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THE ASSOCIATION BETWEEN LEVEL OF KNOWLEDGE AND PRACTICE OF REPEATEDLY HEATED COOKING OIL AMONG THE HOUSEHOLD OF KUANTAN, PAHANG

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BY

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ABSTRACT

THE ASSOCIATION BETWEEN LEVEL OF KNOWLEDGE AND PRACTICE OF REPEATEDLY HEATED COOKING OIL AMONG THE HOUSEHOLD OF KUANTAN, PAHANG

MUHAMMAD AIMAN IRFAN BIN ZAILANI

Objective: This study was conducted to assess the association between the level of knowledge and practice on the usage of repeatedly heated cooking oil (RHCO) among the household in Kuantan, Pahang. **Method:** To identify the level of knowledge and practice of repeatedly heated cooking oil, convenience sampling was used. This study recruited 193 household as the respondents. A set of structured questionnaires was distributed through online platform to get data consists of socio-demographic, knowledge and practice on usage of repeatedly heated cooking oil (RHCO) among the respondents. **Result:** The findings revealed that majority of households in Kuantan, Pahang had good level of knowledge (77.2%) and good level of practice (56.5%) on the usage of RHCO. In addition, this study also showed a significant association between level of knowledge and gender (COR = 0.463, 95% CI = 0.229-0.935, P = 0.032) and marginally associated with monthly income (COR = 1.999, 95% CI = 1.001-3.994, P = 0.050). It revealed that 83.5% male respondents had good knowledge as compared to 70.8% of female. Besides, 81.7% respondents that obtained total household monthly income more than RM 4,850 had good knowledge level as compared to those with lower income (69.9%). Nevertheless, there was no significant association between level of knowledge and practice of RHCO. **Conclusion:** From the findings it was recommended for appropriate health authorities to launch public education initiatives to raise awareness of this little-known but important public health issue regarding RHCO. Future research should focus on uncovering the reasons why men and women have practises and beliefs in different context of RHCO.

Keywords: Knowledge, Practice, Repeatedly Heated Cooking Oil, Household, Kuantan, Pahang

ABSTRAK

HUBUNGAN ANTARA TAHAP PENGETAHUAN DAN AMALAN MINYAK MASAK DIPANAS BERULANG DALAM KALANGAN ISI RUMAH DI KUANTAN, PAHANG.

MUHAMMAD AIMAN IRFAN BIN ZAILANI

Objektif: Kajian ini dijalankan untuk menilai hubungan antara tahap pengetahuan dan amalan penggunaan minyak masak yang dipanaskan berulang kali dalam kalangan isi rumah di Kuantan, Pahang. **Kaedah:** Untuk mengenal pasti tahap pengetahuan dan amalan minyak masak yang dipanaskan berulang kali, "persampelan mudah" digunakan. Kajian ini telah melibatkan 193 isi rumah sebagai responden. Satu set soal selidik berstruktur telah diedarkan melalui platform dalam talian untuk mendapatkan data terdiri daripada sosio-demografi, pengetahuan dan amalan penggunaan minyak masak yang dipanaskan berulang kali dalam kalangan responden. **Keputusan:** Dapatan kajian mendapati majoriti isi rumah di Kuantan, Pahang mempunyai tahap pengetahuan yang baik (77.2%) dan tahap amalan yang baik (56.5%) tentang penggunaan minyak masak berulang kali. Selain itu, kajian ini juga menunjukkan perkaitan yang signifikan antara tahap pengetahuan dan jantina (COR = 0.463, 95% CI = 0.229-0.935, P = 0.032) dan perkaitan yang hamper signifikan dengan pendapatan bulanan (COR = 1.999, 95% CI = 1.001-3.994, P = 0.050). 83.5% responden lelaki mempunyai pengetahuan yang baik berbanding 70.8% responden Wanita. Tambahan lagi, 81.7% responden yang memperoleh jumlah pendapatan bulanan isi rumah melebihi RM 4,850 mempunyai tahap pengetahuan yang baik berbanding mereka yang berpendapatan rendah (69.9%). Namun begitu, tidak terdapat perkaitan yang signifikan antara tahap pengetahuan dan amalan minyak masak yang dipanaskan berulang kali. **Kesimpulan:** Daripada penemuan itu adalah disyorkan untuk pihak berkuasa kesihatan yang sesuai untuk melancarkan inisiatif pendidikan awam untuk meningkatkan kesedaran tentang pengunaan minyak masak yang dipanaskan berulang kali. Penyelidikan masa depan harus menumpukan pada mendedahkan sebab mengapa lelaki dan wanita mempunyai amalan dan kepercayaan yang berbeza.

Kata Kunci: Pengetahuan, Amalan, Minyak Masak Yang Dipanaskan Berulang Kali, Isi Rumah, Kuantan, Pahang

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LIST OF ABBREVIATIONS

KAP	Knowledge, practice and attitude
RHCO	Repeatedly heated cooking oil
WCO	Waste cooking oil
PV	Peroxide Value
AOCS	American Oil Chemist Association
KI	Potassium iodide
UV	Ultraviolet
ROS	Reactive oxygen species
BP	Blood Pressure
FFA	Free Fatty Acid

Chapter 1

Introduction

1.1 Research Background

Vegetable oil is a commonly used source of lipid food for everyday use. In Malaysia, palm oil is the most commonly used cooking or frying oil because it contains 50% saturated and 50% unsaturated fatty acids, making it more durable than other vegetable oils. (Aziz et al., 2018). Given their unsaturated fatty acids and cholesterol-free content, vegetable oils would be considered the healthier option relative to animal fats. In today's fast-paced society, frying is still one of the most popular methods of food preparation. There is high consumption of prepared deep-fried food, particularly in developing countries. The consumption of such fried foods consumes highly oxidized fatty acids.

Edible vegetable oil is the primary ingredient in the creation of fried foods. However, in economic terms, the cost of oil becomes the most critical element thus vegetable oil frequently needs to be heated repeatedly to guarantee cost effectiveness. Cooking oil is often reused, a common practice in Asian countries especially in households, and on the commercial level to reduce costs and maximize profits. The oil is reused before fresh oil is substituted. The major lipid and energy sources, which also act as a key component of bio membrane and hormonal construction blocks, make vegetable oils an essential part of human diets (Ambreen et al., 2020). There have been several studies that showed the harmful effect of usage of repeatedly heated cooking oils due to changes in peroxide value, but the practice appears to be continuing regardless of these studies.

Determination of peroxide value is still the most common chemical method of measuring oxidative deterioration of oils. In other words, it determines the concentration of hydroperoxides. To illustrate this, hydroperoxides and aldehydes are formed when frying

oil is heated to a high temperature. During the cooking process, oil is exposed to an extremely high temperature in the presence of air and moisture. Under these conditions, a complex sequence of chemical reactions occurs, causing the cooking oil's consistency and nutritional content to deteriorate. Cooking oils were frequently heated, resulting in a series of chemical reactions that alter the fat components of the oil via oxidation, hydrolysis, polymerization, and isomerization, eventually resulting in lipid peroxidation and the generation of free radicals that cause oxidative stress. When cooking oil was heated to high temperatures, hydroperoxides and aldehydes are produced. These noxious substances are ingested by food. Following ingestion, these harmful products are transported by food and ultimately reach the gastrointestinal tract, where they then enter the systemic circulation (Leong et al., 2015). Soriguer et al. (2003) stated that constantly RHCO usage was linked with an increased risk of hypertension.

1.2 Problem Statement

In the food processing industry, deep frying is ubiquitous, widespread and one of the most essential processes even in the home kitchen. The explanation is just economically that the oil is costly, and after the first use a great deal of oil remains in the pot, which causes people to use it repeatedly without any regard about the health effects of this oil (Deshmukh, 2019). It is very common in Malaysia for people to reuse cooking oil repeatedly in order to save money, and this practise is often carried out in roadside food stalls, restaurants or even in home kitchens without being aware of the harmful impact of repeatedly reusing cooking oil to body health. For the household, they like to have deep frying food because the food preparation does not take longer time to be served or eaten. Nevertheless, long-term illness can be affected by the utilization of food through RHCO usage (Soriguer et al., 2003).

Repeated heating or frying using the same oil results in physical and chemical changes of oil that are detrimental to human consumption. Lipid peroxidation produces a vast spectrum of volatile or non-volatile components, including free foetal acids, alcohols, aldehydes, kets, hydrocarbons, trans-isomers, cyclic, and epoxy compounds. Additionally,

when the same cooking oil is reused frequently, this results in increased foaming, darkening of the oil's colour, increased viscosity, and off-flavor. While deep-frying, several processes occur, including heat polymerization, hydrolysis, and fast oxidation. A study shows consumption of thermally abused cooking oil in mice feeds has been shown to change genetic cells, exacerbating the growth of late-stage breast cancer (Cam et al., 2019).

Moreover, increased frying practices using the same oil accelerates the development of oxidised and polymerized lipid species, degrading the oil's quality. A high PV measured indicates poor while low of PV illustrate good cooking oil quality. However, households normally were unaware pertaining to detrimental consequences of consuming an excessive amount of deep-fried food in RHCO. Therefore, they often use the same oil again and again due to limited research for public knowledge, and practice towards the usage of RHCO among the household.

1.3 Study Justification

The practice of repeatedly heating cooking oil regularly is very dangerous to humans as it will reduce the health level. However, the health problems of households that arise from food intake that used the same cooking oil are often ignored, although their health could deteriorate dramatically over time. This study is being conducted as a survey regarding level of knowledge and practice of RHCO among the household at Kuantan. The data of the survey were collected by online questionnaire through social media such as WhatsApp, Twitter and Facebook. In short, the result of this survey could be use by Kuantan's Health Authority to organize health campaign or seminar regarding the effect of the RHCO usage among the household in their daily cooking activities. By doing that, the awareness of RHCO usage among the Kuantan's household can be increase in the positive ways with the help from Kuantan's authority.

1.4 Research Question

- What is the socio-demographic of household at Kuantan?
- What is the level of knowledge of RHCO among the household at Kuantan?
- What is the level of practice of RHCO among the household at Kuantan?
- Is there any association between sociodemographic factors and level of knowledge among the household at Kuantan?
- Is there any relationship between level of knowledge and practice of repeatedly heating cooking oil among the household at Kuantan?

1.5 Research Objectives

1.5.1 General Objective

- To determine the association between level of knowledge and practice of repeatedly heated cooking oil among the household in Kuantan, Pahang.

1.5.2 Specific Objective

- To determine the socio-demographic status of household. (age, gender, race, education level, income, monthly food expenses).
- To determine the level of knowledge of RHCO among the household from Kuantan.
- To determine the level of practice of RHCO among the household of Kuantan.
- To determine the association between socio demographic factors and level of knowledge of RHCO among the household of Kuantan.
- To determine the relationship between the level of knowledge and practice of RHCO among the household of Kuantan.

1.6 Research Hypothesis

- There is a significant association between socio demographic factors and level of knowledge on repeatedly heating cooking oil among household from Kuantan.
- The level of practice of RHCO is associated with the level of knowledge among the household from Kuantan.

1.7 Variables

Independent variable: The level of knowledge on RHCO among households.

Dependent variable: The level of practice of RHCO among households.

1.8 Definition of Terms

1.8.1 Conceptual definition

➢ **Socio-Demographic**

Socio-demographic variables included: gender, age, level of education (Koukouli et al., 2002)

➢ **Household**

A household consists of a nuclear family - a man and woman with their children (Unalan, 2005).

➢ **Knowledge**

Knowledge is warranted true belief shows the restrictions supplied by the condition of justification and the nature of truth (Bolisani & Bratianu, 2018)

➢ **Practice**

Acknowledges the individuality of the learning process and the ongoing nature of learning. (Steadman, 2018).

➢ **Repeated Heated Cooking Oil**

Changes in the physical appearance of the oil, such as increased viscosity and darkening in colour, occur when the oil is heated repeatedly. These changes may alter the oil's fatty acid composition, which may be harmful to health (Jaarin & Kamisah, 2012).

1.8.2 Operational definition

➢ **Socio-Demographic**

Socio-demographic factors will be measured using self-administered questionnaires which consist of information about age, gender, race, education level, income and monthly food expenses in Section A of the questionnaire.

➢ **Household**

One or more people share a house together and consume heated cooking oil repeatedly in the residential area.

➢ **Knowledge**

The level of knowledge of household regarding Repeatedly Heated Cooking Oil (RHCO) will be measured through a set of questionnaires. The level of knowledge is divided into 3 categories which are low, medium, and high. Any correct answer for each question in Part B (level of knowledge of RHCO among the respondents) will get 1 mark. Total mark scored in Part B questionnaire will determine the level of knowledge of the household about RHCO.

➢ **Practice**

The level of practice of household regarding Repeatedly Heated Cooking Oil (RHCO) will be measured through a questionnaire. The level of practice is measured on how many time the household use the RHCO. There are 3 level of practice which are bad (5 times or more), moderate (2-4 times), and good (1 time) regarding RHCO usage.

➢ **Repeated Heated Cooking Oil**

Repeatedly usage of the same cooking oil several times before the household dismissed it.

1.9 Conceptual Framework

The figure 1.9.1 below show the independent variables, dependent variables, variables under study and variables not study. There were socio demographic factors that affected the level of knowledge of respondents regarding RHCO. Homebased food seller was excluded from this research.

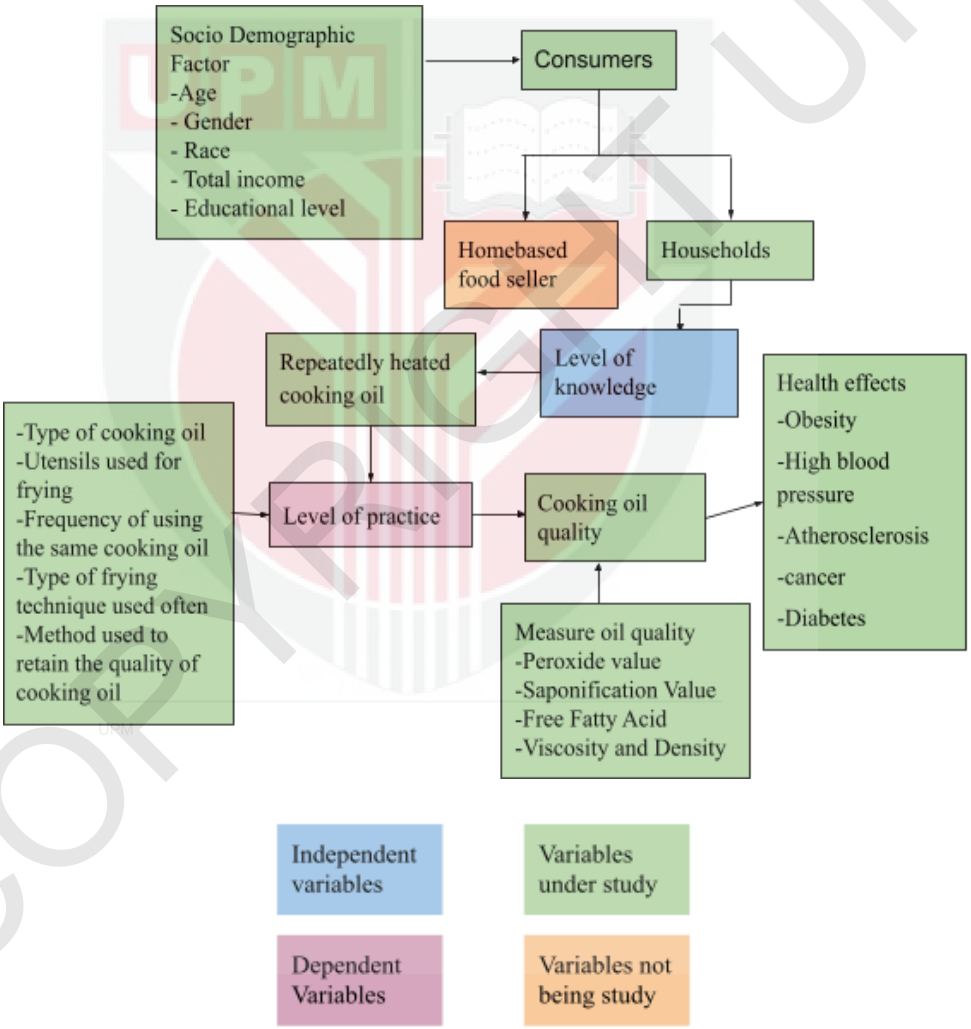

Figure 1.9.1: Conceptual Framework of this study

Chapter 2

Literature Review

This chapter discussed the cooking oil from the perspective of its type, quality, usage in cooking and nutrition value as well as the chemical content, mechanisms, health effects and determination of cooking oil quality related to repeatedly heated cooking oil (RHCO). The methods in determining the cooking oil quality also discussed.

2.1 Cooking oil

Deep-fat frying were one of the most common and widely used food preparation methods. Fried foods have an appealing taste, colour, and crispy texture, which contributes to their popularity among consumers (Boskou et al., 2006). Frying was the method of immersing food in hot oil and bringing the oil, air, and food into contact at a high temperature of 150 to 190 degrees Celsius. Frying creates desirable flavour compounds, changes the flavour stability and consistency of the fried food and its colour, texture and nutrition quality (Choe & Min, 2007). Fried meals were popular because of the appeal of their flavour, aroma, and mouthfeel to consumers. In addition to being the cheapest and easiest technique of cooking, frying was a popular choice for individuals on a limited budget.

Fried meals, despite the fact that they may include polar chemicals or polymers, are generally believed to be safe (Azman et al., 2015). Oils used in food preparation, including frying, baking, dressing, marinating, and extrusion cooking, are a vital part of the human diet. Cooking oils can be divided into numerous varieties. An example is olive oil made from a variety of sources. Because of the fatty acid composition and biological antioxidants in cooking oils, lipids in these fats provide significant nutritional and health benefits. Thermal oxidation, which occurs when freshly prepared cooking oil were heated to high temperatures during various food preparations, was a common occurrence when it

came to cooking oils. (Falade et al., 2017). Cooking oil was a necessary component of daily diet since it contains lipids, an essential source of energy and a key component of biomembranes (Vaskova & Buckova, 2015).

Azman et al. (2015) stated that in their studies the most of the respondents used palm oil for cooked practice. In light of this, Malaysia is the world's leading producer and exporter of palm oil at the time. In Malaysia, palm oil is popular because it is less expensive and more readily available than other cooking oils. Therefore, due to economic reasons, palm oil was the better choice. Besides, palm oil seems were more resistant during heating than soy oil. Previous tests have shown that the specific ingredient of palm oil was better and able withstand heat compare others vegetable oil. To begin, palm oil higher in monounsaturated fatty acids (MUFA) than soy oil, however lower in polyunsaturated fatty acids (PUFA). The high vitamin E content of palm oil may also be a factor in its resistance to thermal oxidation. To clarify this, vitamin E, which effectively prevents the oil's fatty acids from oxidation, degrades with each frying session (Azman et al., 2015). Palm oil has been found to be the main sources of cooking oil in a vast number of developing countries.

2.2 Repeatedly heated cooking oil

2.2.1 Chemical content and mechanisms

Fast food production, the delectable taste of fried food, and significant economic benefits have made deep-fat frying one of the most common methods of food cooking in the average household kitchen (Zhang et al., 2012). A popular practise in households and businesses alike was reusing the frying oil that had previously been used. Thermal oxidation of cooking oils was a common daily occurrence in homes and commercial food industries where edible oils are used for a variety of cooking applications at a range of temperatures from low to very hot (Gupta, 2005). When food is completely submerged in cooking oil at temperatures between 160 and 190 degrees, it was deep fried. During

cooking oil was heated during the deep-frying process, chemical reactions such as oxidation, hydrolysis, and thermal polymerization occur (Azman et al., 2012).

For hydrolysis, when food is fried in hot oil, the moisture in the food condenses to form steam, which evaporates with a bubbling motion and eventually dissipates as the food is fried. Chemical reactions in the frying oil and food are sparked by water, steam, and oxygen. Water, a poor nucleophile, destroys the ester attachment in triacylglycerols, forming diacylglycerols and monoacylglycerols, as well as glycerol and free fatty acids. The content of free fatty acids in frying oil increases in direct proportion to the number of fryings (Chung et al., 2004). The free fatty acid content of frying oil was used to determine its quality. In oil with short and unsaturated fatty acids, hydrolysis was superior instead of long and saturated fatty acid oil because short and unsaturated fatty acids are more water soluble than long and saturated fatty acids. Hydrolysis of short-chain fats and oils was made simple by the presence of water in foods (Nawar, 1969). Significant volumes of water rapidly hydrolyze the oil (Dana et al., 2003). Free fatty acids and their oxidised derivatives impart an off-flavor to the food, making it unsuitable for deep frying. Di- and monoacylglycerols, glycerol, and free fatty acids all aided in the further hydrolysis of oil (Frega et al., 1999).

Next, thermal oxidation follows a chemical pathway that is largely identical to that of autoxidation (Cam et al., 2019). Hydroperoxides are formed as a byproduct of autoxidation, which goes through four separate stages: initiation, propagation I, propagation II, and termination (the last stage). Hydroperoxides can be further degraded to aldehydes and ketones once they are generated. The odours and flavours associated with oxidative rancidity were predominantly caused by the breakdown products of oxidation. Because free radicals are such reactive species, they react quickly with other species once they've been generated. The formed triglyceride free radical combines with an oxygen molecule in step I of propagation to create a hydroperoxy free radical. Step II of propagation includes an attack on another triglyceride molecule by this highly reactive chemical. This results in the formation of another free radical triglyceride radical as well as a reasonably stable hydroperoxide. In order to continue the oxidation reaction and

produce more hydroperoxides, this then interacted with another oxygen molecule. A free radical merger is required for termination to reach its final stage. It was at this moment that one of these methylene groups had a hydrogen removed, creating two possible free radical configurations of triglycerides. Once the double bonds have been created, the location of the free radicals can be changed along the fatty acid chain, allowing the formation of new free radicals. One of four hydroperoxides is created during the propagation step. After the hydroperoxides were autoxidized, the aldehydes were formed. Because the propagation stage hydroperoxides were highly unstable, they degraded further into alkoxy free radicals, resulting in this additional breakdown (Talbot, 2016).

Furthermore, during thermal polymerization, though volatile compounds play a critical role in the flavour characteristics of frying oil and fried foods, volatile compounds were present in the total decomposition products of frying oil at part per million concentrations (Nawar, 1985). Nonvolatile polar compounds and triacylglycerol dimers and polymers are the primary decomposition products of frying oil. Cyclic compounds were abundant in comparison to nonvolatile polar compounds, dimers, and polymers (Dobarganes et al., 2000). Dimers or polymers may be acyclic or cyclic in nature, depending on the reaction process and the form of fatty acids contained in the oil (Tompkins & Perkins, 2000). Dimerization and polymerization were both radical reactions that occur during deep-fat frying. Allyl radicals were preferentially formed at the double bonds of methylene carbons. Dimers are formed when allyl radicals undergo C-C linkage reactions. Peroxy radicals can form peroxy dimers when combined with alkyl radicals. The formation of dimers and polymers is dependent on the type of oil used, the temperature at which it was fried, and the number of fryings (Choe & Min, 2007). Linoleic acidrich oil polymerizes more quickly than oleic acid-rich oil during deep-fat frying (Bastida & Sanchez, 2001).

2.2.2 Health Risks of Consumption of Repeatedly Heated Cooking Oil

Consuming cooking oil that has been heated regularly was unsafe. During cooking process, oil was frequently subjected to high temperatures for prolonged periods of time. Human health may be at risk from the lipid peroxidation products that result from this practise. Previous research on the impact of heated vegetable oils on blood pressure (BP) in both animals and humans has been conducted to determine the relation between heated cooking oil and hypertension. By using heated cooking oil such as palm and soy oils revealed a significant increase in BP on experimental rats (Jaarin et al., 2011). Cooking oil thermal oxidation promote formation of free radicals and had significant role in the pathogenesis of hypertension in rats. A higher likelihood of developing hypertension had been attributed to cooking oil's high concentration of polar molecules.

Cooking oil that has been heated repeatedly raises the chance of developing atherosclerosis, according to the American Heart Association. Atherosclerosis may be caused by lipid peroxidation products, which cause endothelial dysfunction and, in some cases, oxidative stress in endothelial cells. Serum total lipid and low density lipoprotein (LDL) levels have also been associated to the use of cooking oil that has been repeatedly heated (Azman et al., 2015). Consumption of repeatedly heated palm and soybean oils can result in endothelial dysfunction and an increase in contractile responses in male adults Rats Sprague Dawley (Jaarin et al., 2011). Endothelial function testing has been an important method of detecting arterial issues and serves as an early predictor of cardiovascular disease. Damage to the arterial endothelial function in healthy humans occurs as a result of the consumption of fast food that was high in fat and was previously used for deep frying. These findings indicate that ingestion of degradation products generated by fat heating results in endothelial dysfunction (Williams et al., 1999).

Consumption of food cooked in reheated oil for an extended period of time can have a detrimental effect on our antioxidant defence network, resulting in illnesses such as vascular inflammation, diabetes, and hypertension (Leong et al., 2015). The negative health consequences of reheated oil intake extend well beyond the oxidative assaults on

the cellular antioxidant shield, as heated result in the formation of free reactive oxygen species (ROS), which were source of oxidative stress and disruption in various organs throughout the body. Oxidative stress implicated in the pathogenesis of various degenerative diseases including cancer (Halliwell, 2007), Alzheimer disease (Pohanka, 2014), myocardial infarction (Ramond et al., 2013), diabetes mellitus (Yang et al., 2011). The formation ROS as a result of self-oxidation or enzyme-catalyzed oxidation of electrophilic components in reheated cooking oil can result in changes in enzyme levels. From a previous study, Venkata and Subramanyam (2016) stated that blood sample analysis reveals that creatinine, cholesterol and glucose levels have risen, while protein and albumin levels have decreased. Moreover, repeated heating of cooking oil can result in fluid and glucose malabsorption in rats due to deformity of the villus structure caused by dangerous free radicals (Obembe et al., 2011). Mesembe et al. (2004) stated thermally oxidised palm oil causes anaemia and leukocytosis in rats when consumed on a long-term.

2.3 Determination of Cooking Oil Quality

2.3.1 Peroxide Value

The Peroxide value method was still the most widely used chemical method for determining the oxidative degradation of oils. Although hydroperoxides decompose into a mixture of volatile and non-volatile products and often react with endoperoxides and other products, the PV calculation was a useful tool for monitoring the oxidative deterioration of oils, although it should typically be combined with another method for monitoring secondary oxidation products to provide a more complete picture of oxidation progress (Gordon, 2001). Increased a-tocopherol content in an oil can result in an increase in PV while decreasing hexanal formation (Huang et al., 1995). This indicates that a high PV value may represent either increased hydroperoxide formation or decreased decomposition. Polar materials in frying oils are triglycerides and fatty acids, the chemical compositions of which are affected when frying with heat, air, and moisture. Polarity has been defined by a peroxide value (PV), an oil calculation of the hydroperoxide quantity

interacting with a known iodide ion concentration (Cam et al., 2019). PV indicates concentration of hydroperoxide, main byproduct of oxidation. Peroxides liberate iodine from potassium iodide according to this concept (Kong & Singh, 2011). A high quality of cooking oil had peroxide value below 2 Meq/kg (Cheman & Wanhussin, 1998). Fats and oils' quality and stability can be assessed using PV, which has been linked to measurements of rancidity reactions (Ekwu & Nwagu, 2004).

2.3.2 Saponification Value

The saponification value (SV) is a measure a fatty acid's average molecular mass in an oil sample. Smaller fatty acid molecular weight or more ester connections are associated with a lower saponification value. It could mean that fat molecules did not interact (Denniston et al., 2004).

2.3.3 Free Fatty Acid

Measurement of free fatty acid (FFA) and total polar component levels were two ways for determining the quality of oil (Chen et al., 2013). FFA levels were used to reflect the process by which triacylglycerol elements hydrolytic breakdown occurred. The refining process can generally remove crude oils with high concentrations of FFAs constituents. The FFA concentration of refined oil must be lowered by 0.1% (Gunstone, 2008). Tseng et al. (1996) stated that when the FFA concentration of frying oil exceeds 1%, it is recommended that it be discarded. Furthermore, the oils might be rejected if the FFA level was higher than 2%, as claimed by the US Department of Agriculture.

2.3.4 Viscosity and Density

Viscosity measurement was one of the procedures and instruments available for determining the oil's quality. The equipment was designed to determine the production of polymerized and oxidised matter (POM) in spent cooking oil (Stier, 2004). The viscosity of oils is determined by the amount of complicated triglycerides (TGs) present. The arrangement of fatty acids on the glycerol backbone of the triglyceride molecule has the potential to affect the viscosity of the oils. As a result, the length of the chain combined with the chemical features of saturated and unsaturated chains influences the viscosity of oils (Zahir et al., 2014). The viscosity and density decrease with an increase of the unsaturation chain. When the temperature is increased, as well as when the same oil is fried three times, the density of the oils decreases. The density of oils was compared to the Nigerian Standard Organization's standard range of 0.898–0.907 g/ ml (SON, 2000).

2.4 Peroxide Value Measurement

PV values were calculated for frying oil samples using the American Oil Chemists' Society (AOCS) standard titration process. There were milligrammes of active oxygen per kilogramme of crude oil (mEqO2/kg) used to express the peroxide value (Azman et al., 2012) The amount of ROOH (hydroperoxides) produced was then calculated by titration with sodium thiosulfate and the use of a starch indicator. Peroxides are determined by multiplying the amount of sodium thiosulfate (Na2S4O6) absorbed (Kong & Singh, 2011). Along with FFA and PV was a commonly measured consistency parameter during oil processing, storage, and marketing. PV, which was often expressed in milliequivalents of hydroperoxide (ROOH) per kilogramme of oil, was a quantity that indicates the amount of hydroperoxides present in the oil as a result of primary oil oxidation. The first stage of the standard method is the oxidation of KI (in excess of KI) by hydroperoxides in oils. The following stage was volumetric titration of the iodine produced by Na2S2O3 in the presence of a starch indicator: the iodine is complexed with soluble starch, which serves as an indicator, and the iodine is quantified using sodium thiosulfate. Shahidan (2015)

stated that to begin, 2.5 g of each oil sample was added to an Erlenmeyer flask with a volume range of 250 ml – 17 ml and a glass stopper, followed by a weight reading. With a 3:2 ratio, 15 ml of acetic acid and chloroform solution were added, the mixture was shaken to dissolve, and 0.5 ml of KI solution was added using an appropriate volumetric pipet and swirled until saturated. The saturated KI solution was then added to the flask containing the oil sample along with a mixture of starch indicator (0.5 ml) and distilled water (15 ml). Finally, the combination was titrated with 0.1 N sodium thiosulphate. From an oily brilliant yellowish colour, the solution will gradually turn colourless. All samples, including blank samples, are subjected to the same technique three times. The calculation of the peroxide value in meq/kg using the formula below:

$$PV = \frac{(S - B) \times N \times 1000}{W}$$

S = Volume of sodium thiosulphate use for sample titration (ml)

B = Volume of sodium thiosulphate use for blank titration (ml)

N = Normality of sodium thiosulphate

W = Oil sample weight (g)

2.5 Knowledge and Practice on Repeatedly Heated Cooking Oil

A study from Azman et al. (2012) determining the Level of knowledge, attitude and practice (KAP) on the usage of repeatedly heated cooking oil among food outlet operators states that more than half (67.0 %) of the 100 respondents disagreed that repeatedly heating cooking oil was a good idea. The majority (70.0 %) of respondents disagreed that the consistency of cooking oil remained constant regardless of how many times was reused for frying. The majority of respondents (71.0 %) also disagreed that cooking oil can be reused for frying and should be discarded only when it becomes dark. RHCO was deemed unhealthy by 69 people, while cancer was predicted by 43 of those who took part in the survey. According to the data collected in Kuala Lumpur, 63 market food outlet operators out of 100 admitted to deep frying food in repeatedly heated cooking oil. 33 respondents never reused the oil more than twice, while the remainder confessed to doing so up to four times or more (Azman et al., 2012). Kamilah et al. (2015) states that from their studies, several respondents in their study location report using the cooking oil more than twice or before it runs out. This researched established that there was still a lack of community knowledge about the possible harmful health effects of consuming waste cooking oil (WCO). Next, a study performed among 124 of food handlers in Bukit Mertajam, Penang, majority of the respondents has moderate level of awareness on the use of repeatedly heating cooking oil. Additionally, the majority of respondents in the Penang study had a moderate level of practise, using heated cooking oil 2-3 times, while the majority of the remaining respondents (43 %) had a severe level of practise, using heated cooking oil 5 times or more (Aziz et al., 2018). Guillermo et al. (1999) stated that knowledge of how to store heated cooking oil is also low, as heated oil must be stored properly to prevent further reaction during cooling.

2.6 Validated Questionnaire

Aziz et al. (2018) stated that the respondents' data were collected using a modified version of the Abdullah et al. questionnaire. Three parts of information were gathered using a set of pre-tested bilingual (English and Malay) questionnaires: (A) Sociodemographic characteristics; (B) Awareness of the risks associated with repeatedly heating cooking oil; and (C) Practices associated with repeatedly heating cooking oil, as well as the type of cooking oil used in their business. Gender, age, ethnic origin, level of education, and monthly income were all collected as sociodemographic data. Concerning the practise of repeatedly heating cooking oils, respondents provided information on the types of cooking oils used and the frequency with which they recycled the oil before discarding it. Another set of verified standardized questionnaires by Azman et al. (2012) were prepared in both English and Malay language. Three sections were included in the questions. The first section of the questionnaire asks respondents to supply demographic information such as their age, gender, and educational level. The second section of the questionnaire assessed respondents' knowledge on the proper use of RHCO. Cooking oil was subjected to several tests, the results of which were used to determine whether or not it is safe to reheat it multiple times without degrading its nutritional value, whether or not it loses nutrients when heated multiple times, and whether or not different types of cooking oil produce different waste products when heated multiple times each. The final section of the questionnaire assess level of knowledge and practises among the respondents of RHCO.

Chapter 3

Methodology

3.1 Study Design

The cross-sectional study design was chosen to identify the knowledge and practice level of repeatedly heated cooking oil of a population of households at a specific time point. This cross-sectional study conducted over eight-month period from May 2021 to December 2021.

3.2 Study location

This study conducted among the households at Kuantan, Pahang. This location is chosen for the research because the respondents who live there come from different levels of education and income. Hence, the results more detailed. Figure 3.2.1 below shows the map peninsular Malaysia. “X” marked at figure 3.2.1 where the location of Kuantan situated. Figure 3.2.2 shows the Kuantan area zoom in at the google maps.

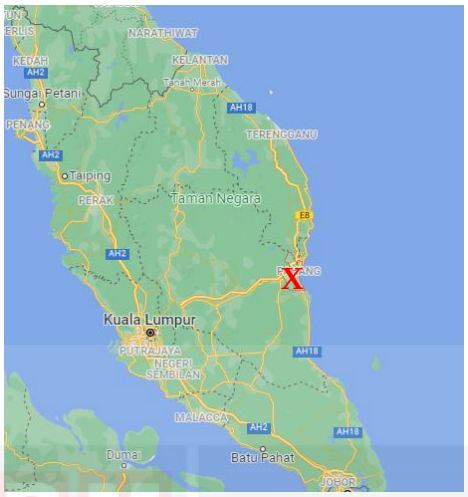

Figure 3.2.1: Maps of Peninsular Malaysia (Source:www.googlemaps.com)

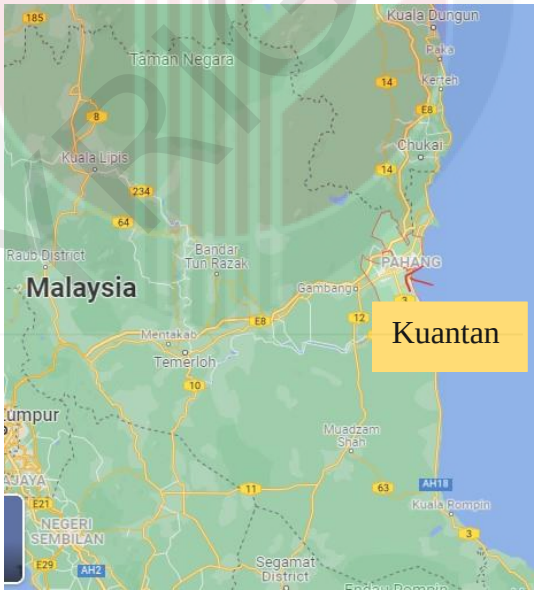

Figure 2.2.2: Zoom in of Kuantan area from google maps

3.3 Sampling Procedure

This study will be conducted upon obtaining the approval from the Ethic Committee for Research Involving Human Subjects of Universiti Putra Malaysia (JKEUPM) and after receiving permission from the village chief. Figure 3.3.1 below shall present the following process of sampling procedure.

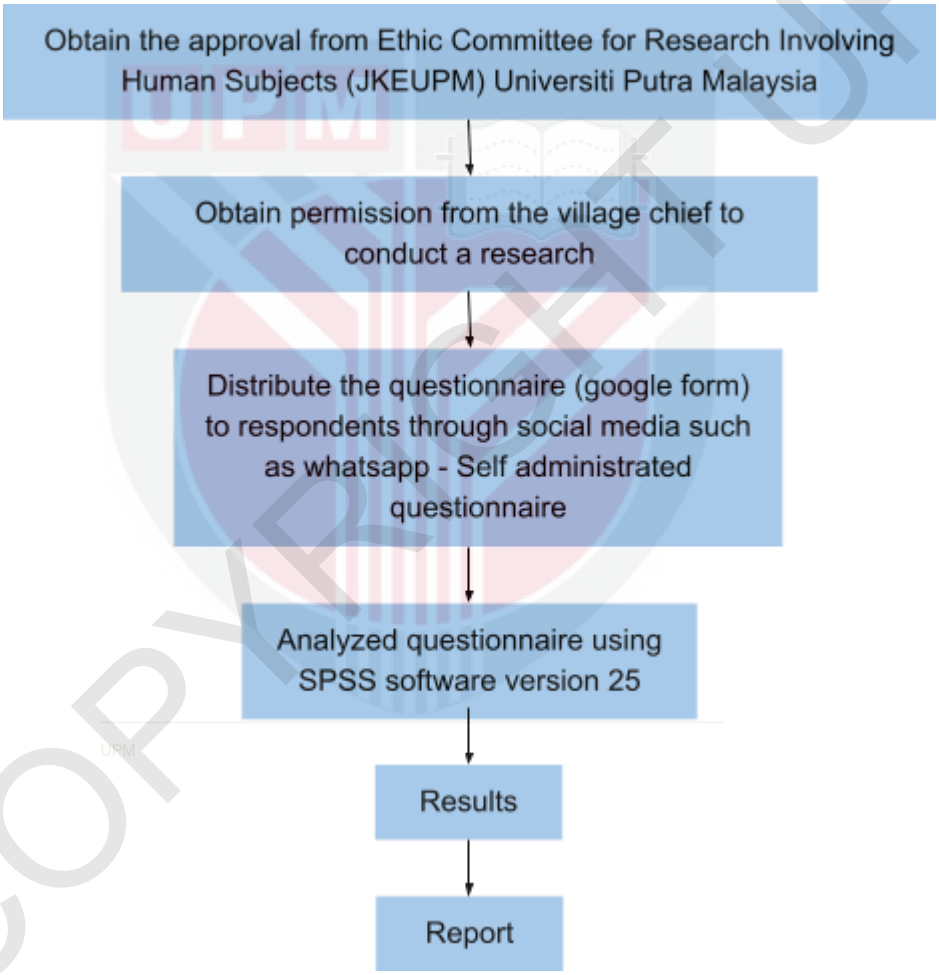

Figure 3.3: Flowchart of the sampling procedure

3.4 Study Sample

The household at Kuantan, Pahang are chosen to participate in this research and subjected to the inclusion and exclusion criteria as follows:

A) Inclusion criteria

- Use palm oil for cooking
- 18 years old and above
- Household from Kuantan, Pahang

B) Exclusion criteria

- Homebased food seller (Food vendor who cook foods and operating their business at home)

3.5 Sampling Method

In this research, a convenience sampling method was conducted among the households from Kuantan, Pahang. This is a non-probability sampling method. The researcher needs to distribute the questionnaire through social media platform such as WhatsApp, Twitter, and Facebook. Respondent who are eligible to answer the questionnaire are welcome to participate.

3.6 Sample Size Calculation

Table 3.6.1 below is the sample size calculation for each specific objective. The highest number from each calculation is considered as minimum number of respondents recruited in this research. The prevalence of practice regarding the usage of RHCO was P= 86.6% (Sivananthan et al., 2013). For one proportion formula with 95% of confidence interval which has 1.96 of standard errors and 5% of desired precision was used for this sample size calculation. Lwanga and Lemeshow (1991) stated that population proportion can be calculated using the formula below:

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

n: sample size

P: Expected prevalence or proportion (86.6% according to Sivananthan et al., 2013)

d: Desired precision (0.05)

Z^2_{1-a} : 1.96

2

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

n: 178.318

n: 179 respondents

The sample size is being selected from the highest of sample size that being calculated was showed in table 3.6.1 where n= 179. However, by considering the response rate= 0.80, the final sample size calculated are shown below:

$$n: \frac{179}{0.80\ (\text{Response rate})}$$

$$n: 223.75$$

$$n: 224$$

Hence, the minimum respondents need in this research is 224.

Table 3.6.1: Sample size calculation for each specific objective

Objective	Formula	Reference	Total sample Size
To determine the level of knowledge of RHCO among the household of Kuantan.	$n = \frac{Z^2_{1-\frac{a}{2}} P(1-p)}{d^2}$ n: sample size P: Expected prevalence or proportion (8%) d: Desired precision (0.05) $Z^2_{1-\frac{a}{2}}$: 1.96 $n = \frac{(1.96)^2(0.08)(1-0.08)}{(0.05)^2}$ n = 114 respondents	Based on the previous study from Ismail (2019) stated that Prevalence of high knowledge is 8% with 95% Confidence interval.	n: 114 respondents

To determine the level of practice of RHCO among the household of Kuantan	$$n = \frac{Z^2_{1-\frac{a}{2}} P(1-p)}{d^2}$$ n: sample size P: Expected prevalence or proportion (86.6%) d: Desired precision (0.05) Z^2_{1-a} : 1.96 2 $$n = \frac{(1.96)^2(0.866)(1-0.866)}{(0.05)^2}$$ n: 178.318 n: 179 respondents	Based on the previous study from (Sivananthan et al., 2013) stated that Prevalence of practice is 86.6% with 95% Confidence interval	n: 179 respondents

To determine the association between socio demographic factors and level of knowledge of RHCO among the household of Kuantan.	$$n = \frac{\left\{\left(Z_{1-\frac{\alpha}{2}}\sqrt{2P\,(1-P)} + Z_{1-\beta}\sqrt{P_1(1-P_1) + P_2(1-P_2)}\right)\right\}^2}{(P_1 - P_2)^2}$$ $P = (P_1 + P_2)/2$ P_1= estimated proportion of exposed with outcome P_2= estimated proportion of unexposed with outcome $Z_{1-\alpha} = 1.96$ 2 $Z_{1-\beta}$ = 80% = 0.842 P1= proportion female with low knowledge = 41/65 = 0.63	Based on the previous study from Ismail (2019) stated that P_1, 0.63 while P_2, 0.43 with 95% Confidence interval	n: 37 respondents
	P2= proportion of male with low knowledge = 25/58 = 0.43 P = (0.63+ 0.43)/2 = 0.53 $n: \frac{\left\{\left(1.96\sqrt{2(0.53)\,(1-0.53)} + 0.842\sqrt{0.63(1-0.63) + 0.43(1-0}\right.\right.}{(0.63 - 0.43)^2}$ n: 36.367 n: 37 respondents		

To determine the relationship between the level of knowledge and practice of RHCO among the household of Kuantan	$= n \frac{\left\{Z_{1-\frac{\alpha}{2}}\sqrt{2P\,(1-P)} + Z_{1-\beta}\sqrt{P_1(1-P_1) + P_2(1-P_2)}\right\}^2}{(P_1 - P_2)^2}$ $P = (P_1 + P_2)/2$ P_1= estimated proportion of exposed with outcome P_2= estimated proportion of unexposed with outcome $Z_{1-\alpha} = 1.96$ 2 $Z_{1-\beta} = 80\% = 0.842$ P1= proportion of low knowledge with low to moderate practice = 33/ = 0.25 P2= proportion of good knowledge with low to moderate practice = 85/111 = 0.77 P = (0.25+0.77)/2 = 0.51 $n = \frac{96\sqrt{2(0.51)\,(1-0.51)} + 0.842\sqrt{0.25(1-0.25) + 0.77(1-0.77)}\}^2}{(0.25 - 0.77)^2}$: 13.37 n: 14 respondents	Based on the previous study from Zahoor (2019) stated that P_1 ,0.25 while P_2, 0.77 with 95% Confidence interval.	n: 14 respondents

3.7 Data Collection and Instrument

Respondents provided with a set of questionnaires to obtain information about their knowledge and practice using repeatedly heated cooking oil. They about 10 minutes to complete the questionnaires with sufficient instruction. The set of questionnaires distributed to the respondents through social media like whatsapp by providing links that have access to google forms where the questionnaires are listed. This survey performed online to allow collection data without risking anyone's health in the situation of a disease pandemic which is Coronavirus Disease 2019 (COVID-19). Therefore, the best alternative method is to do a survey through questionnaires related to RHCO via online.

3.7.1 Questionnaire

This research was conducted through distribution of questionnaires that were modified from Azman et al. (2012). A self-administered questionnaires prepared in bilingual (English and Malay) were distributed to be answered by the respondents. The questionnaire consists of 4 main sections:

Section A: Socio-demographic Information of the Respondents

Generally, demographic survey questions inquire about a population's 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

This section included questions about respondents' understanding of the dangers of repeatedly heating cooking oil and their exposure to peroxide from used cooking oil. A score of 1 be assigned for each agreed response, while a score of 0 be assigned for partially agreeing and disagreeing. Then, the level of knowledge was classified as low (score 0–2), moderate (score 3-5), Good (score 6-7).

Section C: Practice of the Usage of Repeatedly Heated Cooking Oil

This section contains information on the practice of repeatedly heating cooking oil for food preparation. The question raised was the type of oil used, the use of repeatedly heated cooking oil, the frequency of frying using the same oil, the kind of frying technique used often, the way of maintaining the cooking oil quality, the management of waste cooking oil and the source of knowledge gained related to repeatedly heated cooking oil. The prevalence and the relevant factors of respondents who use RHCO were determined. The level of practice was determined based on the frequency of RHCO and classified as low (4 times and above), moderate (3 times), good (2 times and below)

Section D: Recommendations

This last component, which is the recommendation section, encourages responders to provide any relevant ideas for improving and enhancing the level of community knowledge and practice.

3.8 Data Analysis

Data collected from respondents analysed based on the specific objectives of the study, using version 25 of IBM's Social Science Statistical Package (SPSS) software. For the statistical analysis, three of specific objectives of the study were descriptive analysis (frequency and percentage). The three specific objectives were determine the socio-demographic status of household (age, gender, race, education level, income), determine the level of knowledge of RHCO among the household of Kuantan and determine the level of practice of RHCO among the household of Kuantan. Determine the association between socio demographic factors and level of knowledge of RHCO among the household of Kuantan, the statistical that used were chi-square and simple logistic regression. Furthermore, to determine the relationship between the level of knowledge and practice of RHCO among the household of Kuantan used chi-square for statistical analysis.

3.9 Quality Control

3.9.1 Pre-test

The questionnaire was verified by the UPM Ethics Committee for Research Involving Human Subjects (JKEUPM). Pre-testing was carried out on 25 households in Serdang, Selangor. The reliability of the questionnaire was determined using IBM Statistical Package for Social Science (SPSS) version 27, with the Cronbach alpha value used to measure internal accuracy, where the value obtained was 0.728.

3.9.2 Ethical Considerations

This research proposal obtained approval from the Ethics Committee of Universiti Putra Malaysia (JKEUPM) for research involving human subjects and authorised as appropriate to be conducted on study population. Each participant gave their written consent prior to data collection.

3.9.3 Expected Outcome

1. Number of households at Kuantan, Pahang who have high knowledge is more than moderate and low knowledge.

2. From this study, moderate practice among the number of respondents at the area of research are more compared to good and poor practice.

3. There is relationship between the socio-demographic and level of knowledge of repeatedly heated cooking oil (RHCO) among the household from Kuantan, Pahang.

4. The practice on the repeatedly heating cooking oil is associated with the knowledge level of the household in Kuantan, Pahang.

Chapter 4

Result

4.1 Introduction

This chapter reports the findings of the study which includes the socio-demographic data of respondents, their knowledge and practice level on RHCO, association between socio demographic factors and level of knowledge of RHCO and relationship between the level of knowledge and practice of RHCO among the household of Kuantan.

4.2 Response Rate

A total of 193 respondents among households of Kuantan, Pahang who voluntarily took part in this study. Thus, the response rate in this study was 86.2%. The respondents who were excluded from this study were participants who were not live at Kuantan, Pahang, homebased food seller and use others than palm oil during food frying.

4.3 Respondents Socio Demographic Data

A total of 193 of respondents were volunteered to participate in this research. Background of respondents are shows in Table I consists of age, gender, ethnicity, total household income and educational level. For age, the results showed that 151 respondents 78.2% aged between 18 to 50 years old and the remaining 42 respondents 21.8% were above 50 years old. The number of respondents based on gender was 97 (50.3%) male and 96 (49.7%). There were 67.3% of respondents were Malay, 19.7% Chinese and 13.0% Indian. For respondent's total monthly household income, 37.8% of respondents earned less than RM 4,850, 54.4% earned between RM 4,850 and RM 10,959 and 7.8% s earned above

RM 10,959. In terms of educational level, majority of respondents (88.6%) had tertiary level while 11.4% had secondary educational level.

Table 4.3.1: The socio-demographic factors of respondents (N = 193)

Variables	Frequency (n)	Percentage (%)
Age		
18 to 50 years' old	151	78.2
Above 50 years old	42	21.8
Gender		
Male	97	50.3
Female	96	49.7
Race		
Malay	130	67.3
Chinese	38	19.7
Indian	25	13.0
Total Household Monthly Income [k]		
< RM 4,850	73	37.8
RM 4,850 – RM 10,959	105	54.4
> RM 10,959	15	7.8
Educational Level		
Secondary	22	11.4
Tertiary	171	88.6

[k] = Household Income and Basic Amenities Survey Report 2019, Department of Statistics Malaysia (source)

4.4 Knowledge of The Repeatedly Heated Cooking Oil

Based on the 7 questions that been asked through the questionnaire, level of knowledge RHCO can be measured among the residents in Kuantan, Pahang. Table 4.4.1 represents the distribution of answers from respondents regarding the knowledge about RHCO. It shows that 88.1% respondents disagreed that the "usage of RHCO for frying food was a good practice as it saves cost and there was no side effect". In addition, 86.5% respondents disagreed "the quality of oil used for frying remained the same regardless of how many times the oil was reheated" and 85.0% respondents disagreed "we can still use the same oil for many times and discard it only when it turns dark. Furthermore, 85.0% respondents agreed that "loss of nutrients in the RHCO used for frying". Moreover, 89.6% respondents have awareness on how RHCO used for frying cause bad effects to human health. Next, 28.5% choose cancer as type of disease that associate with the prolonged consumption of repeatedly heated cooking oil. 81.9% respondents agree that peroxide presence detected in cooking oil especially if using repeatedly heated cooking oil. For this knowledge 29.5% respondents gained their source of information from internet, 27.5% respondents from newspapers while 24.0% respondents from family and friends.

Table 1.4.1: The level of knowledge of respondents (N = 193)

No.	Question	Frequency (%)
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	8 (4.1)
	Disagree	170 (88.1)
	Not Sure	15 (7.8)
2.	The quality of oil used for frying will remain the same regardless of how many times the oil is reheated.	
	Agree	3 (1.6)

	Disagree	167 (86.5)
	Not Sure	23 (11.9)
3.	We can still use the same oil for many times and discard it only when it turns dark.	
	Agree	25 (13.0)
	Disagree	164 (85.0)
	Not Sure	4 (2.1)
4.	There will be loss of nutrients in the repeatedly heated cooking oil used for frying.	
	Agree	164 (85.0)
	Disagree	0 (0.0)
	Not Sure	29 (15.0)
5.	Repeatedly heated cooking oil used for frying cause bad effects to human health.	
	Agree	173 (89.6)
	Disagree	1 (0.5)
	Not Sure	19 (9.8)
6.	If "Agree" (question no.5), what type of disease do they associate with the prolonged consumption of repeatedly heating cooking oil? (n = 173)	
	Food Poisoning	11 (5.7)
	Cancer	55 (28.5)
	Tuberculosis	47 (24.4)
	Diabetes	13 (6.7)
	Hypertension	45 (23.3)
	Not Sure	2 (1.0)
7.	Presence of peroxide can be detected in cooking oil especially if using repeatedly heated cooking oil.	
	Agree	158 (81.9)

	Not Sure	35 (18.1)
8.	If "Agree" (question no. 7), please state source of information obtained regarding the statement. (n = 158)	
	Newspaper & Magazine	53 (27.5)
	Internet	57 (29.5)
	Family or Friends	48 (24.9)

The score for the knowledge level of respondents towards repeatedly heated cooking oil can be referred in table 4.4.2 Based on the results, a high number of respondents of 149 (77.2%) have a good level of knowledge. 36 respondents (18.7%) have moderate knowledge level while 8 respondents (4.1%) have poor knowledge level.

Table 4.4.2: Results of knowledge level (N=193)

Level of knowledge	**Frequency (n)**	**Percentage (%)**
Good (6-7 score)	149	77.2
Moderate (3-5 score)	36	18.7
Poor (0-2 score)	8	4.1

4.5 Practice of Repeatedly Heating Cooking Oil

Table 4.5.1 shows the distribution of responses by the respondents on questions related to the practice of RHCO. All the respondents (100%) use palm oil for cooking as mentioned in the inclusion criteria of this research. 174 respondents (90.2%) did practice the usage of repeatedly heating cooking oil, but the remaining 19 respondents (9.8%) choose "No" to the repeatedly practice due to reasons such as harmful to health and food will look not appealing. For question 4, 90 out of 174 respondents who practice repeatedly heating cooking oil use of the same cooking oil 2 times or below while other respondents practice repeatedly heating the cooking oil for 3 times or more. Among, 174 respondents who practiced repeated cooking oil, 94 respondents applied deep frying. 65 out of 193 respondents performed oil filtration to strain food particles or foreign matters in cooking oil to maintain quality of cooking oil. 87 respondents voted the way to discard the used cooking oil is by throwing it into dustbin. Next, 54 respondents obtained their source of information regarding the practice of RHCO by reading the newspaper or magazine.

Table 4.5.1: The level of practice of respondents (N = 193)

No.	Question	Frequency (%)
1.	What is the type of cooking oil u`sed?	
	Palm oil	193 (100.0)
2.	Do you use cooking oil repeatedly for frying?	
	Yes	174 (90.2)
	No	19 (9.8)
3.	If choose "No" for (question no. 2), what are the reasons for not using repeatedly heated cooking oil for frying? (n = 19)	
	Harmful to health	8 (42.1)
	Food will look not appealing	5 (26.3)
	Increases cooking oil's cholesterol level	6 (31.6)

4.	If choose "Yes" (in Question 2), how many times is the same cooking oil being reused before discarded? (n = 174)	
	2 times or below	90 (51.7)
	3 times	56 (32.2)
	4 times or more	28 (16.1)
5.	What are the frying methods applied when using repeatedly heated cooking oil? (n = 174)	
	Pan frying	41 (23.6)
	Deep frying	94 (54.0)
	Stir frying	39 (22.4)
6.	What is the method attempted to maintain quality of cooking oil?	
	Use fresh cooking oil for cooking purpose every time	47 (24.4)
	Maintain small flame while cooking process	48 (24.9)
	Transfer oil in stainless steel or glass container after usage	33 (17.1)
	Perform oil filtration to strain food particles or foreign matters in cooking oil	65 (33.7)
7.	How do you discard the used cooking oil?	
	Directly through drainage system and house sink	66 (34.2)
	Into the wastebin	87 (45.1)
	Onto the soil	31 (16.1)
	Others	9 (4.5)
8.	Please state source of information obtained regarding on usage of repeatedly heating cooking.	
	Newspaper or Magazine	54 (28.0)
	Television	47 (24.4)
	Internet	52 (26.9)
	Family or Friends	40 (20.7)

The score for the practice level of respondents towards repeatedly heated cooking oil can be referred in table 4.5.2 Based on the results, 109 respondents (56.5%) have a good level of practice. 56 respondents (29.0%) have moderate practice level while 28 respondents (14.5%) have poor practice level.

Table 4.5.2: Results of practice level (N = 193)

Level of Practice	Frequency (n)	Percentage (%)
Good (2 times or below)	109	56.5
Moderate (3 times)	56	29.0
Poor (4 times or more)	28	14.5

4.6 The Association Between Socio Demographic Factors and Level of Knowledge of RHCO

Table 4.6.1 shows the association between level of knowledge and socio-demographics status of the respondents. The result reveals the frequency of age, gender, race, total household monthly income and educational level of respondents. High percentage of respondents aged 50 years old and above (78.6%) had good knowledge level compared to their younger counterpart (76.8%). In addition, male respondents with good knowledge showed higher percentage (83.5%) as compared to female (70.8%). In terms of race, 84.1% of non-Malay had good knowledge compared to Malay (73.8%). Besides, 81.7% respondents that obtained total household monthly income more than RM 4,850 had good knowledge level as compared to those with lower income (69.9%). Moreover, for educational level respondents of tertiary education had higher percentage (78.9%) of good knowledge compared to secondary education level (63.6%). The result showed that there was a significant association between gender with the level of knowledge ($X^2 = 4.402^a$, P = 0.036). It revealed that 83.5% male respondents had good knowledge as compared to 70.8% of female with good knowledge. The result also implies that there were no significant association between age, race, monthly income and educational level with the respondent's level of knowledge related to RHCO.

Table 4.6.1: Association between socio demographic and knowledge level (N = 193)

Variable	Knowledge Level			X^2	*P*
	Good Knowledge (%)	Poor Knowledge (%)	Total (%)		
Age (Years old)					
18 to 50 years' old	116 (76.8)	35 (23.2)	151 (100)	0.057[a]	0.811
Above 50 years old	33 (78.6)	9 (21.4)	42 (100)		
Gender					
Female	68 (70.8)	28 (29.2)	96 (100)	**4.402[a]**	**0.036***
Male	81 (83.5)	16 (16.5)	97 (100)		
Race					
Malay	96 (73.8)	34 (26.2)	130 (100)	2.548[a]	0.110
Non-Malay	53 (84.1)	10 (15.9)	63 (100)		
Total Household Monthly Income					
< RM 4,850	51 (69.9)	22 (30.1)	73 (100)	3.593[a]	0.058
≥RM 4,850	98 (81.7)	22 (18.3)	120 (100)		
Educational Level					
Secondary	14 (63.6)	8 (36.4)	22 (100)	2.596[a]	0.107
Tertiary	135 (78.9)	36 (21.1)	171 (100)		

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

Table 4.6.2 below shows the result of simple logistic regression between the socio demographic factor with level of knowledge. Simple Logistic regression was performed for a selected socio-demographic factor which were gender and monthly income by using enter method, in order to identify whether it could be a predictor for the level of knowledge on the usage of RHCO. The monthly income was recategorized in this simple logistic regression to test the strength of association with level of knowledge. The monthly income there were only 2 categorized group which were below RM 4,850 and more than RM 4,850 of income. The recategorized of class happened because to stable the data gathered for the association test. The result showed that gender (COR = 0.463, 95% = CI 0.229 – 0.935, P = 0.032) was a predictor for the level of knowledge among respondents. The monthly income (COR = 1.999, 95% CI = 1.001- 3.994, P = 0.050) was marginally associated with level of knowledge. Further details are illustrated in the Table 4.6.2. On the other hand, none of the sociodemographic factors showed significant association with the practice of RHCO.

Table 4.6.2: Simple logistic regression of socio demographic factors with level of knowledge

Predictors N= 193	**COR**	**95% CI**	**P-Value**
Gender			
Male	0.463	0.229 – 0.935	**0.032***
Female			
Monthly Income			
< RM 4,850	1.999	1.001 – 3.994	0.050
≥RM 4,850			

*Significant at P<0.05

4.7 The Association Between Level of Knowledge and Level of Practice of RHCO

Table 4.7.1 shows the association between level of knowledge and level of practice of the respondents regarding RHCO. 55.0% respondents who have good knowledge level also have good practice level. Next, 59.1% of respondents who have poor knowledge level also have good practice level. However, based on the result shows in the table below, there is no significant association between the knowledge level and practice level regarding the RHCO, ($X^2 = 0.227$, P= 0.634)

Table 4.7.1: Association between level of knowledge and level of practice (N = 193)

	Practice Level				
Variable	**Poor (%)**	**Good (%)**	**Total (%)**	**X^2**	**P**
Knowledge level					
Poor	18 (40.9)	26 (59.1)	44 (100)	0.227	0.634
Good	67 (45.0)	82 (55.0)	149 (100)		

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

Chapter 5

Discussion

5.1 Socio-Demographic Characteristics of The Respondents

The result from the table revealed that the surveyed households' age is likely between 18 – 50 years old with 78.2% from total respondents and there was no large difference between number of male and female respondents that participate in this study. 97 respondents are male while 96 respondents are female. This was probably because the ratio between male and female population in Kuantan are in smaller gap. Department of Statistics Malaysia (2020) stated that the ratio between gender in Kuantan on 2019 was 113 male for 100 female. Besides, Malay would be the most predominant ethnic group of respondents (n=130, 67.3%) in this survey. This is in accordance with the Department of Statistics Malaysia (2011) who stated that 63.1% from Malaysian citizens was among the Malay' race. Monthly household income were divide into 3 income group based on Department of Statistics' (DOSM) Household Income and Basic Amenities (HIS/BA) survey of 2019. Top 20% (T20), Middle 40% (M40), and Bottom 40% (B40) are the 3 classification income group. From the survey, 105 (54.4%) respondents were categorized in M40 income group who earned between RM 4,850 – RM 10,959 monthly was the highest number of respondents recorded compared to T20 and B40. This could be related with median monthly income of Kuantan's households mentioned by DOSM which is RM 5,654 on Year 2019.

5.2 Level of Knowledge on Repeatedly Heated Cooking Oil

According to this study, 149 respondents had good degree of understanding about RHCO, compared to 36 respondents who had moderate, and 8 respondents had poor degree level of knowledge. The categorize level of knowledge was based on the scoring from the total question. From the survey, 88.1% of respondents disagree that RHCO usage was a good practice. Next, regardless of how many times the oil was reheated, the quality of the oil used for frying will remain the same in question 2. There were 167 people who disagreed, 3 who agreed, and 23 who not sure. In reality, once it was used in the deep-frying process, the oil quality degraded. Researchers have stated that reheated oil contains larger levels of free fatty acids, hence it was not suggested to use this type of oil in food preparation (Katragadda et al., 2010). Repeated heating degrades the quality of cooking oil by darkening its colour and altering its scent and flavour (Jaarin & Kamisah, 2012).

More respondents (85%) disagreed to discard the oil only when it turns dark. The same finding was found by previous study where repeated oil use was not a desirable practise, and oil should be discarded after each cooking procedure, not kept darken (Sivananthan et al., 2013). When the same cooking oil was reused repeatedly, chemical reactions accelerate foaming, darken the colour of the oil, increase its viscosity, and impart an off-flavor. Thus, repeated heating of the oil might result in chemical and physical degradation of the cooking oil (Leong et al., 2015). Lazarick (2009) stated that Carbonyl secondary oxidation products, glucose, and glycine were all Maillard reaction precursors that significantly influenced the colour change during frying.

85.0% of the 164 people who took the survey agreed that the RHCO was losing nutrients. Nutrient loss occurs when cooking oil was heated repeatedly. Abdullah et al., 2012 confirmed this assumption by stated that vitamin E was destroyed after repeated heating of frying oil. Additionally, repeated heating of cooking oil results in fatty acid oxidation. For question 5, RHCO used for frying cause bad effects to human health, 173 respondents agreed with this statement. Reusing these heated oils is a common practise that may be damaging to tissues due to the increased production of free radicals while frying (Jaarin

et al., 2006). Kamiliah et al. (2015) mentioned consuming large amounts of waste cooking oil was bad practiced. Besides, based on data collected in research imply that it was not advisable to heat cooking oil more than once due to the potential for adverse health effects (Jaarin & Kamisah, 2012).

From the result observed, 55 (28.5%) respondents select cancer as type of disease that associated with the prolonged consumption of repeatedly heating cooking oil. Cancer was linked to the consumption of frequently heated cooking oil (Macrae, 2006). Long-term intake of oil that has been repeatedly heated can have negative health consequences such as cancer (Aziz et al., 2018). However, hypertension and tuberculosis also being chosen by the respondents with 45 (23.3%) and 47 (24.4%) respectively. Fry food with high heat for long periods of time, and cooking oil is frequently exposed to that heat. Lipid peroxidation compounds produced by this process may be harmful to human health. Excess polar molecules found in frequently used frying oil have been linked to an increased risk of developing hypertension. The risk of developing atherosclerosis can be increased by eating frying oil that has been heated repeatedly. Endothelial dysfunction and, possibly, the development of atherosclerosis are the outcomes of oxidative stress caused by lipid peroxidation products. Re-use of vegetable oils led to oil degradation, which in turn led to an increase in blood pressure. (Azman et al., 2012). Hypertension can be the affected by the RHCO usage (Jaarin et al., 2011). Reheated oil can drastically harm one's antioxidant defence network, resulting in ailments such as hypertension, diabetes, and vascular inflammation when consumed over a long period of time (Leong et al., 2015)

Furthermore, 158 respondents (81.9%) agreed that cooking oil contains peroxide, which can be detected when practice RHCO. Oxidation of fats and oils results in the production of hydroperoxides. PV is consequently a measure of the amount of hydroperoxides created during primary oil oxidation and represents the degree of oxidation. The PV value rises when cooking oil is heated (Abdullah et al., 2012). Oils from palm and soy were found to have much higher peroxide values after five heatings than oil heated only once or fresh oil. (Deshmukh, 2019).

5.3 Level of Practice on Repeatedly Heated Cooking Oil

100% of households surveyed in Kuantan, Pahang utilised palm oil for cooking. Given that Malaysia was leading producer and exporter of palm oil, this was hardly surprising. In Malaysia, palm oil was widely used due to its low price and extensive availability, both of which contributed to its popularity. A huge number of developing countries relied on palm oil as their principal source of cooking oil. Because of its low cost, palm oil was the best option for those who frequently fry food in oil. Palm oil appears were more resistant no repeated heating than soy oil. Previous research has indicated that palm oil's particular makeup enables it to endure heat better than soy oil (Abdullah et al., 2012).

From the data collection, 174 respondents who use the cooking oil repeatedly while 19 respondents choose not to use the same cooking oil for frying. Nevertheless, 19 respondents were selected as good practice of repeatedly heating cooking oil usage. Additionally, habit about recycling oil for frying was prevalent. However, there are some people who object to the practise of reusing cooking oil. Reusing cooking oil was out of concern for the appearance of food deep fried in re-used cooking oil, not because they were aware of the dangers of repeatedly heating cooking oil. Repeated heating of cooking oil resulted in an increase in viscosity, a darker colour, froth, and a lower smoke point that makes the oil more harmful when taken with food. Others avoided repeatedly heating cooking oil concerned for their health. Next, some believe that continually heating cooking oil can raise the oil's cholesterol content. Besides, various studies have established that reheated oils are genotoxic (Dung et al., 2006), mutagenic and carcinogenic potential (Srivastava et al., 2010). 56.5% respondents used 2 times or below the same cooking oil before discard. This was not too terrible, given they all used palm oil for frying, which were quite resistant to thermal oxidation, as indicated previously (Abdullah et al., 2012). Moreover, from the past research among food operators in Bukit Mertajam, Penang, where 50% of respondents acknowledged their practice of cooking oil towards reused it twice or less than five times before disposal (Aziz et al., 2018).

More than half respondents applied deep frying method when cooking. The survey shows 94 respondents used to do it. Deep frying had become a common method of food preparation, particularly for frozen fried dishes, snacks, and fast food (Sivananthan et al, 2013). Aziz et al. (2018) expressed that unique flavour, golden brown colour, and crispy texture were the results of deep frying at a high temperature. When oils were used in frying, compounds undergo physicochemical changes such as oxidation, hydrolysis, cyclization, and polymerization before degrading to volatile chemicals (Ku et al., 2014).

Initiation, propagation, and termination are 3 phases that occur during oxidation of oil (Gotoh et al., 2007). Choe and Min (2007) stated that these processes generate additional free radicals such as lipid peroxides, polycyclic aromatic hydrocarbons (PAH), aldehydes, ketones, alcohols, and acids. Furthermore, there are various advantages to deep frying, including rapid cooking, consistent cooked product, energy and cost efficiency, the preservation of micronutrients, and the addition of flavour, colour, and crispiness (Mehta & Swinburn, 2001). Traditionally, frying was a popular food preparation method since it results in a dish that is both visually appealing and flavorful. In today's world, a common problem with cooking oil is that it needs to be heated and used repeatedly. But if the designated authority effectively spreads information about the dangers of cooking oil that has been repeatedly heated, this problem can be resolved.

5.4 Association Between Socio-Demographic and Level of Knowledge of Respondents

To test the strength of socio demographic factors that become the predictor for level of knowledge, simple logistic regression test was used. The outcome of this study revealed that there was a significant association between gender (P = 0.032) and level of knowledge. The result showed, 83.5% male respondents had good knowledge compared to 70.8% female respondents. This showed that, male have a greater understanding of how to use RHCO than female.

From the association test, monthly income (P = 0.50) seen to have marginally association with level of knowledge. Besides, the result showed 81.7% respondents of higher monthly income had good knowledge as compared to 69.9% lower monthly income. According to a survey performed in Kuala Lumpur, the majority of respondents acknowledged to frequently heating cooking oil. Respondents with a higher income level had a greater knowledge of the issue (Jaarin & Kamisah, 2012). For other factors of socio-demographic such as age, race and educational level, there is no significant association with the level of knowledge. This is in the agreement with the previous study, Abdullah et al. (2012) stated that night market food vendors' educational status was not associated with their knowledge regarding RHCO usage.

5.5 Association Between Level of Knowledge and Level of Practice of Respondents

This current study found there was no significant association between the level of knowledge and level of practice among the household in Kuantan related to RHCO, (X^2 = 0.227, P= 0.634). The same finding was found in previous study. There was no significant association between the night market food outlet operators' level of knowledge and practice regarding the usage of repeatedly heated cooking oil (P=0.55) (Azman et al., 2012). This may be due to the experienced they gained throughout their life that determined their practice. For example, even the respondents have poor level of knowledge, but they have good level of practice regarding RHCO as they only practice one or two times of the same oil before discarded it. They either learned it from their family members to use 1-2 times only the same oil or they have higher of monthly income so the consumers can easily get the fresh palm oil.

Chapter 6

Conclusion

6.1 Conclusion

In conclusion, overall, the majority of respondents (77.2%) had good knowledge level on RHCO and the number of respondents with poor level of knowledge were the lowest. The level of knowledge could be correlated with gender where male is 83.5% to have good knowledge. The level of practice regarding RHCO is quite good as 56.5% practiced good on RHCO. Those who practiced frequently repeatedly heating the oil for cooking were due cost effectiveness. There was no significant association found between the level of knowledge and level of practice among the household of Kuantan, Pahang.

6.2 Study Limitations

Limitations of online survey such as the population to which they are distributed cannot be described. To illustrate this, the questionnaire may have gathered demographic information, but it is impossible to generalize the results to people with these demographics because no random sample of people with these demographics was selected. Representative of the population demographics cannot assume among the persons who responded to the survey. Thus, cannot describe the population to which the findings can be generalized. Moreover, respondents with biases may select themselves into the sample also the limitation of online survey. A variety of factors could have resulted in sampling bias. The questionnaire, for example, would have only reached those who had access to the internet and would have only been completed by those who were literate and sufficiently interested in the topic.

6.3 Recommendations

Future research should focus on uncovering the reasons why men and women have practises and beliefs in different contexts. There is a similar divide between rural and urban populations when it comes to their level of knowledge and their level of practise. The findings of this study will serve as a guide for the next step. The government or other relevant entities should provide financial assistance for future study and grant researchers the power to gather data. In addition, some respondents agreed to several recommendations of appropriate measures to curb the lack of proper education of the usage of RHCO, including public awareness campaigns, using media technology to increase promotion, providing public education in the state and district level on its correct handling, and finally, establishing guidelines and legal enforcement to control the adulteration of heated cooking oil. There should be more one-on-one meetings as well as wide media coverage of this little-known household health issue. The appropriate health authorities should launch public education initiatives to raise awareness of this little-known but important public health issue regarding RHCO. Follow-up prospective cohort study is also needed to establish whether the practises and knowledge of households surveyed about RHCO usage have improved.

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APPENDIX I
INFORMED CONSENT FORM

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:

Association Between Level of Knowledge and Practice of Repeatedly Heated Cooking Oil Among The Household of Kuantan, Pahang.

2. INTRODUCTION:

You are invited to participate in a voluntary research study. This study is related to the level of knowledge and practice on the use of cooking oil during food preparation. Cooking oil is a necessity at home as most dishes require cooking oil during food preparation. However, the use of the same cooking oil repeatedly will produce harmful compounds that will adversely affect human health. Consumption of repeatedly heated cooking oil over a long period of time will cause non communicable diseases such as high blood pressure, diabetes, cancer, tuberculosis and more. This study is conducted to determine the association between level of knowledge and practice of repeatedly heated cooking oil as well as the associated factors among the households of Kuantan, Pahang.

3. WHAT WILL YOU HAVE TO DO?

Before you agree to participate in this research study, you are required to read and understand the study information first. Your participation in this study is expected to take only 10 minutes. Your participation for this study is voluntary and you are allowed to withdraw from the study at any time you wish without any cost. There will be no payment provided by participating in this study. A

copy of the consent form will be given to you for your safekeeping when you agree to participate in this study. A total of 224 people is expected to participate in this study. A set of questionnaires will be provided to you which you will need to complete it within the allocated time and return it to the researcher. This questionnaire consists of 4 sections: Section A (Sociodemographic background), Part B (Knowledge of repeated use of cooking oil), Part C (Practice on repeated use of cooking oil) and Part D (recommendation)

4. WHO SHOULD NOT PARTICIPATE IN THE STUDY?

Individuals who refused to get involved as well as food vendors who cooked their food at home are excluded from this study.

5. WHAT WILL BE THE BENEFITS OF THE STUDY:

(a) TO YOU AS THE SUBJECT?

There are no direct benefits to the participants however the participants have the opportunity to contribute to the research development by providing the needed information to the researcher.

(b) TO THE INVESTIGATOR?

This study can provide data on the level of knowledge and practices of repeatedly heated cooking oil as well as the associated factors from the households. This data will be useful in developing programs and campaign to increase the level of public awareness on the health effects due to consuming food which has been prepared using repeated heated cooking oil.

6. WHAT ARE THE POSSIBLE RISKS?

There will be no known risk by participating in this study as the data collection only involved the use of validated questionnaire. All your answers will be treated as private and confidential. Please inform the researcher if you encounter any problems or have any important information that may change your agreement to continue participating in this study.

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

The information you provide will be kept confidential by the researcher. It will not be disclosed publicly unless required by law. The data obtained from this study will not identify you individually. The results of the study may be published for the purpose of knowledge sharing. All original study forms and data may be reviewed by the researcher, the Study Ethics Committee and regulatory authorities for the purpose of validating procedures or data. Your information will be stored in computer and only authorized study personnel are allowed to obtain and process the data. By signing this consent form, you consent to the review of records, storage of information and processing of data as described above.

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

If you have any questions about this research procedure or your rights, please contact;

i. Muhammad Aiman Irfan Bin Zailani (Researcher)
Phone Number: 011-21936808
Email: aimanirfan259@gmail.com

ii. Dr. Saliza Binti Mohd Elias (Supervisor)
Phone Number: 016-2213574
Email: saliza_me@upm.edu.my

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

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)

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

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

Hubungan Antara Tahap Pengetahuan dan Praktis Mengenai Pemanasan Minyak Masak Berulangan Dalam Kalangan Isi Rumah di Kuantan, Pahang.

2. PENGENALAN

Anda dipelawa untuk menyertai satu kajian secara sukarela. Kajian ini adalah berkaitan tahap pengetahuan dan praktis terhadap penggunaan minyak masak semasa penyediaan makanan. Minyak masak merupakan satu keperluan di rumah kerana kebanyakan masakan memerlukan minyak masak semasa penyediaan makanan. Walau bagaimanapun, pengunaan minyak masak berulang kali akan menghasilkan kompaun merbahya yang akan memberi kesan buruk kepada kesihatan manusia. Penggunaan minyak masak berulangan dalam jangka masa yang lama akan menyebabkan penyakit tidak berjangkit seperti darah tinggi, kencing manis, kanser, batuk kering dan banyak lagi. Kajian ini dijalankan untuk menentukan hubungan antara tahap pengetahuan dan praktis mengenai penggunaan minyak masak yang sama berulang kali serta faktor berkaitan dalam kalangan isi rumah di Kuantan, Pahang.

.

3. APAKAH YANG PERLU ANDA LAKUKAN?

Sebelum anda bersetuju untuk menyertai kajian ini, anda dikhendaki untuk membaca dan memahami maklumat kajian terlebih dahulu. Penyertaan anda di dalam kajian ini dijangka mengambil masa 10 minit sahaja. Penyertaan anda di dalam kajian ini adalah secara sukarela dan anda dibenarkan untuk menarik diri pada bila-bila masa. Tidak ada bayaran akan diberi dengan penyertaan anda dalam kajian

ini. Satu salinan borang persetujuan akan diberi untuk simpanan anda apabila anda bersetuju untuk menyertai kajian ini. Seramai 224 orang dijangka akan menyertai kajian ini. Satu set borang kaji selidik akan diberikan dan anda perlu melengkapkannya dalam tempoh masa yang ditetapkan sebelum mengembalikannya kepada penyelidik. Borang kaji selidik ini mengandungi 4 bahagian: Bahagian A (Latarbelakang sosio-demografik); Bahagian B (Pengetahuan mengenai pengunaan minyak masak berulangan); Bahagian C (Praktis mengenai pengunaan minyak masak berulangan); dan Bahagian D (Cadangan).

4. SIAPA YANG TIDAK BOLEH MENYERTAI KAJIAN INI?

Individu yang enggan terlibat dan juga penjual makanan yang memasak makanannya di rumah tidak perlu menyertai kajian ini.

5. APAKAH FAEDAH MENYERTAI KAJIAN INI?

a) KEPADA ANDA SEBAGAI PESERTA?

Peserta tidak akan mendapat faedah secara terus tetapi berpeluang untuk menyumbang kepada pembangunan kajian dengan memberi maklumat yang diperlukan kepada penyelidik.

b) KEPADA PENYELIDIK?

Kajian ini dapat menghasilkan data mengenaii tahap pengetahuan dan praktis mengenai pengunaan minyak masak berulangan serta faktor berkaitan dalam kalangan isi rumah. Data ini boleh digunakan dalam membangunkan program dan kempen untuk meningkatkan kesedaran awam tentang kesan kesihatan kerana memakan makanan yang disediakan menggunakan minyak masak yang dipanaskan berulangan.

6. ADAKAH IA BERISIKO?

Tiada kemugnkinan risiko yang diketahui akibat menyertai kajian ini kerana pengumpulan data hanya melibatkan penggunaan boran kaji selidik yang telah divalidasi. Kesemua jawapan anda adalah dianggap peribadi dan sulit. Sila maklumkan kepada kakitangan kajian sekiranya anda menghadapi sebarang masalah atau mempunyai sebarang maklumat penting yang mungkin mengubah persetujuan anda untuk terus menyertai kajian ini.

7. ADAKAH MAKLUMAT DAN IDENTITI SAYA KEKAL RAHSIA?

Maklumat yang anda berikan akan dirahsiakan oleh kakitangan kajian. Ianya tidak akan dedahkan secara umum melainkan jika ia dikehendaki oleh undang-undang. Data yang diperolehi dari kajian ini tidak akan mengenalpasti anda secara perseorangan. Hasil kajian mungkin akan diterbitkan untuk tujuan perkongsian ilmu. Semua borang kajian dan data yang asal mungkin akan disemak oleh pihak penyelidik, Jawatankuasa Etika kajian ini dan pihak berkuasa regulatori bagi tujuan mengesahkan prosedur dan/atau data. Maklumat anda akan disimpan dalam komputer dan hanya kakitangan kajian yang dibolehkan sahaja dibenarkan untuk mendapatkan dan memproses data tersebut. Dengan menandatangani borang persetujuan ini, anda membenarkan penelitian rekod, penyimpanan maklumat dan pemprosesan data seperti yang dihuraikan di atas.

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

Sekiranya anda mempunyai sebarang soalan mengenai prosedur kajian ini atau hak-hak anda, sila hubungi;

i. Muhammad Aiman Irfan Bin Zailani (Penyelidik)
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Jabatan Kesihatan Persekitaran dan Pekerjaan
Fakulti Perubatan Sains dan Kesihatan
Universiti Putra Malaysia

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 Helaian 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.

Saya 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
QUESTIONNAIRE

Questionnaire

Date/Tarikh:_____

QUESTIONNAIRE/BORANG KAJI SELIDIK

RESEARCH TITLE/TAJUK KAJIAN**:**	THE LEVEL OF KNOWLEDGE AND PRACTICE OF REPEATEDLY HEATED COOKING OIL AMONG THE HOUSEHOLD FROM KAMPUNG DATO ABU BAKAR BAGINDA, SELANGOR
RESEARCHER NAME/NAMA PENGKAJI**:**	MUHAMMAD AIMAN IRFAN BIN ZAILANI

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 penggunaan 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: Latar Belakang 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*

18-50 years old ( ) Above 50 years old ( )

2. Gender/*Jantina:*

Male ( ) Female ( )

3. Races/*Bangsa:*

Malay ( ) Indian ( ) Chinese ( )

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

<RM 4,850 ( ) RM 4,850-RM 10,959 ( ) >RM 10,959 ( )

5. 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.	If "Agree" (question no.5), what type of disease do they associate with the prolonged consumption of repeatedly heating cooking oil? *Jika "Setuju" (soalan no.5), apakah jenis penyakit yang dikaitkan dengan penggunaan minyak masak yang dipanaskan berulang kali?*	<table><tr><td>Food Poisoning</td><td></td></tr><tr><td>Hypertension</td><td></td></tr><tr><td>Cancer</td><td></td></tr><tr><td>Tuberculosis</td><td></td></tr><tr><td>Diabetes</td><td></td></tr><tr><td>Not Sure</td><td></td></tr></table>		
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*	**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. What 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 and below /*2 kali dan kebawah*

☐ 3 times/*3 kali*

☐ 4times 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*

Section D: 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.

i. *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 sila nyatakan:

Thank You/ Terima Kasih!

APPENDIX III
ETHICAL APPROVAL LETTER