low practice

= 85/111

= 0.77

P = (0.25+0.77) / 2

= 0.51

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

$$n = \ 13.37$$

$$n = \ 13$$

3.6.4. Association between knowledge and socio-demographic factors

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

Age with knowledge

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

Table 3.6.4.: Finding of Ismail (2019) regarding age and knowledge

P1= proportion of ≤35 with low knowledge

= 49/79

= 0.62

P2= proportion of >35 with low knowledge

= 17/44

= 0.39

P = (0.62 + 0.39) / 2

= 0.505

$$n = \frac{\left\{\left(1.96\sqrt{2(0.505)\ (1-0.505)} + 0.842\sqrt{0.62(1-0.62) + 0.39(1-0.39)}\right)\right\}^2}{(0.62+0.39)^2}$$

$$n = 79.40$$

$$n = 80$$

Gender with knowledge

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

Table 3.6.4.: Finding of Ismail (2019) regarding gender and knowledge

P1= proportion of female with low knowledge

= 41/65

= 0.63

P2= proportion of male with low knowledge

= 25/58

= 0.43

P = (0.63+0.43) / 2

= 0.53

$$n = \frac{\left\{\left(1.96\sqrt{2(0.53)\ (1-0.53)} + 0.842\sqrt{0.63(1-0.63) + 0.43(1-0.43)}\right)\right\}^2}{(0.63+0.43)^2}$$

$$n = 35.64$$

$$n = 36$$

3.6.5. Selection of sample size

The sample size is selected according to the highest sample size calculated, where n= 179. By considering of 5% for unavailability of subjects, non-response, missing data, or refusal to participate, the sample size of this study is calculated as below:

$$n = 179 + \left[179 \times \frac{5}{100}\right]$$

$$n = 187.95$$

$$n = 188$$

Hence, the minimum respondents need in this study is 188.

3.7. DATA COLLECTION AND INSTRUMENT

The data was collected using a set of questionnaires regarding knowledge and practice of RHCO. The process of filling in questionnaires was explained and guided properly to the respondents.

3.7.1. QUESTIONNAIRES

The questionnaires are self-administered questionnaires that were modified from Azman et al. (2012). The questionnaire was written in bilingual language (English and Malay) to assist and enhance the respondent's understanding about the questionnaires and the study that is conducted. The survey was conducted via online due to the pandemic COVID-19 in the country. The questionnaires that were conducted consist of 4 main sections. The questionnaires distributed through online platform such as WhatsApp, Facebook, LinkedIn, Twitter, and Instagram to residents that stayed in Putrajaya.

SECTION A: SOCIO-DEMOGRAPHIC INFORMATION OF THE RESPONDENTS

Generally, demographic survey questions inquire about the population's demographic characteristics such as age, gender, race, income level, monthly food expenses, and highest level of education.

SECTION B: KNOWLEDGE ON THE USAGE OF REPEATEDLY HEATED COOKING OIL

The section B questions are related to respondents' level of knowledge of using repeatedly heated cooking oil and the exposure to peroxide from used cooking oil. For every correctly answered, a score of one given and zero score for partially agree and disagree. Then, the level of knowledge categorized into poor (score 0 – 3) and good (4 to 7) (Azman et al., 2012).

SECTION C: PRACTICE OF THE USAGE OF REPEATEDLY HEATED COOKING OIL

This section C collects data on the practice of frequently heating cooking oil during the meal preparation process. The type of oil used, their practice of using cooking oil, the frequency with which they use the same oil, the type of frying technique frequently used, the method used to preserve the quality of cooking oil, waste cooking oil management, and the source of knowledge acquired about repeatedly heated cooking oil are all included in the question. The proportion of respondents who use frequently heated cooking oil will be determined, as well as the factors that influence this proportion. The level of practice was determined using a question from this section on how many times they used RHCO. Not use at all and two times count as good. While 3 times and 4 times and more were poor practice.

SECTION D: RECOMMENDATIONS

The final portion is the recommendation section, it encourages responders to make any pertinent suggestions for improvement and to help raise the community's level of knowledge and practice.

3.8. DATA ANALYSIS

The data collected from respondents were analysed using IBM's Statistical Package for Social Sciences (SPSS) software Version 25. The statistical analysis for each specific objective is summarised in Table 3.8.1. All the data are not normal due to all of it are categorical. The significance value for the testing is p-value below 0.05.

	Methodology	Variables	Type of Data	Statistical Analysis
I	To obtain the socio-demographic background of the households.	Age, gender, education	Categorical	Descriptive statistic (Frequency and percentage)
II	To determine level of knowledge of repeatedly heated cooking oil (RHCO) among respondents.	Level of knowledge	Categorial	Descriptive statistic (Frequency and percentage)
III	To determine level of practice of repeatedly heated cooking oil (RHCO) among respondents.	Level of practice	Categorial	Descriptive statistic (Frequency and percentage)
IV	To associate between knowledge and practice of respondents on repeatedly	Level of knowledge	Categorical	Chi-square test

	heated cooking oil (RHCO).			
V	To associate between socio-demographic and knowledge level on repeatedly heated cooking oil (RHCO) among respondents.	Level of practice Age and gender Level of knowledge	Categorical	Chi-square test

Table 3.8.1.: Research objectives and statistical analysis used for the study

3.9. QUALITY CONTROL

3.9.1. PRE-TEST

Prior to executing the study, a pre-test was conducted to assess the data collection tool dependability and data collection timeline. The questionnaire was distributed to 25 respondents who meet the same criteria but do not live in the study area. The necessary improvements for this study made and implemented. Reliability test also was conducted, Cronbach's Alpha. Cronbach's Alpha is the average value of the reliability coefficient. It is used to measure the internal consistency reliability. The value for Cronbach's alpha should be more than 0.7 to 0.9 to have a high degree of internal consistency

3.9.2. ETHICAL CONSIDERATION

This research proposal was reviewed and approved by the Universiti Putra Malaysia's Ethics Committee for Research Involving Human Subjects (JKEUPM) to ensure that the methodology is appropriate for conducting the study on the intended study population. Then, prior to data collection, a written consent was obtained from the respondents.

CHAPTER 4

RESULT

4.1 INTRODUCTION

This chapter addresses the study's findings, which include the respondents' sociodemographic characteristics, their degree of knowledge and practice on RHCO, the association between respondents' level of knowledge and sociodemographic status, and the association between level of knowledge and level of practice related to RHCO.

4.2 RESPONSE RATE

The study consists of 176 respondents from households in Putrajaya who volunteered to participate in this study. Thus, the response rate was 96.2% in this study. Participants who are the residents of Putrajaya that used cooking oil for their home-based food business were excluded from this study.

4.3 RESPONDENTS SOCIO-DEMOGRAPHIC DATA

A total of 176 respondents from Putrajaya households that volunteered to participate in this study. Table 4.3.1 summarizes the respondent's demographic characteristics, including their age, gender, race, total household monthly income, and educational level.

The data indicate that the respondents were female at 89 respondents (50.6%) and male at 87 respondents (49.4%). Regarding the age, results indicated that 113 respondents (64.2%) were between the ages of 18 and 45, while the remaining 63

respondents (35.8%) were over the age of 45. Next, the races indicate that 161 (91.5%) of respondents identified as Malay, 8 respondents (4.5%) as Chinese, and 7 respondents (4.0%) as Indian.

In terms of total monthly household income, below RM 4,850 were 8 respondents (4.5%), RM 4,850-RM 10,595 were 72 respondents (40.9%), and above RM 10,595 were 96 respondents (54.5%). In terms of educational attainment, most respondents (165) with 93.7% held a tertiary, while 10 respondents (5.7%) held secondary and only 1 respondent held a primary.

Table 4.3.1 : The socio-demographic factors of respondents (N = 176)

VARIABLES	FREQUENCY (n)	PERCENTAGE (%)
Gender		
Male	87	49.4
Female	89	50.6
Age		
18 to 45 years' old	113	64.2
Above 45 years old	63	35.8
Race		
Malay	161	91.5
Chinese	8	4.5
Indian	7	4.0
Total Household Monthly Income		
Below RM 4,850	8	4.5
RM 4,850 – RM 10,595	72	40.9
Above RM 10,595	96	54.5
Educational Level		
Primary	1	0.6
Secondary	10	5.7
Tertiary	165	93.7

4.4 KNOWLEDGE OF REPEATEDLY HEATED COOKING OIL

The level of knowledge regarding RHCO usage was determined using seven statements that focused on general information about the substance.

The distribution of respondent's responses to questions about their understanding of RHCO is shown in Table 4.4.1. It indicates that 83.3 % of respondents disagree with the statement that " Usage of repeatedly heated cooking oil for frying food is a good practice as it saves cost and there is no side effect." Following that, 93.2% of respondents disagreed that "the quality of frying oil would remain constant regardless of how many times it is reheated" and 73.3% disagree that " We can still use the same oil for many times and discard it only when it turns dark." Over half of responders successfully answer the subsequent four to seven correct statements. 76.6% of respondents are aware that RHCO used for frying will lose nutrients, while 85.2% are aware that RHCO used for frying will have a negative effect on human health, 79.5% agreed that hypertension, diabetes, tuberculosis, food poisoning, and cancer are diseases associated with prolonged consumption of RHCO, and 50.0% agreed that " Peroxide presence can be detected in cooking oil especially if using repeatedly heating cooking oil." Additionally, most respondents 48.9% obtained information on the comments via the internet.

Table 4.4.1 : The level of knowledge of respondents (N = 176)

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	14 (8.0)
	Disagree	147 (83.5)
	Not Sure	15 (8.5)
2.	The quality of oil used for frying will remain the same regardless of how many times the oil is reheated.	
	Agree	6 (3.4)

	Disagree	164 (93.2)
	Not Sure	6 (3.4)
3.	We can still use the same oil for many times and discard it only when it turns dark.	
	Agree	35 (19.9)
	Disagree	129 (73.3)
	Not Sure	12 (6.8)
4.	There will be loss of nutrients in the repeatedly heated cooking oil used for frying.	
	Agree	135 (76.7)
	Disagree	18 (10.2)
	Not Sure	23 (13.1)
5.	Repeatedly heated cooking oil used for frying cause bad effects to human health.	
	Agree	150 (85.2)
	Disagree	13 (7.4)
	Not Sure	13 (7.4)
6.	Hypertension, diabetes, tuberculosis, food poisoning and cancer are the diseases associated with the prolonged consumption of repeatedly heating cooking oil.	
	Agree	140 (79.5)
	Disagree	13 (8.0)
	Not Sure	22 (12.5)
7.	Peroxide presence can be detected in cooking oil especially if using repeatedly heating cooking oil.	
	Agree	88 (50.0)
	Disagree	16 (9.1)
	Not Sure	72 (40.9)

8.	Please state source of information obtained regarding the statement in section B.	
	Newspaper & Magazine	26 (14.8)
	Television	35 (19.9(
	Internet	86 (48.9)
	Family & Friends	29 (16.5)

Table 4.4.2 contains the findings of the survey on respondent's degree of knowledge regarding repeatedly heated frying oil. According to the results, a sizable proportion respondent 67.7% have a moderate degree of knowledge. 31.3% have a good level of knowledge. Only a few responders of 2% had poor knowledge level.

Table 4.4.2: Results of knowledge level (n = 176)

Level of knowledge	Frequency (n)	Percentage (%)
Good (6-7 score)	55	31.3
Moderate (3-5 score)	119	67.7
Poor (0-2 score)	2	1.1

4.5 PRACTICE OF REPEATEDLY HEATED COOKING OIL

The distribution of respondent's responses to questions about RHCO practice is shown in Table 4.5.1. Most respondents 94.9% use palm oil for cooking, and the majority 79.5% of respondents use RHCO on a regular basis, while the remaining respondents 20.5% chose "No" to the practice because more than 9.7% were aware of the health risks, 7.4% because the food will look bad and 6.8% because the oil increase cholesterol level.

The level of practice was determined mainly on how many times they used RHCO.

Most respondents of 140 respondents who selected "Yes" to the practice of RHCO use the same cooking oil up to twice (48.9%), 3 times (25.0%) and 4 times or more ((7.4%). The other 36 respondents who answered no indicates they not using RHCO. Next, 59.6% respondents indicated that they used RHCO by deep frying. 67.0% respondents use fresh cooking oil for cooking purposes on a consistent basis as a technique of attempting to maintain the quality of cooking oil, and 77.8% respondents chose to keep and recycle at respective recycle center as method for discarding the oil. The majority of respondents of 76.1% acquired knowledge about RHCO via internet. The level of practice was determined mainly on how many times they used RHCO.

Table 4.5.1: The level of practice of respondents (n = 176)

No.	Question	Frequency n (%)
1.	Type of cooking oil used.	
	Palm oil	167 (94.9)
	Corn oil	3 (1.7)
	Coconut oil	3 (1.7)
	Olive oil	3 (1.7)
2.	Do you use cooking oil repeatedly for frying?	
	Yes	140 (79.5)
	No	36 (20.5)
3.	If choose “No” (question no. 2), what are the reasons for not using repeatedly heated cooking oil for frying? (n=42)	
	Harmful to health	17 (9.7)
	Food will look bad	13 (7.4)
	Increases cooking oil’s cholesterol level	12 (6.8)
4.	If choose “Yes” (in Question 2), how many times is the same cooking oil being reused before discarded? (n=140)	
	2 times	86 (48.9)
	3 times	44 (25.0)
	4 times or more	13 (7.4)

5.	What are the frying methods applied when using repeatedly heated cooking oil?	
	Pan frying	53 (30.1)
	Deep frying	104 (59.1)
	Stir-frying	19 (10.8)
6.	What is the method attempted to maintain quality of cooking oil?	
	Use fresh cooking oil for cooking purpose every time	118 (67.0)
	Maintain small flame while cooking process	18 (10.2)
	Transfer oil in stainless steel or glass container after usage	14 (8.0)
	Perform oil filtration to strain food particles or foreign matters in cooking oil	26 (14.8)
7.	How do you discard the used cooking oil?	
	Directly through drainage system and house sink	10 (5.7)
	Into the waste bin 469 2521 701	12 (6.8)
	Onto the soil	8 (4.5)
	Keep and recycle at respective recycle centre	137 (77.8)
	Other	9 (5.1)
8.	Please state source of information obtained regarding on usage of repeatedly heating cooking in section C.	
	Newspaper & Magazine	9 (5.1)
	Television	18 (10.2)
	Internet	134 (76.1)
	Family & Friends	14 (8.0)
	Others	1 (0.6)

4.6 ASSOCIATION BETWEEN THE LEVEL OF KNOWLEDGE AND LEVEL OF PRACTICE

Table 4.6.1 shows the association between knowledge level and practice level of respondents regarding repeatedly heated cooking oil (RHCO). There is a total of 176 respondents included in this result. The results indicate the frequency of knowledge level of the respondents. The good knowledge level (83.6%) had the highest percentage of goof practice level followed by poor knowledge level (60.3%). While the lowest percentage of poor practice level is poor knowledge level (39.7%) followed by good knowledge level (16.4%). Other than that, there is a significant association between knowledge level of RHCO and practice level of RHCO (X^2 = 9.379[a], P = 0.03).

Table 4.6.1: Association between knowledge level and practice level of respondents (N=176)

Variable	Practice			X^2	*P*
	Good n (%)	Poor n (%)	Total n (%)		
Knowledge level					
Good	46 (83.6)	9 (16.4)	55 (100)	9.379[a]	**0.03***
moderate and below	73 (60.3)	48 (39.7)	121 (100)		

Note: (*) Significant at P <0.05, ([a]) Continuity Correction, X^2 = Chi-square value

Simple Logistic regression was performed for the knowledge level by using enter method, to identify whether it could be a predictor or not for the level of practice on the usage of RHCO. The result showed that knowledge level was a predictor for the level of practice among respondents (COR= 3.361, 95% CI=1.507,7.493, P= 0.003). Further details are illustrated in the Table 4.6.2.

Table 4.6.2: Knowledge level associated with level of practice

Predictors (N=176)	COR	95% CI	P-value
Knowledge Level			
Good	3.361	1.507-7.493	0.03
Moderate & below	1.00		

Significant at P <0.05

4.7 ASSOCIATION BETWEEN SOCIO-DEMOGRAPHIC AND LEVEL OF KNOWLEDGE

Table 4.7.1 illustrates the relationship between respondent's level of knowledge and their sociodemographic status. The result indicates the frequency of respondent's age, gender, race, total household monthly income, and educational level.

Respondents below the age 18-45(31.9%) have slightly higher of good knowledge level than the age above 45 (30.2%). Then, the female respondents had slightly lower with 30.3% than male with 32.2% of good knowledge. For the races, non-Malay (33.3%) had a higher percentage than Malay (31.1%). For total household monthly income, the results showed that the group of below RM 10,959 (31.7%) had higher level of good knowledge than the group above RM 10,959 (30.6). Lastly, tertiary (31.5%) had higher percentage for good knowledge than secondary (27.3%) for educational level.

The finding indicates that there was no significant relationship between respondent's age, gender, race, total household monthly income, and educational level and their level of knowledge about RHCO as there is no significant association between all the socio-demographic data and level of knowledge

Table 4.7.1: Association between Socio-Demographic status and knowledge level of respondents.

Variable	Knowledge			X^2	*P*
	Good n (%)	**Moderate & below n (%)**	**Total n (%)**		
Age (Years old)					
18 to 45 years' old	36 (31.9)	77 (68.1)	113 (100)	0.054[a]	0.866
Above 45 years old	19 (30.2)	44 (69.8)	63 (100)		
Gender					
Female	27 (30.3)	62 (69.7)	89 (100)	0.070 [a]	0.871
Male	28 (32.2)	59 (67.8)	87 (100)		
Race					
Malay	50 (31.1)	111 (68.9)	161 (100)	0.033 [a]	0.856
Non-Malay	5 (33.3)	10 (66.7)	15 (100)		
Total Household Monthly Income					
≤ RM 10, 959	33 (31.7)	71 (68.3)	104 (100)	0.027 [a]	1.000
>RM 10, 959	22 (30.6)	50 (69.4)	72 (100)		
Educational Level					
Secondary	3 (27.3)	8 (72.7)	11 (100)	0.086 [a]	1.000
Tertiary	52 (31.5)	2 (1.2)	165 (100)		

Note: (*) Significant at $P < 0.05$, ([a]) Continuity Correction, X^2 = Chi-square value

CHAPTER 5

DISCUSSION

5.1 SOCIODEMOGRAPHIC CHARACTERISTICS OF THE RESPONDENTS

This study was conducted to assess the level of knowledge and practice regarding RHCO of households that live in Putrajaya under Perbadanan Putrajaya. The population of this study is quite interesting as they are considered to live in urban area which experiencing modernization and development. Putrajaya is an area that is allocated to be residential area with emphasis on well-balanced environment, social structured and well economic element (Praveena et al., 2020). There is no significant difference in number between male and female respondents in this study.

The data collected showed that the total monthly income for most of the respondents belong to groups of M40 (40.9%) and T20 (54.5%). Other than that, 165 respondents out from 176, have tertiary level of education and only 11 respondents that have secondary and below. This can be said as the Federal Territory of Putrajaya is a planned capital city which functions as the administrative capital and the judicial capital of Malaysia (Moser, 2010). Therefore, the households mostly are occupants that are working with the government. Furthermore, the government officials in Putrajaya mostly are Malays, that have stable financial income, and tertiary level of education.

5.2 KNOWLEDGE ON REPEATEDLY HEATED COOKING OIL

The study conducted found that knowledge level of respondents that live in Putrajaya mostly are moderate (67.7%) with scoring from 3-5 followed by good (31.3%) with scoring of 6-7 and lastly only 1.1% is poor with 0-2 scoring level. The total scoring are the results of all the questions that being asked in this study.

From the data collected, most of the respondents (83.5%) disagreed that the usage of repeatedly heated cooking oil for frying food is a good practice as it saves cost and there is no side effect. Next, 93.2% of the respondents also disagreed that the quality of oil used for frying will remain the same regardless of how many times the oil is reheated. 73.3% of the respondents disagreed to use the same oil for many times and discard it only when it turns darks. Next, for the loss of nutrients in RHCO, 76.7% of the respondents agreed in it. 85.2% of respondents agreed that RHCO cause bad effects on human health with 79.5% of them agreed that some of the bad effects are hypertension, diabetes, tuberculosis, food poisoning and cancer if RHCO consume in a prolonged period. Half of the respondents agree that there is peroxide presence, and it can be detected in cooking oil.

The level of knowledge regarding the RHCO is moderately good as most of them have moderate and good level. The reason for this is the quality determination of the oil can be made visually by looking at the physical and chemical properties of the oil. Repeated heating of oil can result in physical changes to the oil, such as increased viscosity, darkening of the colour, increased foaming, and a reduction in the oil's smoke point (Azman et al., 2012). Other than that, the Putrajaya is an urban area which experienced the modernization and technology. Hence, all of the residents have the ability to access to lot of sources such as Television, Newspaper, and Internet. From the data collected, majority of the respondents said that the source of their information regarding RHCO come from Internet or social media. This can be said as one of the contributing factors why the respondents have a moderately good knowledge regarding RHCO. One of a study in 2018 regarding NCDs in Urban Area in Negeri Sembilan stated that most of the respondents had good knowledge (81.2%) and attitude (53.1%) regarding NCDs (Ithnin et al.,2018)

Nevertheless, in this case, little effort was made by associated bodies to bring about resolution of these little-known difficulties. On that basis, significant action should be made to highlight the harm presented in continuing consumption of food prepared with RHCO at all levels of society. Fundamental knowledge of oil characteristics and physicochemical reactions must be taught to the public. They used cooking oil on a nearly daily basis and need knowledge on how to maintain the oil safe. They must know how to properly handle RHCO may help decrease the likelihood of used oil degrading further. This information should be taught in schools since it is an integral component of our everyday lives. In addition, this action can educate and serve as a first defence line against their practice in continuing their custom of repeatedly heated cooking oil.

5.3 PRACTICE ON REPEATEDLY HEATED COOKING OIL

Level of practice on repeatedly heated cooking oil among respondents is quite interesting. Most of the respondents use palm oil (94.9%) for their cooking oil. This is an expected outcome as Malaysia currently is the second largest producer of palm oil in the world with 26% of world production of palm oil come from Malaysia (United States Department of Agriculture, 2021). Other than that, the other reason palm oil was chosen as the primary form of oil is that it is less expensive than other types of oil and is widely available in Malaysia. Other than palm oil, the remaining respondents use corn oil, coconut oil, and astly olive oil. In addition, other finding also showed that most of Malaysian use palm oil as their cooking oil (Sulaiman et al., 2011).

Next, 140 respondents (79.5%) admit that they use repeatedly heated cooking oil in preparing food. Among the 140 respondents, nearly half of respondents (60.1%) use the same cooking oil in preparing food twice. This finding nearly matched a previous survey conducted among food operators in Kuala Lumpur in which 52% of respondents admitted using it twice before dispose the oil (Azman et al., 2012). Other than that, Kamilah et al. (2015) conducted another study in which they compared the RHCO oil in suburban and rural communities and found that many of their respondents from both locations using the cooking oil twice. For the method that

being applied when using RHCO, deep frying (59.1%) held the highest percentage. It is the most popular method of using repeated cooking. In addition, deep fried foods exquisite an exceptional and unique flavours. Thus, most people do apply it. Deep frying is a method of cooking food fully submerged in frying oil at temperatures ranging from 160 to 190°C in the presence of air and moisture. However, many researchers have discovered that deep frying promotes the formation of toxicologically significant chemicals such as unsaturated aldehydes, heterocyclic aromatic amines (HAAs), glycidamide, acrylamide, and acrolein through intense reactions that occur at high temperatures, posing a health risk. Carcinogenic HAAs and mutagenic HAAs were the most widely investigated of potentially harmful chemicals originating from temperature misused processes in protein-rich goods. (Chang et al., 2019)

About 118 (67.0%) respondents agreed that to maintain quality of cooking oil, they must use fresh cooking oil every time when cooking. On the other hand, 77.8% of the respondents said that for discarding the used cooking oil, they keep and store it and send it to the respective recycle centre. This finding showed that most of the respondents know exactly how to conduct a right and healthy cooking oil practice. For the source of information, 76.1% of the respondents stated that they learned and gain the information via the internet.

5.4 ASSOCIATON KNOWLEDGE LEVEL AND PRACTICE LEVEL OF RHCO AMONG RESPONDNETS

The knowledge level and practice level were recategorize. Knowledge's level was recategorize into two groups good and moderate & below. Practice level also was recatego-rize into two groups, poor and good. There is a total of 176 respondents included in this result. The reason for the recategorize is to gain more meaningful and significant outcome. The results from the analyzation of the data revealed that there was a significant association between knowledge level of RHCO and practice level of RHCO ($X^2 = 9.379^a$, P = 0.03). 83.6% of the respondents who have a good level of knowledge have a good level of practice. Next, 60.3% respondents with level of knowledge that are moderate and below has a good practice. On the other hand, there

are some respondents (16.4%) that have good level of knowledge but poor practice on RHCO. Lastly, respondents with moderate and below knowledge level that have poor practice on RHCO stated with 39.7%.

From the analyzation of the data, we found that most of the respondents that have good knowledge have a good practice. Meanwhile, there is also respondents with good knowledge level with poor practice on RHCO. There is a study of human behaviour that explains why humans have excellent knowledge but yet not reflect on their knowledge level. This is due to other factor that contributed to it, an element that contributed to this situation is the price of oil. The respondents stated that they will save their budget at the lowest cost daily (Ardichvilli et. al.,2019). In Malaysia, cooking oil price of 5 kg brand Saji today is RM 29.70, it increases about twice the price from 2020, which is about RM 19.00.

Based on simple logistic regression analysis, it was found that knowledge level of RHCO (COR= 3.361, 95% CI=1.507,7.493, P= 0.003) is a significantly predicting practice level of RHCO. This can be said that good of knowledge on safe handling of RHCO contributes to the good practice among respondents. Other than that, due to access of nutritional and healthy dietary information because of urbanization, populations tend to have a significantly higher level of awareness (Sharkawi et al., 2014).

5.5 ASSOCIATON BETWEEN SOCIODEMOGRAPHIC AND LEVEL OF KNOWLEDGE OF RESPODENTS

Knowledge level of a person can be associated with several factors. In this study the factors that being assessed including age, gender, races, total household monthly income, and educational background. There is no significant association between socio-demographic of respondents with knowledge level of RHCO. From the result we found that the sociodemographic factors do not resemble knowledge level of RHCO. Nowadays, respondents' knowledge and practices tend to be influenced by media and internet trends, as well as arising issues. They are more likely to be aware of the issue of unsafe food caused by repeatedly heated cooking oil if the issue went viral on social media (Ahmed et al., 2019).

CHAPTER 6

CONCLUSION

6.1 CONCLUSION

In conclusion, most of the respondents were Malays that aged between 18-45 years old. The study also found that majority of the respondents consists of people with tertiary level of education. For the total household monthly income, respondents who belonged to T20 group is the largest group followed by M40 group, and B40 group. Next, this study found that the knowledge level of respondents regarding RHCO is moderately good and practice level of respondents is also categorized as good regarding RHCO. Furthermore, there is a significant association between knowledge level and practice level of RHCO. Respondents with good level of knowledge tend to have good practice level of RHCO. The result predicted that good knowledge level were 3.3 times more likely to have good level of practice. Lastly, this study also found that there is no significant association between sociodemographic of respondents and knowledge level of RHCO.

6.2 STRENGTH AND LIMITATIONS

One of the study's strengths was that the outcome data obtained will serve as a reference for obtaining information during the construction of the intervention programme. Additionally, the results of this knowledge and practice survey can be used to compare pre-intervention and post-intervention health programme implementation.

Every effort has been made to accomplish the study's objectives as efficiently and reliably as possible. Nonetheless, as with any other research, some limitations were recognised along the process. One of the study's drawbacks was its cross-sectional design. The results of this study cannot be used to determine the causal relationships

from the result. Due to the self-administered nature of this questionnaires, information bias such as recollection bias may arise. Respondents may have provided inaccurate information because of their prior experience. The third disadvantage of this study is that data collection was conducted using an online platform, which resulted in non-response bias. Without assistance, participants may have difficulties remaining completely focused on a survey that lasts more than 8 to 10 minutes. Additionally, this online questionnaire may be unable to reach certain segments of the population due to their unwillingness to participate. This disadvantage would have been mitigated if the interview had been conducted face to face.

6.3 RECOMMENDATIONS

To improve the representation of Malaysian respondents in future studies, it is suggested that the sample size be expanded to encompass entire states in Malaysia. Future research should devote significant resources to investigate further. Likewise, there is a disparity between rural and urban resident's levels of knowledge and practise. As such, this study will serve as a guide for the subsequent action. The government or other appropriate bodies shall support future research by arranging for appropriate funding and authorising the researcher to collect data. Apart from that, some respondents agreed on several recommendations for appropriate measures to address the lack of proper education regarding the use of RHCO, including public awareness campaigns, the use of media technology (television, internet, and radio) to increase promotion, public education at the state and district levels about proper handling, and finally, the establishment of guidelines and legal enforcement to prevent adulteration of heated cooking oil. In addition, Putrajaya has a well-organized community. It is suggested that doing an educational awareness campaign regarding RHCO in their community program.

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APPENDIX I
QUESTIONNAIRE

Date/*Tarikh*: ID No.:

UNIVERSITI PUTRA MALAYSIA
BERILMU BERBAKTI

QUESTIONNAIRE/*BORANG KAJI SELIDIK*

RESEARCH TITLE/TAJUK KAJIAN**:**	***THE LEVEL OF KNOWLEDGE, AND PRACTICE OF REPEATEDLY HEATED COOKING OIL AMONG HOUSEHOLDS IN PUTRAJAYA MALAYSIA*** *TAHAP PENGETAHUAN DAN PRAKTIS MENGENAI PEMANASAN MINYAK MASAK BERULANGAN DIKALANGAN ISI RUMAH DI PUTRAJAYA, MALAYSIA*
RESEARCHER NAME/NAMA PENGKAJI*:*	**MOHAMAD HAFIZ IQBAL BIN MAZUAN**

Instructions/*Arahan*

This questionnaire contains 4 sections:

Borang kaji selidik ini mengandungi 4 bahagian:

1. Section A: Socio-demographic information
   Bahagian A: Latar belakang sosio-demografik

2. Section B: Knowledge on the usage of repeatedly heated cooking oil
   Bahagian B: Pengetahuan mengenai pengunaan minyak masak berulangan

3. Section C: Practice of the usage of repeatedly heated cooking oil
   Bahagian C: Praktis mengenai penggunaan minyak masak berulangan

4. Section D: Recommendations
   Bahagian D: Cadangan

Section A: Socio-demographic information
Bahagian A: Latarbelakang sosio-demografik

INSTRUCTIONS: Please tick your answer and fill in the blanks for the questions below.

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

1. Age/*Umur*: .....

2. Gender/*Jantina:*

   ☐ Male/*Lelaki* ☐ Female/*Perempuan*

3. Races/*Bangsa:*

   ☐ Malay/*Melayu* ☐ Chinese/*Cina* ☐ Indian/*India*

   Others/*lain-lain*: .....

4. Total household income/*Pendapatan isi rumah* (RM): .....

5. Monthly food expenses/*Perbelanjaan makanan bulanan* (RM): .....

6. Highest education level/*Taraf pendidikan tertinggi:*

   ☐ SRP/PMR/SPM ☐ Bachelor's Degree/*Ijazah Sarjana Muda*

   ☐ Certificate/ Sijil ☐ Master's Degree/*Ijazah Sarjana*

   ☐ Diploma ☐ PhD

   Others/*lain-lain*: .....

Section B: Knowledge on the usage of repeatedly heated cooking oil
Bahagian B: Pengetahuan mengenai penggunaan minyak masak berulangan

INSTRUCTIONS: Please tick your answer based on the questions below.
ARAHAN: Sila tandakan jawapan anda untuk soalan dibawah.

No.	Questions/*Soalan*	Agree/ *Setuju*	Partially Agree/ *Separa Setuju*	Disagree/ *Tidak Setuju*
1.	Usage of repeatedly heated cooking oil for frying food is a good practice as it saves cost and there is no side effect. *Penggunaan minyak masak berulang kali adalah praktis yang baik kerana ia adalah menjimatkan dan selamat.*			
2.	The quality of oil used for frying will remain the same regardless of how many times the oil is reheated. *Kualiti minyak yang digunakan untuk menggoreng kekal sama walaupun dipanaskan semula berulang kali.*			
3.	We can still use the same oil for many times and discard it only when it turns dark. *Minyak yang sama masih boleh digunakan semula dan hanya dibuang apabila ia sudah menjadi gelap.*			

4.	There will be loss of nutrients in the repeatedly heated cooking oil used for frying. *Kehilangan nutrisi akan berlaku didalam minyak masak yang digunakan berulang kali semasa menggoreng.*			
5.	Repeatedly heated cooking oil used for frying cause bad effects to human health. *Penggunaan minyak masak berulang kali untuk menggoreng akan memberikan kesan tidak baik kepada kesihatan manusia.*			
6.	Hypertension, diabetes, tuberculosis, food poisoning and cancer are the diseases associated with the prolonged consumption of repeatedly heating cooking oil. *Darah tinggi, kencing manis, batuk kering, keracunan makanan dan barah adalah penyakit yang dikaitkan dengan kesan pengambilan minyak masak berulang kali dalam jangka panjang.*			
7.	Peroxide presence can be detected in cooking oil especially if using repeatedly heating cooking Oil. *Kehadiran peroksida dapat dikesan di dalam minyak masak terutama sekali jika menggunakan minyak masak berulang kali.*			

8.	If "Agree" (question no. 7), please state source of information obtained regarding the statement. *Jika "Setuju" (soalan no. 7), Sila nyatakan sumber informasi yang diterima mengenai pernyataan berikut.*	**Newspaper & Magazine** ***Surat khabar & Majalah***	**Television** ***Televisyen***	**Internet** ***Internet***	**Family & Friends** ***Keluarga & rakan-rakan***

SECTION C: PRACTICE OF THE USAGE OF REPEATEDLY HEATED COOKING OIL

Bahagian C: Praktis mengenai penggunaan minyak masak berulangan

INSTRUCTIONS: Please tick your answer and fill in the blanks for the questions below.

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

1. Type of cooking oil used/*Jenis minyak masak yang digunakan:*

   ☐ Palm oil/*Minyak sawit* ☐ Coconut oil/*Minyak kelapa*

   ☐ Corn oil/*Minyak Jagung* ☐ Olive oil/*Minyak zaitun*

   Others/*lain-lain*: ……

2. Do you use cooking oil repeatedly for frying?
   Adakah anda menggunakan minyak masak berulangkali semasa menggoreng?

   ☐ Yes/Ya ☐ No/Tidak

3. If choose “No” (question no. 2), what are the reasons for not using repeatedly heated cooking oil for frying?
   Jika pilih “Tidak” (soalan no. 2), apakah sebab untuk tidak menggunakan minyak masak berulang kali semasa menggoreng?

   ☐ Harmful to health/*Membahayakan kesihatan*

   ☐ Food will look bad/*Makanan kelihatan tidak menyelerakan*

   ☐ Increases cooking oil’s cholesterol level/
   Meningkatkan tahap kolesterol di dalam minyak masak

4. If choose “Yes” (in Question 2), how many times is the same cooking oil being reused before discarded?
   Jika pilih “Ya” (soalan no. 2), Berapa kali minyak masak yang sama digunakan semula sebelum dibuang?

   ☐ 2 times/*2 kali*

   ☐ 3 times/*3 kali*

   ☐ 4 times or more/*4 kali atau lebih*

5. What are the frying methods applied when using repeatedly heated cooking oil?
   Apakah kaedah menggoreng yang dilakukan semasa menggunakan minyak masak yang telah digunakan berulang kali?

   ☐ Pan frying/*Menggoreng minyak tohor*

   ☐ Deep frying/*Menggoreng minyak penuh*

   ☐ Stir-frying/*Menggoreng kering*

6. What is the method attempted to maintain quality of cooking oil?
   Apakah kaedah yang digunakan untuk mengekalkan kualiti minyak masak?

   ☐ Use fresh cooking oil for cooking purpose every time/
   Menggunakan minyak masak yang baru untuk setiap masakan

   ☐ Maintain small flame while cooking process/
   Mengekalkan api kecil semasa proses memasak

   ☐ Transfer oil in stainless steel or glass container after usage
   Memindahkan minyak kedalam bekas tahan karat atau kaca selepas penggunaan

   ☐ Perform oil filtration to strain food particles or foreign matters in cooking oil/ *Menjalankan penapisan minyak daripada lebihan cebisan makanan atau benda asing*

7. How do you discard the used cooking oil?
   Apakah kaedah yang digunakan untuk mengekalkan kualiti minyak masak?

   ☐ Directly through drainage system and house sink/
   Secara langsung kedalam sistem saliran dan sinki rumah

   ☐ Into the wastebin/
   Kedalam tong sampah

   ☐ Onto the soil/
   Keatas tanah

   Others/*lain-lain*: ……

8. Please state source of information obtained regarding on usage of repeatedly heating cooking.
   Sila nyatakan sumber informasi yang diterima mengenai penggunaan minyak masak berulangan.

   ☐ Newspaper & Magazine/*Surat khabar & Majalah*

   ☐ Television/*Televisyen*

   ☐ Internet

   ☐ Family & Friends/*Keluarga & rakan-rakan*

RECOMMENDATIONS

Bahagian D: CADANGAN

INSTRUCTIONS: Please tick your answer and fill in the blanks for the questions below

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

1. What do you think the most appropriate measure that can be taken by the authorities to increase the level of knowledge, and practice (KP) of repeatedly heated cooking oil among households?
   Apakah cara yang paling sesuai yang anda fikir boleh dilakukan oleh pihak berkuasa untuk meningkatkan tahap pengetahuan, dan praktis (KP) mengenai penggunaan minyak masak berulangan dikalangan masyarakat?

   ☐ Public awareness campaigns/
   Kempen kesedaran awam.

   ☐ Promote through media technology such as the television, internet and radio/
   Mempromosikan melalui teknologi media seperti televisyen, internet dan radio.

   ☐ Public Education by state and district on the proper usage of cooking oil
   Pendidikan awam mengikut negeri dan daerah terhadap pengunaan minyak masak yang sesuai.

   ☐ Develop guidelines on the proper usage of cooking oil/
   Mewujudkan garis panduan pengunaan minyak masak yang sesuai.

If any other recommendation, please specify:
*Jika terdapat cadangan lain** delete where necessary*, sila nyatakan*

Thank you*/Terima Kasih!*

APPENDIX II
GANTT CHART

GANTT CHART FOR RESEARCH PROCESS

RESEARCH ACTIVITIES	FEBRUARY 2021	APRIL 2021	MAY 2021	JUNE 2021	JULY 2021	AUGUST 2021	SEPTEMBER 2021	OCTOBER 2021	NOVEMBER 2021	DECEMBER 2021	JANUARY 2022
Assign supervisor											
Initial meeting with supervisor											
Topic selection											
Gather information											
Prepare proposal											
Ethical Submission											
Proposal Presentation											
Data collection											
Data Analysis											
Research Writing First Draft											
Research Writing Second Draft											
Research Writing Final Draft											
Research Poster presentation											
Research presentation											
Submission of thesis											

APPENDIX III
INFORMED CONSENT FORM

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:

THE LEVEL OF KNOWLEDGE AND PRACTICE OF REPEATEDLY HEATED COOKING OIL AMONG HOUSEHOLD IN PUTRAJAYA, MALAYSIA.

2. INTRODUCTION:

This study is a study or survey about the knowledge and practice regarding the usage of cooking oil in preparing food. You have been asked to join this study as a respondent voluntarily.

The majority of cooking needs the use of cooking oil, which is an essential in a kitchen. Repeatedly usage of the same frying oil becoming a common practice which is mainly intended for cost saving in Malaysia. To cut down on costs, frequent use of the same cooking oil has become widespread in the home. Nonetheless, this approach will result in the production of hazardous substances that will have a negative impact on human health. Consumption of cooking oil on a regular basis over an extended length of time will result in non-communicable diseases such as high blood pressure, diabetes, TB, and cancer. As a result, this study was done to ascertain the level of knowledge and practice about the repetitive heating of cooking oil in households and to raise consumer awareness.

3. WHAT WILL YOU HAVE TO DO?

Before agreeing to participate in this research, it is critical that you read and understand the study information. Your participation is entirely voluntary, and you may withdraw at any moment. You will not be compensated for your time in this study. If you agree to participate in this study, you will be sent with a copy of this form to keep on file. The time taken for this study is estimated to be between 15 and 20 minutes. This study is expected to enrol 321 individuals.

If you agree to participate in this research, you will receive a set of survey questionnaires that you must complete within the specified time period and return to the researcher. This survey form is divided into four sections: Section A (Sociodemographic background); Part B (Knowledge of repeated cooking oil use); Part C (Attitudes toward repeated cooking oil usage); and Part D

(Proposal).

4. WHO SHOULD NOT PARTICIPATE IN THE STUDY?

Individuals that are not willing to participate as well as food sellers.

5. WHAT WILL BE THE BENEFITS OF THE STUDY:

a) TO YOU AS THE SUBJECT?

The questionnaire form offered in this study may provide you with health-related information. The findings of this study are likely to raise awareness among people who use cooking oil on a regular basis.

b) TO THE INVESTIGATOR?

The study's findings on the public's knowledge and practices regarding the repeated use of cooking oil will enable researchers, authorities, and other stakeholders to refer to them. The finding of this study also can be used to raise public awareness about the health risks associated with eating food that using repeatedly heated cooking oil.

6. WHAT ARE THE POSSIBLE RISKS?

This research do not have any risks and effects to the participants. Your responses are completely private and secure. Kindly notify the study staff if you encounter any difficulties or obtain any critical information that may alter your decision to continue participating in this trial.

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

The study's staff will keep the information you provide as confidential. Unless compelled by law, it will not be published publicly. This study's data will not be used to personally identify you. The study's findings may be shared with the public for educational purposes. The researcher, the study's Ethics Committee, and regulatory authorities may review the original study forms and data in order to validate procedures and/or data. Your data will be stored on a computer and will be accessible to and processed by only approved study workers. By signing this permission form, you consent to all the above record review, information storage, and data processing.

8. WHO SHOULD I CONTACT IF I HAVE ADDITIONAL QUESTIONS WHILE PARTICIPATING IN THIS RESEARCH?:

For any inquiries regarding the procedures of the study or your rights as a resppondent, kindly contact:

i. Mr. Mohamad Hafiz Iqbal Bin Mazuan (Researcher)
Contact number: 010-4591305
Email: hafiziqbal235@gmail.com

ii. Dr. Saliza Binti Mohd Elias (Supervisor)
Contact number: 016-2213674
Email: saliza_me@upm.edu.my

Department of Environmental and Occupational Health
Faculty Medicine and Health Sciences
Universiti Putra Malaysia

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 ……..…… Signature ……..…….
(Respondent) (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)

APPENDIX IV
ETHICAL APPROVAL LETTER

Ref. No: UPM/TNCPI/RMC/JKEUPM/1.4.18.2 (JKEUPM)
Date: 11 October 2021

Dear Prof./Dr./Mr./Ms.,

APPLICATION FOR JKEUPM ETHICAL CLEARANCE: APPROVED

With reference to the above, I am pleased to inform you that your application for ethical clearance for the research project entitled **'The Level of Knowledge and Practice of Repeatedly Heated Cooking Oil Among Household in Putrajaya, Malaysia'** has been approved.

Please note that the official letter of approval will be issued as soon as possible. However, the ethical clearance is considered effective from the date of this email, and you may now proceed with your research.

Kindly remind the ethical approval is required in the case of amendments/ changes to the study documents/ study sites/ study team.

Researchers should also complete a Study Final Report upon study completion. The form can be obtained from the Ethics Committee for Research Involving Human Subjects (JKEUPM) website (http://www.tncpi.upm.edu.my/faildokumen).

If you have any enquiries, please contact Ms. Nurulhasanah Ishak (03-97691605) or Ms. Nor Ellia Abd Ajis (03-97691244).

Note: Please use this reference number for any transaction.

- JKEUPM-2021-375

Thank you.

Yours faithfully,

Prof. Dr. Zamberi Sekawi
Chair
Ethics Committee for Research Involving Human Subjects
Universiti Putra Malaysia