



UNIVERSITI PUTRA MALAYSIA

***LEVEL OF KNOWLEDGE AND PRACTICE AMONG BANANA
FRITTER HAWKERS REGARDING OIL QUALITY UNDER KAJANG
MUNICIPAL COUNCIL AND DETERMINATION OF PEROXIDE VALUE
IN REPEATEDLY HEATED COOKING OIL***

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COUNCIL AND DETERMINATION OF PEROXIDE VALUE IN
REPEATEDLY HEATED COOKING OIL**

BY

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**This thesis submitted in fulfilment of the requirement for the degree of Bachelor
Science (Environmental and Occupational Health) from the Faculty of Medicine
and Health Sciences, Universiti Putra Malaysia.**

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ABSTRACT

LEVEL OF KNOWLEDGE AND PRACTICE AMONG BANANA FRITTER HAWKERS REGARDING OIL QUALITY UNDER KAJANG MUNICIPAL COUNCIL AND DETERMINATION OF PEROXIDE VALUE IN REPEATEDLY HEATED COOKING OIL.

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Introduction : Banana fritter is one of the famous local street food and is prepared by deep frying method. Peroxide is a major concern in deep frying session due to its bad effects to the health such as hypertension and cancer. The peroxide can be found in the cooking oil after several cycles of deep frying process and the amount will increase with the increase of repetition. **Objective :** The aim of this study was to evaluate the level of knowledge and practice among banana fritter hawkers regarding oil quality and determination of peroxide value (PV) in repeatedly heated oil used in their food preparation. The socio-demographic information of the respondents, level of knowledge and practice were also identified. This study also assessed the correlation between PV with the level knowledge and practice as well as correlation between practice with knowledge. **Methodology :** The study design was cross sectional study while the sampling method was convenient sampling. The study locations were the night markets under Kajang Municipal Council and the respondents were banana fritter hawkers. The modified questionnaires were used to assess the level of knowledge and practice and its comprised of four sections. The PV was measured using iodometric titration technique from American Oil Chemist Society (AOCS). The IBM SPSS Statistic Version 22 was used to run the statistical analysis for each objective. The statistical analysis used were descriptive analysis, one sample T-test, Spearman correlation and Chi-square. **Result :** There were 123 respondents enrolled this study which consists of 58 male and 65 female. The age of respondents were in the range of 18-56 years old and all of them were Malays. Majority of respondents (92.6%) had secondary education while respondents with tertiary education only 7.3%. The level of knowledge and practice among respondents regarding oil quality were in the moderate level with the percentage of 93.4% and 48.7% respectively. There was a significant correlation between knowledge and practice level of respondents toward oil quality ($r=0.368$, $p=0.001$). In addition, there was a significant association between knowledge level with the respondent's age ($\chi^2=6.217, p=0.013$). There was also a significant relationship between practice level with the age ($\chi^2=6.183, p=0.013$) of the respondents. In term of PV, 14.6% oil samples exceeded the limit of 10 mEqO₂/kg and consider not safe for consumption. There was no significant correlation between PV with knowledge ($r=0.071, p=0.433$) and practice ($r=0.113, p=0.214$) level. **Conclusion :** It is important to increase the practice level of respondents since most of them had moderate level. The knowledge also should be improve as it can influence the respondents practice towards cooking oil. Although most of the samples were below the limit recommended by the AOCs, well planned action is needed to ensure all food especially banana fritters, that reach the customer is in high quality and for safe for consumption.

Keywords : Peroxide, deep frying, banana fritters, knowledge, practice

ABSTRAK
TAHAP PENGETAHUAN DAN AMALAN PENJUAL GORENG PISANG
MENGENAI KUALITI MINYAK MASAK DIBAWAH MAJLIS
PERBANDARAN KAJANG DAN PENENTUAN NILAI PEROKSIDA
DALAM MINYAK MASAK YANG DIPANASKAN BERULANG KALI.

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Pengenalan: Pisang goreng merupakan makanan tempatan yang terkenal dan disediakan melalui kaedah menggoreng. Peroksida yang terhasil daripada kaedah menggoreng sangat dititikberatkan kerana kesan buruknya terhadap kesihatan seperti darah tinggi dan kanser. Peroksida terhasil selepas beberapa kali proses menggoreng dan jumlahnya terus meningkat mengikut kekerapan gorengan. **Objektif:** Tujuan kajian ini adalah untuk menilai tahap pengetahuan dan amalan penjual goreng pisang mengenai kualiti minyak masak di bawah Majlis Perbandaran Kajang dan penentuan nilai peroksida dalam minyak masak yang dipanaskan berulang kali. Kajian ini juga menilai korelasi antara nilai peroksida dengan tahap pengetahuan dan amalan serta korelasi antara amalan dengan pengetahuan responden. **Metodologi:** Kajian keratan rentas telah digunakan dalam kajian ini manakala kaedah pensampelan adalah persampelan yang mudah. Lokasi kajian adalah pasar malam di bawah Majlis Perbandaran Kajang dan para responden adalah penjual pisang goreng. Borang soal selidik yang diubahsuai digunakan untuk menilai tahap pengetahuan dan amalan penjual pisang goreng dan terdiri daripada empat bahagian. PV diukur menggunakan teknik titisan iodimetrik daripada Persatuan Ahli Kimia Minyak Amerika (AOCS). Statistik SPSS IBM Versi 22 digunakan untuk menjalankan analisis statistik bagi setiap objektif. Analisis statistik yang digunakan adalah analisis deskriptif, One sample T-test, Spearman Correlation and Chi-square. **Hasil:** Seramai 123 responden menyertai kajian ini yang terdiri daripada 58 lelaki dan 65 wanita. Umur responden berada dalam lingkungan 18-56 tahun dan semuanya adalah orang Melayu. Majoriti responden (92.6%) mempunyai pendidikan menengah manakala responden dengan pendidikan tinggi hanya 7.3%. Tahap pengetahuan dan amalan di kalangan responden mengenai kualiti minyak berada pada tahap sederhana dengan peratusan 93.4% dan 48.7% masing-masing. Terdapat korelasi yang ketara antara tahap pengetahuan dan amalan responden mengenai kualiti minyak ($r = 0.368$, $p = 0.001$). Di samping itu, terdapat persamaan yang signifikan diantara tahap pengetahuan dengan umur responden ($\chi^2 = 6.217$, $p = 0.013$). Terdapat juga hubungan yang signifikan antara tahap amalan dengan umur responden ($\chi^2 = 6.183$, $p = 0.013$). Dari segi PV, 14.6% sampel minyak melebihi piawai 10 mEqO₂ / kg dan dianggap tidak selamat untuk digunakan. Tidak terdapat korelasi yang signifikan antara PV dengan tahap pengetahuan ($r = 0.071$, $p = 0.433$) dan amalan ($r = 0.113$, $p = 0.214$). **Kesimpulan:** Adalah penting untuk meningkatkan tahap amalan responden kerana kebanyakan mereka mempunyai tahap sederhana. Pengetahuan juga harus dipertingkatkan kerana dapat mempengaruhi amalan responden terhadap minyak masak. Untuk memastikan semua sampel tidak melebihi piawain yang dicadangkan oleh AOCs, kaedah menggoreng yang betul perlu ditekankan terutama kaedah menggoreng pisang goreng, supaya pelanggan memperoleh makanan yang berkualiti dan selamat.

Kata kunci: peroksida, menggoreng, pisang goreng, amalan, pengetahuan

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LIST OF ABBREVIATIONS

PV	Peroxide value
LDL	Low density lipoprotein
AOCS	American Oil Chemists' Society
mEqO₂/kg	Miliequivalents of peroxide per kilogram
KI	Pottasium iodide
SDS	Sodium dodecyl sulphate
SPSS	Statistical Package for Social Science
BHA	Butylated hydroxyanisole
BHT	Butylated hydroxytoluene
PG	Propyl gallate
TBHQ	Tert-butylhydroquinone
MUFA	Monounsaturated fatty acids
PUFA	Polyunsaturated fatty acids

CHAPTER 1

INTRODUCTION

1.1 Background

Deep-frying is a method of dry-heat cooking, using fat or oil to cook foodstuffs. The process works by submerging food entirely in hot liquid. Depending on the type of oil selected and the food being fried, a high temperature of up to 204 ° C (400 ° F) is sustained in a short time to produce golden-brown surface textures. The bubbles will appear and circulating around the food when hits the hot oil. The moisture from the food surface quickly becomes steam, causing the crust formation process to begin. The food that is fried is generally starchy or first coated with a breading or batter. The starches gradually dry on the surface, forming a crispy crust. Once moisture moves out, those oil will migrate inward, but it often sticks to the outside of the food. The quantity of oil absorbed in the food is nearly equal to the quantity of water eliminated during frying (Gavin,2019).

Cooking oil is the most important ingredient to consider when preparing meals. The flavor of food is based not just on how warm the ingredients are, but also on the types and how much time we have cooked the oil. In stores and supermarkets there are many varieties of cooking oil available, including sunflower oil, olive oil, palm oil, grapeseed, soybean oil, peanut oil, and coconut oil. Based on the world consumption of major vegetable oils data, the palm oil consumption is 56.02 million metric tons (Ladela et al., 2008), coconut oil consumption is 3.82 million metric tons (Mendis et al.,2001), olive oil consumption is 3.05 million metric tons (Buil-Cosiales et al.,2008), sunflower oil consumption is 14.07 million metric tons (Binkoski, et al.,2005) and soybean oil consumption is 44.17 million metric tons (Hassan & Abdel-Wahha,2012).

About 548,000 tons of cooking oil were produced in Malaysia in 2017. Based on a monthly survey of the use of cooking oil by the Ministry of Health and the Ministry of Home Trade, Cooperatives and Consumerism, Malaysians used 45 million kilograms of cooking oil per month (Azmi, 2016). Even though many cooking oils are available, reusing oil during the preparation of meals is common and widespread among Malaysians. Furthermore, this practice is not only limited to food stalls on the roadside, but prestigious food outlets in large capital cities across Malaysia also use this method to reduce costs (Jaarin et al., 2011).

1.2 Problem Statement

Banana fritters are one of the most popular local street food because of its delicious and crunchy taste. However, the oil that has been absorbed by the banana fritters can be harmful to the human health if it is prepared using repeatedly heated cooking oil. The usage of repeatedly heated cooking oil is unsafe. This kind of practice is really popular among the banana fritter hawkers in order to cut cost and save money. He reported that 73.2 percent of food operators confessed using cooking oil constantly for frying and 24.8 percent agreed that this is a good practice because it saves costs and there is no side effect (Azman et al., 2015). Only when it becomes foamy, emits bad smell or the color becomes dark is the oil discarded (Phiri & Mangwera, 2006).

During deep-frying, the oil will be exposed to high temperatures for long periods, forming lipid peroxidation products that could harm human health (Lapointe & Couillard, 2006). An increased risk of developing hypertension in regularly used frying oil was related with the presence of residual polar compounds. Regular intake of heated cooking oil may induce atherosclerosis risk (Soriguer et al., 2003). Lipid peroxidation products cause oxidant stress in endothelial cells, which can eventually lead to endothelial dysfunction (William et al., 1999). Increased levels of total serum lipid and low density lipoprotein (LDL) are also linked to the intake of constantly heated cooking oil (Garrido et al., 2004).

A study found that in the cooking oil survey, 84 percent of 215 respondents from the 121-night market had no knowledge of peroxide (Inarah,2015). Lack of knowledge will indicate a negative cooking oil practice as they continued to use the oil repeatedly as long as the color of the oil appears acceptable (Inarah,2015). The oil is discarded when the oil becomes foamy, produces bad smell or when the color of the repeatedly used oil becomes dark, according to literature survey (Azman et al., 2012). These attitudes are popular on the night market across the country among banana fritter hawkers and other sellers. Recycled and reused oils have already been used by many shops and restaurants (Vijaindren,2016). Repeated heating of cooking oil leads to further lipid peroxidation-prone oil (Jaarin, et al., 2011). Moreover, repeated frying oil will distorts the oil quality at different rates (Azman, et al., 2012). Due to poor knowledge and practice, those oils will produce high peroxide. Hence, it is believed that the peroxide value (PV) in repeatedly heated cooking oil is associated with the banana fritter hawkers ' level of knowledge and practice.

1.3 Study Justification

As demand of the deep-fried food in Malaysia highly increased, the consumers might have potential to get any related disease due to the usage of repeatedly heated cooking oil. Consumption of ready-made deep-fried food is high, especially in developing countries (Jaarin et al.,2011). The peroxide produced from repeatedly heated cooking oil were present in the food at the night markets. According to Azman et al (2015), they found that 38 % of the cooking oil samples from the night market in Kuala Lumpur could be considered as not fit for human consumption as peroxide value exceeded the standard.

Besides, the information in literature about knowledge and practice of banana fritter hawkers and detection of peroxide in repeatedly heated cooking oil of banana fritter in Malaysia was very little and limited. It is crucial to detect the peroxide value in cooking oil in order to know whether the peroxide value high in repeatedly heated cooking oil. Hence, the study was conducted to meet a void in research.

1.4 Important of Study

The finding of this study will give the benefits to communities in determining the practice and knowledge on repeatedly heated cooking oils usage among banana fritter hawkers. The practice and knowledge of banana fritter hawkers play an important role in food quality and food hygiene. Good practices on cooking oils will assure the less peroxide present in food. The result of PV from iodometric titration process can be used to guide the communities to choose the food with less peroxide contained which will prevent communities from health problems that may arise from the peroxide exposure, as well as to educate the communities regarding the safe and healthy ways to prepare their food.

1.5 Research Questions

Some of the research questions in this study including

1. What is the level of knowledge and practice among banana fritter hawkers regarding repeatedly heated cooking oil?
2. What is the quality of the repeatedly heated cooking oil from banana fritter hawkers?
3. Is the peroxide value in repeatedly heated cooking oil exceed the standard?
4. Is the socio-demographic background of the banana fritter hawkers associated with their knowledge and practice?

1.6 Research Objectives

General Objective :

To determine the level of knowledge and practice among banana fritter hawkers under Kajang Municipal Council and the peroxide value in repeatedly heated cooking oil used by these respondents.

Specific Objectives :

- 1. To determine the socio demographic background of banana fritter hawkers.**
- 2. To determine the level of knowledge and practice in repeatedly heated cooking oil usage among banana fritter hawkers.**
- 3. To measure the peroxide value in cooking oils and compare them with American Oil Chemists' Society (AOCS) standard of 10 mEqO₂/kg.**
- 4. To determine the association between socio demographic background and the level of knowledge and practice in repeatedly heated cooking oil usage among banana fritter hawkers.**
- 5. To determine the association between the level of knowledge with the level of practice among banana fritter hawkers.**
- 6. To determine the association between the level of knowledge and practice with peroxide value in cooking oil.**

1.7 Definition

1.7.1 Cooking Oil

Conceptual : Plant, animal or synthetic fat used in frying, baking, and other types of cooking. Cooking oil commonly a liquid at room temperature and acts as important thing during food preparation.

Operational : In this study, the cooking oil was collected from banana fritter hawkers that operated in Kajang Municipal Council. The cooking oil was analysed through iodometric titration in the lab to determine the PV.

1.7.2 Banana Fritter Hawkers

Conceptual : Street vendors that were sold banana fritters.

Operational : Street vendors that sold banana fritters in Kajang Municipal Council and they will be act as respondents in this research.

1.7.3 Banana Fritter

Conceptual : A fried meal item made from a batter consisting primarily of ripe bananas (usually overripe) and flour.

Operational : A mixture of banana and flour that was fried in oil between 160 to 180 degrees Celcius until brown.

1.7.4 Peroxide Value (PV)

Conceptual : A value of hydroperoxide formed due to primary oxidation of the cooking oil. Generally, a good quality cooking oil has lower PV.

Operational : The peroxide value is determined by using a peroxide to measure the iodine released from potassium iodide using the titrant solution of sodium thiosulfate. The value of peroxide is expressed as millions of peroxide equivalents per kg of oil. The measurement was repeated to obtain a triplicate measurement using the other oil sample.

1.7.5 Repeatedly Heated Cooking Oil

Conceptual : The same cooking oil use for multiple time during cooking.

Operational : Repeatedly heated cooking oil used by the respondents in the preparation of the banana fritters.

1.7.6 Socio-demographic status

Conceptual: Socio-demographic is a population's characteristics such as age, sex, level of education, family income, marital status, occupation, average family size (Business Dictionary, 2014)

Operational: In this study, it focused on socio-demographic factor such as age, gender and family income level.

1.8 Conceptual Framework

The conceptual framework (Figure 1.8.1) below showed the independent variables, dependent variable, variables under study and variables not being study. Independent variables including age, educational status and gender while dependent variables including knowledge and practice.



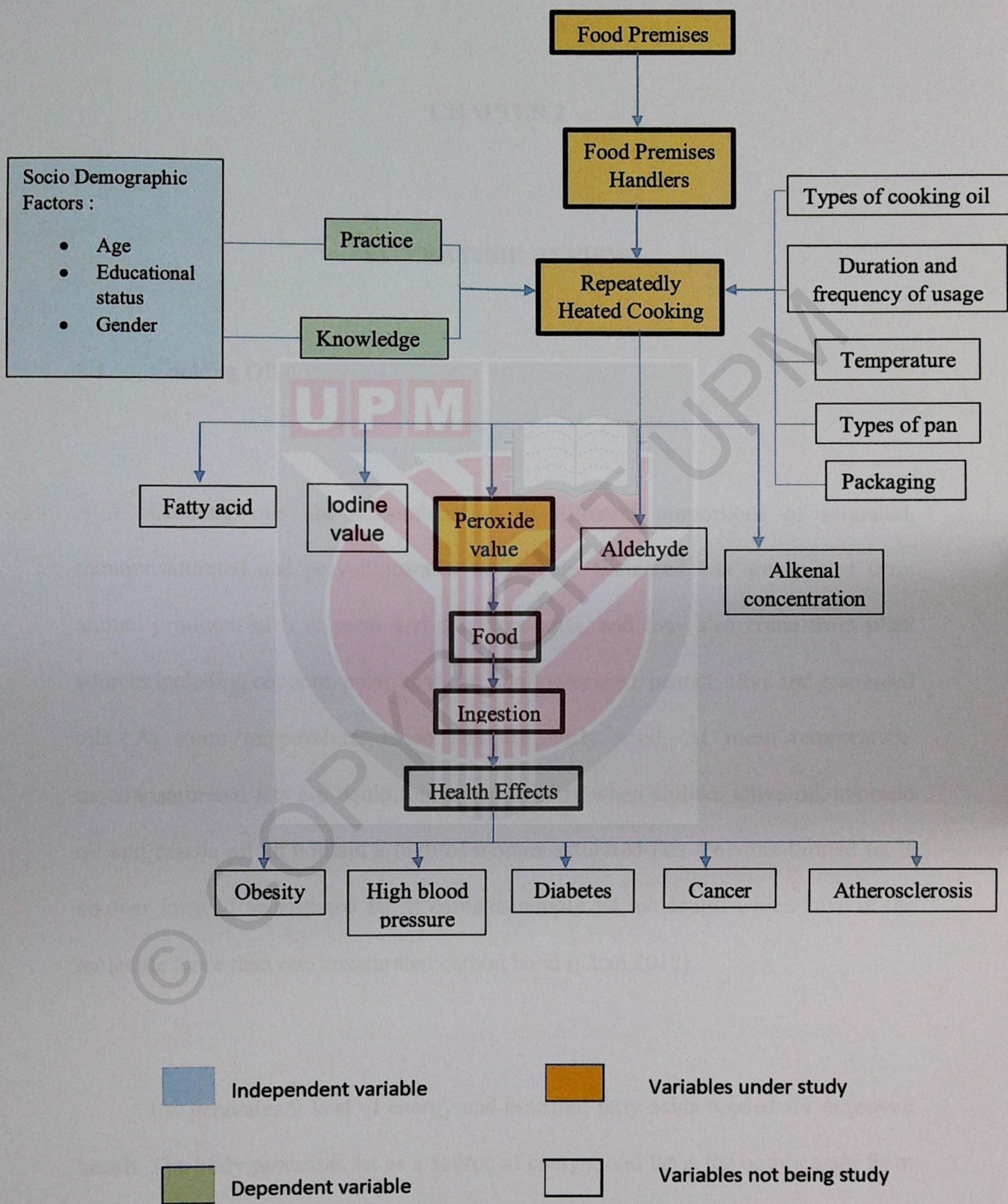


Figure 1.8.1 : Conceptual framework

CHAPTER 2

LITERATURE REVIEW

2.1 Cooking Oil

Cooking oils are a combination of different proportions of saturated, monounsaturated and polyunsaturated fatty acids. Saturated fats are derived from animal products such as meat and dairy products, and they also come from plant sources including coconut, palm, soybean, sunflower seed, peanut, olive and grapeseed oils. At room temperature, these fats are fairly solid. At room temperature, monounsaturated fats are liquid, but it can solidify when chilled. Olive oil, avocado oil and canola oil all contain a high of monounsaturated fats. Polyunsaturated fat is another form of unsaturated fat. It contains simply fat molecules which have in the molecule more than one unsaturated carbon bond (Chan,2018).

Fat generates 9 kcal of energy and essential fatty acids needed for improved health. The body processes fat as a source of energy, and fat is the body's main form of energy storage. Fat also has other important functions in the body, and the diet requires a minimal amount for good health. It helps keep healthy skin and control the metabolism of cholesterol, and contributes to substances called prostaglandins in the

body that regulate other processes in the body. Dietary fat helps to absorb fat-soluble vitamins A, D, E, and K and helps to satisfy the appetite by making it complete after eating (Holzmeister, 2007).

Although the fat performs some of the essential functions in our bodies, due to high fat consumption from the food, it can also contribute to many health problems. such as cancer, heart disease, diabetes, and obesity. Not only that, saturated fat, trans fat, and cholesterol consumption will increase the risk of unhealthy blood fat level. In the ranges between 20 percent and 35 percent of total calories, human needs only the amount of fat. Consuming fat more than 35 percent of total calories can lead to a high intake of saturated fat and can also make it difficult to maintain a desirable level of calorie intake (Holzmeister, 2007).

2.2 Palm Oil

Palm oil is edible vegetable oil obtained from the palm fruit's mesocarp and kernel. There are three palm trees that are *Elaeis guineensis*, *Elaeis oleifera* and *Attalea maripa* which can be used to make palm oil. Palm oil has reddish color due to high levels of beta-carotene in mesocarp while if the palm oil consists of kernel the color may not be red due to lack of carotenoids in the palm kernel. Even so, when the crude palm oil is refined, bleached and deodorized, the carotenoid will destroy (Matthaus,2007).

Palm oil is the most commonly consumed vegetable oil on the world and is practically present in all supermarkets across the world (Chin,2019). For example, palm oil is used in the making of instant noodle and its weight up to 20 % of a pack instant noodle. The noodles are pre-cooked so all you have to do is add hot water. Frozen and fresh pizza dough is also made up of palm oil because the palm oil can prevent it from sticking together and enhance texture. In addition, in margarine, palm oil is used because it is solid at room temperature and free of trans fats. Palm oil also helps to make some chocolate look smooth and shiny and keeps it from melting (Fund,2015).

Palm oil consists of minor components in terms of nutrients that demonstrate primary nutritional and health benefits. These are carotenoids, tocopherols, tocotrienols, sterols, phospholipids, glycerolipids, and squalene (O'Brien, 2010). Carotenoids, tocopherols and tocotrienols maintain palm oil's stability and quality and act as biological antioxidants as well (Wu & Ng, 2007). Tocopherols and tocotrienols function as anti-cancer, anti-inflammatory agents, atherosclerosis control, and cholesterol reduction (Wu et al., 2008). The increasing interest in these micronutrients ' bioactivities has resulted in the development of functional foods or nutraceuticals incorporated with phytosterols, tocopherols, and tocotrienols (Zou et al., 2012).

2.3 Low Grade and Recycled Oil

Cooking oil is revealed at a very high temperature during deep frying and a series of complex chemical reactions will occur with the presence of moisture and air under such condition. This will result in the loss of the cooking oil's quality and nutritional values. Long-term reuse of cooking oil will result in lipid peroxidation. This happens when a series of chemical reactions alter cooking oil's fat constituents through polymerization, oxidation, hydrolysis, and isomerization (Das et al., 2013).

The lipid peroxidation generates the volatile or non-volatile component which includes free fatty acids, trans isomers, ketones, aldehydes, alcohols, hydrocarbons, cyclic and epoxy compounds. As the effect, excessive lipid peroxidation will increase the recycled cooking oil's dark color and viscosity. Recycled cooking oil therefore leads to chemical and physical degradation of the cooking oil (Arvind, 2018).

2.4 Hydroperoxide

Lipid oxidation is triggered by removing an unsaturated fatty acid's energetically weakest bound proton, resulting in an alkyl radical being formed. Radicals of peroxy are formed by reacting with oxygen. They can react with other fatty acids to develop hydroperoxides, the primary oxidation products and new alkyl radicals, demonstrating the autocatalytic character of the lipid oxidation propagation

reaction. While most volatile compounds are lost during the frying process, the degradation products formed during deep frying include both volatile and non-volatile compounds. The non-volatile products of decomposition are primarily due to thermal oxidation and polymerization of unsaturated fatty acids (Ramadan-Hassanien, 2011). The lipid oxidation mechanism is shown in Figure 2.4.1.

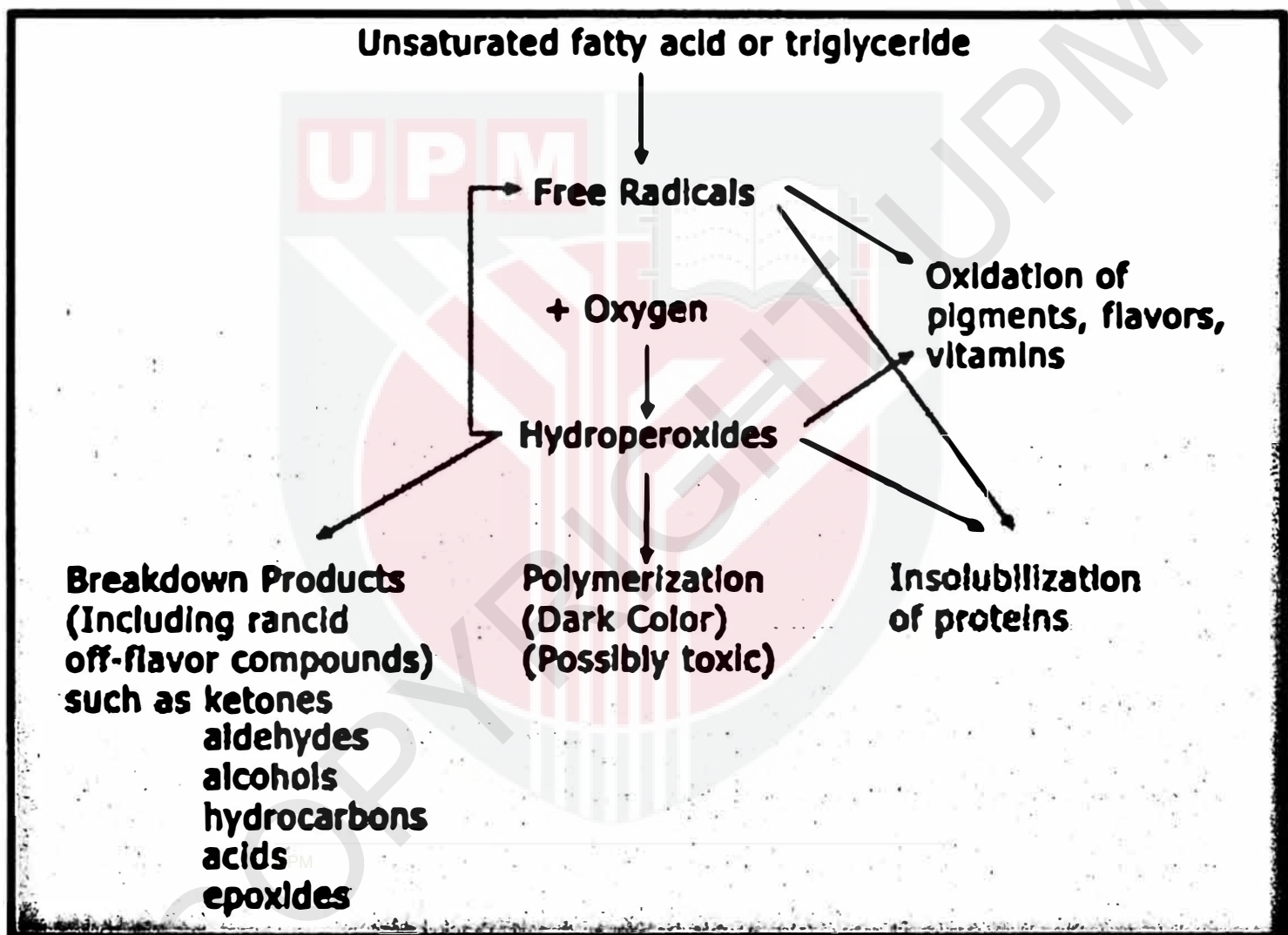


Figure 2.4.1: Lipid Oxidation Mechanism (Food Science & Food Technology, Central Food Technological Research Institute, 2015).

2.5 Peroxide Value

Fat and oils oxidation is an important indicator of oils' performance and shelf-life (Marina, et al., 2013). The process of oxidation is complex depending on the intensity and temperature of the light. Hydroperoxides, peroxides and then peroxide polymers are formed in the first stage (Lupea, 2004). Peroxide value (PV) is associated with the measurement of rancidity reactions that can be used as an indication of fat and oil quality and stability (Ekwu & Nwagu, 2004).

Variations in PV may result from multiple factors such as the degree of unsaturation of the fatty acids present in the particular oil, storage, light exposure, and the content of metals or other compounds that may catalyze the oxidation processes (Choe & Min, 2006). The peroxide value may increase corresponds to the storage time, oil sample contact with air and temperature (Zahir, et al., 2014).

2.6 Oil Changes during Deep Frying

Frying is among the most popular food preparation methods in the world, yet the frying oil's quality significantly impacts the quality of the fried food in it. As deep-fat frying is normally performed at high temperatures (between 160 and 180 ° C) and in the presence of air and moisture, the physical and chemical properties of the oil change significantly due to hydrolysis, oxidation and thermal changes that directly affect the functional, sensory and nutritional quality of the oil (Shaker, 2015).

As these reactions continue, the oil quality changes and eventually reaches a point where high-quality fried products can no longer be prepared and the frying oil must be discarded. The quality of the frying medium is therefore crucial to the finished products' nutritional quality and shelf-life (Ramadan-Hassanien,2011). Examples of deep fried food which can be found in a typical Malaysian night market (pasar malam)

include potato chips (French fries), goreng pisang (fried banana fritters), goreng ubi (fried tubers such as fried sweet potato, yam or cassava fritters), keropok lekor, fried fish cakes, fried chicken and fried sausages.

2.7 Iodometric Titration

This method describes the determination of peroxide values for oils and fats from animals, vegetable oils and fats, as well as flavor and fragrance materials. The peroxide value is a variable that specifies the oxygen content as peroxide in a substance, particularly hydroperoxides. The value of peroxide is a measure of the present oxidation. The sample is treated with a mixture of acetic acid and an appropriate organic solvent in solution and then with a potassium iodide solution. The released iodine is titrated with a standard sodium thiosulfate solution.

Peroxides and related products under test conditions which oxidize potassium iodide may contribute to the value of peroxide. The results may be affected by procedural variations. Peroxide values are either expressed in milliequivalent peroxide / kg or peroxide / 1 millimoles. The peroxide value is determined by measuring the iodine released by a potassium iodide from peroxide using a solution of sodium thiosulfate as a titrant (AOCS,2011).

2.8 Health Effects

Antioxidant such as tocopherol can initially prohibit lipid peroxidation. Repeated heating, however, eventually decreases the oil's antioxidant content. As a result, the remaining drained antioxidants in the oil may not be able to protect against free radicals and oxidative damage. Excessive free radicals cause a shift in the human body's redox state, resulting in lipid peroxidation. Even though lipid peroxidation is a natural, unabated process, it is a important step in fundamental deteriorating mechanisms including cell injury, enzyme damage and mutagenesis of nucleic acid (Ayala, et al., 2014).

Ultimately, oxidative damage to lipid architectures can lead to disorganization and dysfunction of membranes, enzymes, and proteins (Halliwell, 1997). Lipid peroxidation subsequently inhibits membrane functions, inactivates membrane-bound receptors or enzymes, and disturbs ion permeability and fluidity, eventually leading to

rupture of the membrane (Gutteridge, 1995). A recent research in our department demonstrates that constantly heated soy oil consumption could lead to an increase in lipid peroxidation and LDL in ovariectomized female rats (simulating a post-menopausal state with human oestrogen deficiency) (Siti, et al., 2008).

In addition, reactive electrophilic harmful byproducts resulting from such lipid peroxidation reactions, namely α - and β -aldehydes, are also damaging to cell viability (Auczaj & Skrzydlewska, 2003). Lipid peroxidation causes gene expression alterations and immunological responses (Yadav & Ramana, 2013). Oxidative damage can deteriorate over time, leading to cell injury and pathologies, including cardiovascular diseases (Rumley, et al., 2004) and inflammatory disorders (Deaney, et al., 2001).

2.9 Practice and Knowledge on Cooking Oil

Currently, no standard guideline for measuring the cooking oil quality used in this country by food outlet operators. Furthermore, it is not regulated how long or how many times the cooking oil is used before it is discarded by food outlet operators. Recent survey on night food operators revealed that they used the cooking oil only once, but the oil was used continuously for long-term deep frying food, which is a bad practice that makes the oil susceptible to thermal oxidation and degradation. The reason they did not re-use cooking oil was not because of their awareness of the risks of consuming repetitively heated cooking oil, but because of their worries about the

physical attractiveness of food if deep fried using re-used oil. There is a lack of knowledge among night market food outlet operators about proper frying techniques (Aziz et al, 2018).

In this survey, the night market food outlet operators were asked if they followed any official or unofficial (personally made) guidelines when frying deep food using cooking oil, for example, whether they control the temperature of the oil using a thermometer and how long the oil is heated before being overturned, replaced or discarded, all of which replied that they did not follow any guideline. This illustrates a negative attitude on the part of food outlet operators with regard to the use of repetitively heated oil, as they perceived that as long as the oil's color looks desirable, it would be reasonable to use the oil repetitively and continuously, even for the next day to fry another batch of food, which is, of course, a very bad practice (Azman, et al., 2012).

A large number of the food operators surveyed on the night market were conscious that usage of repeatedly heated cooking oil is not safe, although they don't know exactly why. The use of palm oil highlights a good attitude and practice on the part of night food outlet operators, not only because it is made locally, but also healthier than soy oil, even if it is heated up to five times continuously (Shuid, et al., 2007).

CHAPTER 3

METHODOLOGY

3.1 Study Location

This study was targeting the banana fritter hawkers operated under Kajang Municipal Council. It is covered the areas of Kajang, Cheras, Semenyih, Beranang and Hulu Langat. These areas are chosen because to control the quality of samples in term of transportation and the distance to be taken into the laboratory.

3.2 Study Sample

3.2.1 Respondents

The respondents in this study were banana fritter hawkers who sold banana fritters under Kajang Municipal Council.

3.2.2 Repeatedly Heated Cooking Oil Samples

The used of repeatedly heated cooking oils were collected from the banana fritter hawkers under Kajang Municipal Council. An amount of 50 ml cooking oil were collected and stored in a dark bottle to prevent radiation.

3.2.3 Inclusion and Exclusion Criterias

Inclusion : Banana fritter hawkers who are selling banana fritters in Kajang Municipal Council areas.

Exclusion : Banana fritter hawkers who fry banana fritters with other foods using the same cooking oil.

3.3 Study Design

The study design was cross-sectional study. Cross-sectional study is a method by which information such as socio-demographic, knowledege and practice on cooking oil by banana fritter hawkers was gathered in a particular time between January to February 2019. This study was focus on the banana fritter hawkers who used repeatedly heated cooking oil.

3.4 Sampling Method

The sampling method used was convenient sampling. The respondents were selected until the respondents obtained.

3.5 Sample Size

The sample size calculation was based on by Lemeshow et al., (1990) equation for cross-sectional study of one group population. The formula and calculation shown below (Equation 3.5.1 and 3.5.2) :

$$n = \frac{Z_{1-\alpha/2}^2 P(1-P)}{d^2} \quad \text{Equation 3.5.1}$$

Where $Z_{1-\alpha/2}^2$ = z-score (1.96 for 95% confident interval)

P = Anticipated population proportion

(86.6% according to the Sivananthan et al., 2013)

d = Absolute precision required on the either side of the proportion

(Margin of error is $\pm 5\%$ or 0.05)

The calculation of estimated sample size:

$$\begin{aligned}n &= (1.96)^2 \times 0.866 \times (1-0.866)/(0.05)^2 \\&= 3.8416 \times 0.866 \times 0.134/(0.0025) \\&= 0.3408 / 0.0025 \\&= 178.32 \\&= 179 \text{ respondents}\end{aligned}$$

Finite population correction factor.

$$n_a = \frac{n_r}{1 + \frac{(n_r-1)}{N}} \quad \text{Equation 3.5.2}$$

Where n_a = The adjusted sample size

n_r = The original required sample size

N = Population size (total night marker operators registered under MPKJ)

$$\begin{aligned}n_a &= \frac{178.32}{1 + \frac{(178.32-1)}{213}} \\&= 97.31 \\&= 98 \text{ respondents}\end{aligned}$$

Thus, an additional of 20% from the total respondents required to counter non-responsive case and reject questionnaire samples.

$$= 98 + [(98 \div 0.8) \times 0.2]$$

$$= 98 + 24.5$$

$$= 122.5$$

$$\approx 123 \text{ respondents}$$

Therefore, the minimum sample size needed were 123 respondents to participate in this study. The total of 123 respondents who represented 123 stalls were involved. The owner or person who fully responsible in the stall operation were selected to enroll in this study

3.6 Data Collection and Instrumentation

3.6.1 Questionnaire

The interview was conducted based on structured questionnaire. The questionnaire were filled by the researcher during face-to-face interview. A set of questionnaire was established which consists of part A, part B, part C and part D. For the part A, the respondents were asked about their socio – demographic information including age, sex, race, marital status, educational level, income, how long they work per day and type of oil used for frying. In the part B, the information such as the knowledge on the usage of repeatedly heated cooking oil of the respondents were evaluated while in the part C the respondents should answer the questions on the factors affecting cooking oil quality, factors of cooking oil oxidations, peroxide in the repeatedly heated cooking oil and the health effects due to peroxide. Then in part D the question were designed to determine the level of practice on the repeatedly heated cooking oil usage before the cooking oil was discarded. The questionnaires used in this study was adopted from previous study (Azman,2015).

The validity of the questionnaire was assessed through pre-testing on 13 respondents which were UPM's vendors (cafes and workers in UPM). The value obtained for Cronbach's alpha was 0.723. The 13 respondents are represented 10% of the total sample size. Some of the questions were modified prior to the feedback of respondent from the pre-testing.

The answered questionnaires were score based on their knowledge and practice score. A score of one was given for the correct answer and zero score for the incorrect. The questions in part C (questions 1 to 9) and D (questions 1 to 5) were used to calculate the score. For knowledge, the score were categorized into High (7 to 9 socres), Moderate (4 to 6 scores) and Low (0 to 3 scores). For practice, the score were categorized into Good (4 to 5 scores), Medium (2 to 3 scores) and Poor (0 to 1 scores). The scoring range illustrated in Table 3.6.1.1

Table 3.6.1.1 : The Scoring Range for Knowledge and Practice

Category	Level	Range
Knowledge	High	7-9
	Moderate	4-6
	Low	0-3
Practice	Good	4-5
	Median	2-3
	Poor	0-1

3.6.2 Peroxide Value Measurement

There were three main steps in determining the peroxide value. Firstly, the repeatedly heated cooking oil was collected from the banana fritter hawkers in the Kajang Municipal Council areas. Next, the cooking oil sample was analysed through iodometric titration process in the lab to determine peroxide value. Thirdly, the peroxide value result was compared with the AOCS standard to determine whether it was below or exceed the permissible limit. The procedure of this process was shown in figure 3.6.2.2 while in figure 3.6.2.1 showed the instruments and reagents that will be used.

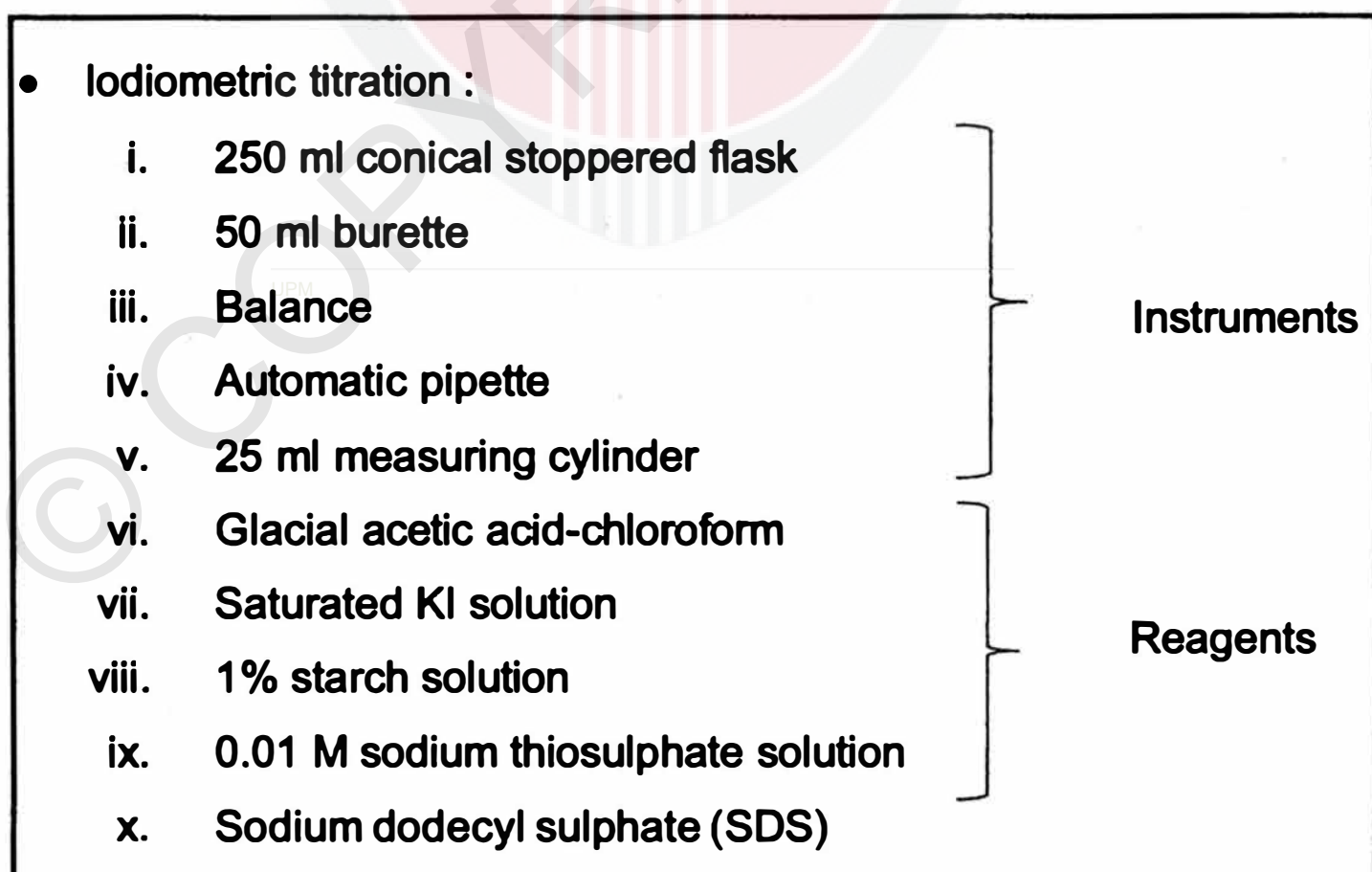


Figure 3.6.2.1 : Instruments and reagents used in titration iodometric.

Preparation of Reagents :

- 1) The acetic acid was mixed with isooctane with the proportion of 3:2.
- 2) Saturated potassium iodide solution was prepared by mixing the potassium iodide with distilled water. The solution considered saturated if undissolved potassium iodide presence.
- 3) Sodium thiosulphate 0.1 M solution was prepared by dissolving 24.8g of sodium thiosulphate in 1L distilled water.

Procedure to measure PV in cooking oils :

- 1) The test portion 5.00 ± 0.05 g of cooking oil sample was weighed into a 250-mL Erlenmeyer flask with glass stopper.
- 2) 50 mL of the 3:2 acetic acid–isooctane solution was added into the sample. The sample was swirled to dissolve the sample.
- 3) 0.5 mL of saturated KI solution was added using a volumetric pipet. The solution was allowed to stand for exactly 1 min, thoroughly shaking the solution at least three times during the 1 min.
- 4) 0.5 mL of 10% SDS was added, and then add about 0.5 mL of starch indicator solution.

5) The solution was titrated with 0.1 N sodium thiosulfate, adding it gradually and with constant and vigorous agitation. The thiosulfate solution was added dropwise until the blue color just disappears.

6) The reading of sodium thiosulfate used to liberate the iodine was taken. Thereafter, the following equation was used to determine PV:

$$\text{Peroxide Value (meq)} = \frac{[\text{Volume of thiosulphate titrate (ml)} \times \text{Concentration of thiosulphate solution (N)} \times 1000]}{\text{Weight of sample (g)}}$$

7) The peroxide value result was compared with the standard. The reference standard of 10meqO₂/kg was according to the American Oil Chemists Society (AOCS).

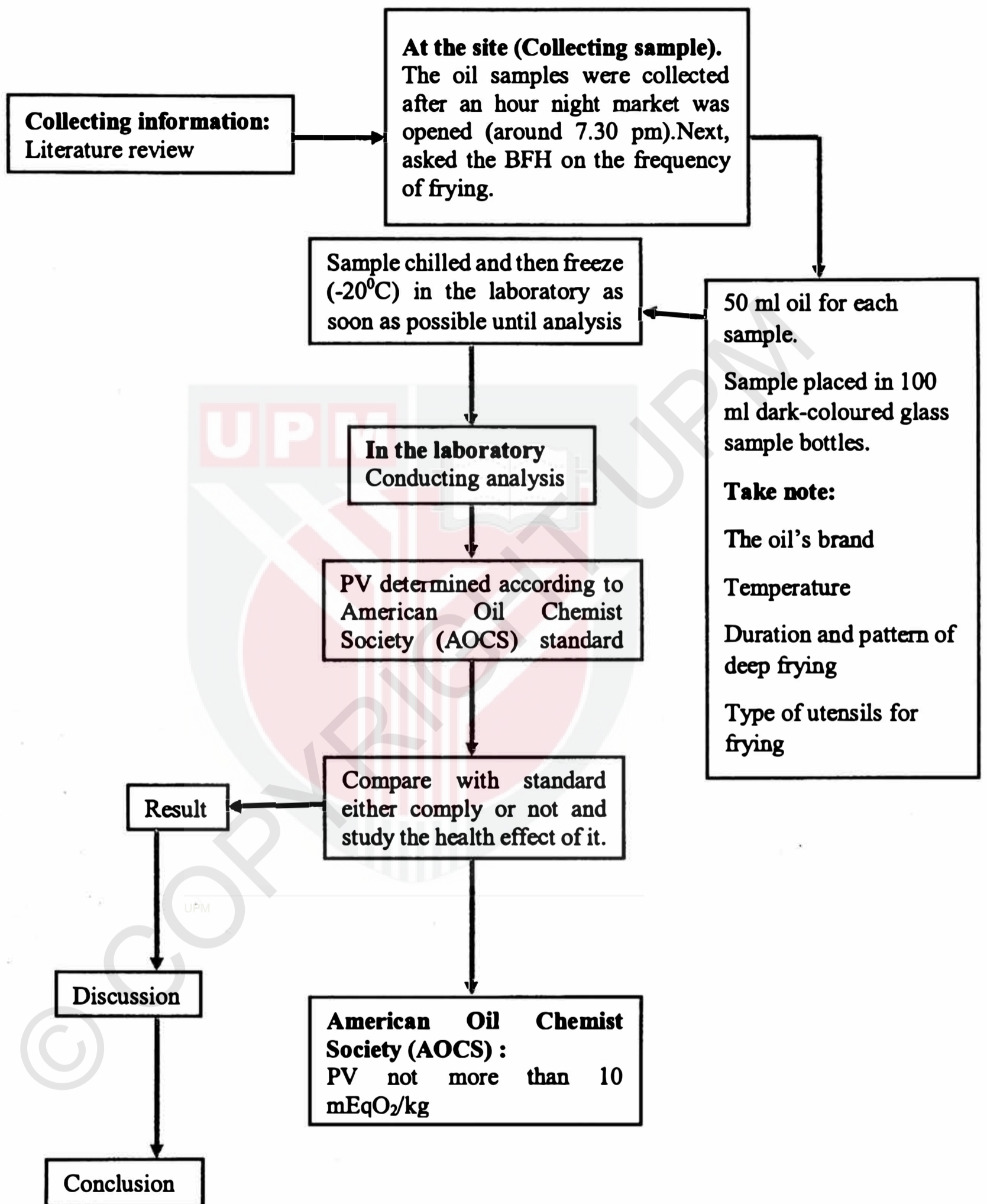


Figure 3.6.2.2: The procedure to measure the total of Peroxide value in the repeatedly heated cooking oil.

3.7 Quality Control

3.7.1 Preservation and storage of cooking oil sample

The dark color bottle was cleaned each day before collection of samples to remove all unnecessary foreign matters Only the dried bottles were used to collect the sample. Next, the volume of samples were collected sufficiently to perform the peroxide analysis. As a precaution step during the experiment all samples were chilled and frozen until analysis of PV (Aziz et al.,2018).

3.7.2 Personal Protective Equipment

In the laboratory, the glove, goggle and full cover lab coat were used during conducting the iodometric titration to prevent any splash or contact to the chemical. Besides, such protection kits also to ensure there was no cross contamination to the samples which can produce error in the readings.

3.7.3 Analysis of PV

The potassium iodide (KI) solution was prepared fresh each day analysis was performed. The KI was stored in the dark when not in use. Besides, a blank determination of the reagents was conducted daily to ensure the result reliability. The blank titration must not exceed 0.1 mL of the 0.1 N sodium thiosulfate solution. Next, the eyes position was parallel to the meniscus of the burette to avoid error during the measurement was taken.

3.7.4 Questionnaire

An adopted questionnaire from Azman et al (2015) was used in this study. The form used in Bahasa Melayu so that the respondents can easily to understand the question given. A pre-test was conducted for the validity of the questionnaire. The aim of this test was to know either the subjects understand the questions in the questionnaire or not. At the same time, the questionnaire was reviewed and edited if there were criticism from the respondents. The same questionnaire was given back to them to ensure the answer was the same.

3.8 Data Analysis

All the data from this study were analysed by using software Statistical Package for Social Science (SPSS) version 22. The statistical analysis used was shown in the table below :

Table 3.8.1 : Statistical analysis tests

Objectives	Variables	Type of Data	Hypothesis	Statistical Analysis
To determine the socio demographic factors of banana fritter hawkers.	- Age - Gender - Education - Races	- Categorical - Continuous	No hypothesis	Descriptive statistic: frequency, percentage, mean, Std
To determine the level of knowledge and practice in repeatedly heated cooking oil usage among banana fritter hawkers.	-Level of knowledge. -Level of practice.	-Categorical -Continuous	No hypothesis	Descriptive statistic (frequency and percentage)
To measure the peroxide value in cooking oils and compare them with American Oil Chemists' Society standard.	-Cooking oil -Peroxide value -AOCs standard	-Continuous	There is a significant association between peroxide value with the standard.	Descriptive statistic: frequency, percentage, median, IQR One sample T-test

<p>To determine the association between socio demographic with the level of knowledge and practice in repeatedly heated cooking oil usage among banana fritter hawkers.</p>	<p>-Age -Education -Gender -knowledge level -practice level</p>	<p>Categorical</p>	<p>There is a significant association between age with the level of knowledge and practice in repeatedly heated cooking oil usage among banana fritter hawkers.</p>	<p>Chi-square</p>
<p>To determine the association between the levels of knowledge and the level of practice in repeatedly heated cooking oil usage among banana fritter hawkers.</p>	<p>-knowledge score -practice score</p>	<p>-Continuous</p>	<p>There is association between the levels of knowledge with the level of practice in repeatedly heated cooking oil usage among banana fritter hawkers.</p>	<p>Spearman Correlation</p>
<p>To determine the association between the level of knowledge and practice among banana fritter hawkers with the peroxide value.</p>	<p>-knowledge score -practice score -Peroxide value</p>	<p>-Continuous</p>	<p>There is association between the level of knowledge and practice among banana fritter hawkers with peroxide value.</p>	<p>Spearman Correlation</p>

CHAPTER 4

RESULT

4.1 Socio demographic background

Table 4.1.1 shows that the socio demographic factors of banana fritter hawkers under Kajang Municipal Council. Based on Table 4.1.1, there were 123 respondents were enrolled this study. From that amount, 58 (47.2%) were males and 65 (52.8%) were females. In term of age, 79 (64.2%) of the respondents were 35 years old and below and the rest 44 (35.8%) respondents were above 35 years old. The median of the respondent's age was 33 and the ranged was from 18 to 56 years old. All banana fritter hawkers that joined this study were malays. Besides, majority (93 %) of the respondents had secondary education. A small percentage of the respondents had tertiary education (7%) with diplomas and a bachelor degree. These respondents sold the banana fritters as their part time job to help their family.

Table 4.1.1 : The socio-demographic background of respondents (N = 123)

Variables	Frequency (%)	Median (IQR)	Range
Gender			
Male	58 (47.2)		
Female	65 (52.8)		
Age (Years)			
<35	79 (64.2)	33 (12)	18-56
>35	44 (35.8)		
Race			
Malay	123 (100.0)		
Educational status			
Secondary	114 (92.6%)		
Tertiary	9 (7.3%)		

4.2 Knowledge and practice on repeatedly heated cooking oil among the respondents.

The description of the frequency and percentage of respondent's answer for part B and C was shown in the table 4.2.1. For the question number 1 "Usage of repeatedly heated cooking oil for frying food is a healthy practice" 70.7 % respondents answered 'no' and 29.3 % answered 'yes'. The correct answer for this question was 'no' and most of the respondents answered it correctly. The respondents were disagreed that usage of repeatedly heated cooking oil for frying food was a healthy practice. Besides, the second question was asked on the usage of repeatedly heated cooking oil for frying food was good for saving cost. Many of the respondents answered 'yes' and this represents 79.7 %. Only 20.3 % of the respondents were answered 'no'. Based on this question many respondents answered it correctly and were agreed that usage of repeatedly heated cooking was one the way to cut cost in business.

For the question number 5 "We can use the oil for many times and discard it only when it turns darks" the percentage of the respondents answered 'yes' was 95.1% and 'no' was 4.9%. Most of the respondents cannot answered this question correctly because they were agreed that the oil could be used for many times and discard it only when it turns darks. "Will repeatedly heated cooking oil used for frying cause bad effects to our health?" and for this question 85.4% answered 'yes' and 14.6% answered 'no'. Not only that, most of the respondents also knew about the peroxide that can be found in the repeatedly heated cooking oil and this represents 98.4 %.

Table 4.2.1 : The frequency and percentage of knowledge level using repeatedly heated cooking oil among respondents (N=123)

No	Question	Frequency
1	Usage of repeatedly heated cooking oil for frying food is a healthy practice.	
	Yes	36 (29.3%)
	No	87 (70.7%)
2	Usage of repeatedly heated cooking oil for frying food is good for saving cost.	
	Yes	98 (79.7%)
	No	25 (20.3%)
3	Usage of repeatedly heated cooking oil for frying food has no side effect.	
	Yes	25 (20.3%)
	No	98 (79.9%)
4	The quality of oil used for frying will remain the same regardless of how many times the oil is reheated.	
	Yes	33 (26.8%)
	No	90 (73.2%)
5	We can use the oil for many times and discard it only when it turns darks.	
	Yes	117 (95.1%)
	No	6 (4.9%)
6	There will be loss in nutrient in the repeatedly heated cooking oil used for frying.	
	Yes	9 (7.3%)
	No	114 (92.7%)
7	The type of cooking oil does not influence the type of constituents produced from the repeatedly heated cooking oil.	
	Yes	13 (10.6%)
	No	110 (89.4%)
8	Will repeatedly heated cooking oil used for frying cause bad effects to our health?	
	Yes	105 (85.4%)
	No	18 (14.6%)
9	Do you know peroxide contain in the repeatedly heated cooking oil?	
	Yes	121 (98.4%)
	No	2 (1.6%)

The description of the frequency and percentage of respondent's answer for part D was shown in the table 4.2.2. Based on this table, majority of the respondents were agreed that fresh oil was a good practice to maintain cooking oil quality. 93.5 % of the respondents answered 'yes' and 6.5 % answered 'no' for this kind of practice. Some respondents thought that small flame can also maintain cooking oil quality and this represents 35.8%. The rest 64.2% were disagreed small flame can maintain cooking oil quality. A part of that, 88.6 % of the respondents chooses stainless steel utensil could be used to maintain cooking oil quality and only 11.4 % were had opposite thought. For the question number 5 "Filter the cooking oil to catch any food leftover or foreign matter" with 83.7% answered 'yes' and 16.3 answered 'no'.

Table 4.2.2 : The frequency and percentage of practice using repeatedly heated cooking oil in deep-frying among respondents (N=123)

No	Questions	Frequency
Choose the methods to maintain the cooking oil quality:		
1	Use fresh oil for every frying.	
	Yes	115 (93.5%)
	No	8 (6.5%)
2	Maintaining small flame during frying.	
	Yes	44 (35.8%)
	No	79 (64.2%)
3	Using stainless steel utensil.	
	Yes	108 (88.6%)
	No	15 (11.4%)
4	Store cooking oil in stainless steel or glass container after used.	
	Yes	16 (13%)
	No	107 (87%)
5	Filter the cooking oil to catch any food leftover or foreign matter.	
	Yes	103 (83.7%)
	No	20 (16.3%)
6	How many times the cooking oil is reused before discarded :	
	2	102 (82.9%)
	3	21 (17.1%)

The description of the frequency and percentage for knowledge level of respondents was shown in the Table 4.2.3. The result showed that 5.6 % of the respondents had low knowledge and 93.4 % had moderate knowledge. Besides, 0.8 % of the respondents had high knowledge and this showed that not less than half of the participants had high knowledge on repeatedly heated cooking oil. Half of the total participants were in the level of low and moderate.

Table 4.2.3 : The knowledge level of the respondents on repeatedly heated cooking oil usage (N=123).

Variable	Level (Scores range)	Frequency (%)
Respondent's knowledge on repeatedly heated cooking oil usage	Low (0-3)	7 (5.6%)
	Moderate (4-6)	115 (93.4%)
	High (7-9)	1 (0.8%)

The description of the frequency and percentage of respondent for practice level was shown in the Table 4.2.4. Table 4.2.4 shows that the respondents were divided into three level of practice which were poor, moderate and good. Based on this table, some of the respondents had good practice on repeatedly heated cooking oil and this represents 39.0% respondents. On the other part, 48.7 % respondents were in moderate level and 12.1% respondents were in poor level.

Table 4.2.4 : The practice level of using repeatedly heated cooking oil among respondents (N=123).

Variable	Level (Scores range)	Frequency (%)
Respondent's practice on repeatedly heated cooking oil usage	Poor (0-1)	15 (12.1%)
	Moderate (2-3)	60 (48.7%)
	Good (4-5)	48 (39.0%)

4.3 The association between the socio-demographic background with level of knowledge and practice on repeatedly heated cooking oil.

There was a significant association between the respondent's age with level of knowledge and practice on repeatedly heated cooking oil with $p < 0.05$. There was no significant association between the respondent's education and gender with level of knowledge and practice on repeatedly heated cooking oil.

Table 4.3.1 : The association between the socio-demographic background with level of knowledge and practice on repeatedly heated cooking oil (N=123)

	<u>Knowledge</u>		χ^2	p	<u>Practice</u>		χ^2	p
	Low	High			Poor	Good		
Age								
<u><35</u>	49	30	6.217	0.013*	54	25	6.183	0.013*
<u>>35</u>	17	27			20	24		
Education								
<u>Secondary</u>	61	53	0.912	0.823	45	69	3.369	0.338
<u>Tertiary</u>	5	4						
Gender								
<u>Female</u>	41	24	4.917	0.207	38	27	0.166	0.683
<u>Male</u>	25	33			36	22		

*significant at $p < 0.05$

4.4 The correlation between respondent' s knowledge with practice

The result below showed that there was significant different between knowledge with practice because p value was less than 0.05. The r value was 0.368 and this indicates there was fair correlation between knowledge and practice because the r value in the range of 0.26-0.50.

Table 4.4.1 : The correlation between respondent' s knowledge with practice(N=123).

Variable	r	p
Knowledge	0.368	0.001*

*significant at $p < 0.05$

4.5 Peroxide value in cooking oil

A number of 123 cooking oil samples were collected from the banana fritter hawkers and were titrated in lab to obtain the peroxide value. Based on these results, 18 cooking oil samples were exceeded the AOCS standard and this represents 14.6 %. The harmful cooking oil samples were detected from banana fritter hawkers in Bandar Bukit Mahkota, Bandar Seri Putra, Desa Jenaris, Hentian Kajang, Kg Baru Sg. Chua, Seksyen 16, Seksyen 7, Seksyen 9, Sg Jelok, Taman Bukit Merah, Taman Delima, Taman Kajang Perdana, Taman Kenari and Taman Setia Sg Chua. The results shown below:

Table 4.5.1 : Peroxide value in cooking oil samples collected from banana fritter hawkers in selected locations (N=123)

Selected locations	PV of individual oil samples (mEqO₂/kg)	Median(IQR) (mEqO₂/kg)
BANDAR BUKIT MAHKOTA	6.00 7.00 10.10* 6.70 6.50 7.00	6.85(4.1)
BANDAR RINCHING	5.30 5.50 5.90 5.40 6.30	5.5(1.0)
BANDAR SERI PUTRA	5.50 5.20 5.30 6.00 7.00 12.70*	5.75(1.8)
BAZAR MALAM REKO SENTRAL	5.00 6.80 5.60 5.70 6.90	5.7(1.9)
BAZAR MALAM TAMAN KAJANG PUTRA	6.00 7.50 7.70	7.5(1.7)
DESA JENARIS	5.80 4.90 10.20* 6.30 6.30	6.3(5.3)
HENTIAN KAJANG	13.20* 5.00 5.90	5.8(0.9)
KG.BARU SG.CHUA	5.00 5.50 6.00 10.10* 5.30	5.5(5.1)
PEKAN BANGI	6.00 6.10 6.60	6.1(1.0)

	5.60 6.30	
PEKAN SEMENYIH	4.80 5.60 6.00 6.10 5.90	5.9(1.3)
PRIMA SAUJANA	6.00 6.10 6.70 5.00 7.10	6.1(2.1)
SEKSYEN 16	11.70* 5.80 7.80 6.00 14.50* 6.70 7.00	6.7(3.3)
SEKSYEN 4	4.90 5.00 6.90 4.30 6.80	5.0(2.6)
SEKSYEN 7	5.50 7.70 5.10 5.50 11.50* 7.00	5.65(2.6)
SEKSYEN 9	5.80 6.00 4.50 12.6* 6.30	6.0(2.5)
SG. JELOK	10.20* 10.50* 5.00 5.50	6.4(5.2)
TAMAN ASA JAYA	6.20 5.30 5.10 5.11 5.20 5.40 4.80	5.3(1.1)
TAMAN BUKIT MEWAH	10.30* 4.80 5.70 5.80	5.75(5.5)

TAMAN DELIMA	6.70 10.20* 7.00 6.80	6.9(3.5)
TAMAN JASMIN	5.11 5.20 5.40 4.80	5.16(0.6)
TAMAN KAJANG PERDANA	10.30* 5.80 5.80 6.10	5.95(4.5)
TAMAN KAJANG UTAMA	5.00 10.10* 5.70 6.00 4.90	5.7(5.2)
TAMAN KENARI	8.70 8.60 10.40* 5.60 5.50 5.30	5.55(5.1)
TAMAN PALING JAYA	4.90 8.00 7.00 6.90 6.30	6.9(3.1)
TAMAN SETIA SG.CHUA	5.90 10.00* 10.10*	7.3(4.1)

*Cooking oil sample that harmful for human consumption according to AOCS guideline (PV > 10 mEqO₂/kg).

There were many types of cooking oil brands used by the BFH to fry the banana fritters which were Bukit Emas, Asri, Bagus, Bulu Tangkis, Kapal Emas, Kelapa Bali, Keris, Nice Day, Sehati and Tiga Udang. Nice Day brands was the most cooking oil used by the BFH while Kelapa Bali brands was the less used. The detail information about cooking oil brands stated in the table below :

Table 4.5.2 : Brands of cooking oil used by respondents (N=123).

Brands	Frequency (%)
Bukit Emas	12 (9.7)
Asri	11 (8.9)
Bagus	11 (8.9)
Bulu Tangkis	20 (16.2)
Kapal Emas	6 (4.8)
Kelapa Bali	5 (4.1)
Keris	10 (8.1)
Nice Day	29 (23.5)
Sehati	6 (4.8)
Tiga Udang	13 (10.5)

4.6 The comparison peroxide value with the AOCS standard

One sample T-test was used to run this analysis. The result showed that the mean of the peroxide value in cooking oil samples were significantly difference from the standard.

Table 4.6.1 : The comparison peroxide value with the AOCS standard

Variables	Mean(Std Dev)	p
Peroxide	7.1(2.2)	0.001

4.7 The association between knowledge, practice and peroxide value.

The IBM SPSS Statistic Version 22 was used to run the statistical analysis for these variables and the test was Spearman correlation. According to table 4.6.1, there was no sigificant association between practice and peroxide because p value was more than 0.05. This shows that, the respondent's practice on cooking oil usage will not affect the peroxide value. Besides, there was no significant association between knowledge and peroxide as the $p > 0.05$. Both variables had poor correlation with peroxide because $r < 0.25$. The results were shown in the table below :

Table 4.7.1 : The association between respondent' s knowledge and practice with the peroxide value (N=123).

Variables	r	p
Knowledge	0.071	0.433
Practice	0.113	0.214

***significant at $p < 0.05$**

CHAPTER 5

DISCUSSION, CONCLUSION & RECOMMENDATION

5.1 Discussion

5.1.1 Socio demographic background

Based on table 4.1.1, most of the respondents were female (n=65) and from that amount only 20 respondents were above 30 years old. The others 45 respondents were below 30 years old. The male respondents that involved in this study were 58. The youngest respondent in this study was 18 years old (n=3) and the oldest was 56 years old (n=1). Besides, majority of the respondents were 38 years old (n=10).

In term of race only Malays (100%) were involved in this study. This was because the selected locations were in the Malay's residential areas. Other than that, it was difficult to find other races selling banana fritters because banana fritters was one of the food that synonym to malays.

The respondents that involved in this study had different level of educations. The highest education level received by the respondent was degree (n: 1) followed by diplomas (n=8). All of them were just finished their study and sold banana fritters as their part time job while waiting for the interview from the companies. On top of that, most of the respondents only had secondary education where 52 respondents had Penilaian Menengah Rendah and 62 respondents had Sijil Pelajaran Malaysia. These respondents were permanent banana fritter hawkers with some of them were Indonesians. It was difficult to identify their educational level since they have different academic structure from us.

5.1.2 Knowledge and practice on repeatedly heated cooking oil among the respondents.

Based on table 4.2.1, most respondents disagreed (70.7 %) that it was a good practice to use repeatedly heated cooking oil. This is consistent with Azman et al's past finding (2012). Based on his study, most night market sellers were aware that repeatedly heated cooking usage was not healthy, although they did not know exactly why it was so. Furthermore, 53 out of 82 respondents did not agree with the statement "the use of repeatedly heated cooking oil for frying food is a good practise as this practice saves expenses and no side effects" (Sivananthan et al., 2013). This finding was in line with earlier study which stated that up to 44.4 percent of respondents

disagreed with the use of repetitively heating cooking oil during meal preparation to recover costs in the long term (Aziz et al., 2018).

During the interview session, these respondents said that the cooking oil that had been used for many times was a bad practice and can cause health problem. Some of them claimed that they will discard the used cooking oil before the closing and use new cooking oil for the next day. However, the results obtained were against as their claim. Majority (95.1%) of the respondents said that they could use the oil for many times and discard it only when it turns darks. The reason behind this practice was they want to save the costs as much as they could from buying new cooking oil for the next day. Amount of 79.7% of them were agreed usage of repeatedly heated cooking oil for frying food was good for saving costs. Previous study also reported the same finding as the food operators only discarded the cooking oil used whenever the factors such as the duration and frequency of cooking sessions permitted appear to be necessary without measures (Wai, 2007). Simultaneously, Aziz et al (2018) also revealed the same finding which 57.3 percent of respondents agreed that they would still be able to reuse the same oil several times and eliminate it once the color changes to brownish.

The respondents said in the interview that the price of cooking oil nowadays was higher than in previous years, they bought only the cheapest cooking oil that is usually low quality cooking oil .Among the brands of cooking oil purchased by respondents include Asri, Bagus, Bukit Emas, Bulu Tangkis, Kapal Emas, Kelapa Bali, Keris, Nice Day, Sehati and Tiga Udang. All of the brands stated were very unfamiliar compare with the popular brands such as Buruh, Seri Murni and Knife. All respondents

were used palm oil to fry the banana fritters as it was cheaper than other cooking oil and most available in the market. This is not strange as Malaysia is now the world's largest palm oil producer and exporter (Basiron, 2007). Also helping to make it a popular choice of cooking oil is the fact that palm oil is cheaper and widely available in Malaysia. This is in line with the finding that palm oil in many developing countries is the major source of cooking oil (Klurfeld, 1991).

Moreover, majority of the the respondents (98.4%) realize that repeatedly heated cooking oil could cause health problems. They answered that the usage of repeatedly heated cooking oil for long term might result in hypertension and cancer. Based on Jaarin et al's study (2011), they reported that long-term intake of heated palm and soy oils over a 24-week period led to significant blood pressure increases. They also reported that when this oil has been heated repeatedly, the level of vitamins and antioxidants will decrease and free radicals will be produced, resulting to oxidative stress.

5.1.3 Level of Knowledge and Practice among respondents.

Based on table 4.2.3, majority of respondents (93.4%) had moderate level of knowledge on repeatedly heated cooking oil. Based on the survey, majority of the respondents scored 3 to 5 out of total scores of 9. This happened among the respondents due to lack of information and basic knowledge on the detrimental health effects and risk of prolonged consumption of rancid oil from the repeatedly heating

process during the food preparation. At the same time, some of the respondents conceded that they have no related knowledge regarding this particular issue. They only knew about the effect of repeatedly heated cooking oil when we explained to them. Other research conducted in Bukit Mertajam, Pulau Pinang showed almost the same finding which roughly half of respondents (53.2 %) scored 4 to 6 out of 9 total scores, indicating that most of them had a moderate level of awareness (Aziz et al., 2018).

A number of 48.7 % of the respondents had moderate level of practice on repeatedly heated cooking oil usage and this the highest percentage compare to poor and good level. According to this finding, almost half of the respondents scored 2 to 3 out of total scores of 6. Among the practice performed by the respondents include use fresh oil for every frying (93.5%), maintaining small flame during frying (35.8%), using stainless steel utensil (88.6%) and store cooking oil in stainless steel or glass container after used (87.0%). This is a good practice, since low concentration of copper found in brass and other copper alloy utensils is a catalyst for thermal oxidation. Most respondents also retain a small flame while frying, which is also a advisable because cooking oil can degenerate very quickly at very high temperatures (Berger,2005).

5.1.4 The association between the respondent's age with level of knowledge and practice on repeatedly heated cooking oil.

Based on table 4.3.1, age of the respondent is one of the factor that influence the level of knowledge and practice. This is because when the respondents getting older they tend to have wide experience on handling the cooking oil. Generally, the older respondents will have more experience on the factors such as composition of the oil used, frying temperature, duration of frying time, use of a continuous or intermittent frying method and selection of cooking oil. On the other part, the younger respondents might do minor mistake on these factors due to lack of experience and exposure. Supposedly, the elder respondents shoul have higher level of knowledge and practice regarding the repeatedly heated cooking oil since they able to gain information from the resources that are made availble for them. For instance, in this study most of the respondents used the newspaper and internet as their source of information regarding this issue. In addition, according to the US Committee of the Institute of Medicine (1991), an aging population was likely to be more concerned about health implications compared to adolescents and elderly people. Their practice of using cooking oil for frying might have changed.

5.1.5 The association between knowledge and practice among respondents.

Based on the table 5, there was significant association between knowledge and practice regarding the usage of repeatedly heated cooking oil ($r = 0.368, p = 0.001$). From this finding, it showed that the knowledge will influence the practice of respondents on the usage of repeatedly heated cooking oil. One important factor that plays a vital role in increasing the level of knowledge and practice was the level of education received by the respondents. Based on the research conducted by Abdullah et al (2015), they stated that there was a significant relationship between the educational level and the level of knowledge and practice about the usage of repeatedly heated cooking oil. From this research, he concluded that those who had higher education level would had more aware of this issue because they were able to gain more information from the resources that were made available to them.

5.1.6 Quality of cooking oil used by the respondents

Plenty of cooking oils that was used by the respondents exceeded the standard (14.6%) and these cooking oils were considered not suitable for human consumption as the peroxide value (PV) content more than 10 mEqO₂/kg. Measurement of PV in the repeatedly heated cooking oil was done according to American Oil Chemists' Society (AOCS) Official Methods Cd 8-53. The PV was an useful method to measure the quality of cooking oil, providing an index to quantify the amount of hydroperoxide

in fats and oil (Gotoh, 2006). Consequently, PV demonstrates the degree of oxidation in the substance and measures the amount of total hydroperoxides as a primary oil oxidation product (Saad et al. 2006). Although the PV rises whenever heated, at high temperatures it also decomposed gradually. This process was important for decreasing the amount of hydroperoxide in cooking oil remains low in order to make the fried food safe for consumption (Azman et al., 2012).

Eventhough, the percentage of cooking oil sample exceeded the standard was small, it was important to identify and discuss the factors that contributed to this. Firstly, many respondents did not concern that the temperature might affect the fat content in fried food. The suggested ideal temperatures for frying were around 180-185 degrees Celcius (Firestone, 1993). A higher frying temperature will make the oil to degrade faster, thus producing toxic by products. The heat and mass transfer of oil, food and air during deep frying creates the unique and attractive quality of fried foods during the frying process (Choe, 2007). Previous study mentioned that the PV in cooking oil will increased accordingly to the frequency of heating. Increased PV prove increased lipid peroxidation byproduct content, especially the peroxide that were produced in the cooking oil during heating process. The extent of oxidation in the oils was affected by the number of frying. Apart from peroxides, other oxidized components, such as oxidizing dimers and oxidized triacylglycerols, are produced during oil heating (Picariello et al., 2009).

Secondly, during the interview session some respondents told that they did not discard the used cooking oil but they added new cooking oil when the volume become less. The balance cooking oil will be store in plastic container and will be reuse again for the next day. The cooking oil only will be discard after 2-3 times of reused for the different days. A previous study stated that this kind of habit was a bad practice since it will increase the PV. The practice of replenishing cooking oil by partial replacement with fresh oil, rather than totally replacing all the fat at once, was associated with significantly elevated levels of oil degradation products which can be carcinogenic (Morley-John,2002). This statement was further supported by the Katragadda et al (2010) statement where they reported that the cooking oil will change physically and chemically once it was introduced into deep frying process. At the same time, they also mentioned that the cooking oil will produce high free fatty acid content once it was reheated and this type of oil was not recommended.

Other than that, the reason also include lack of knowledge on the suitable frying methods among the respondents. Lack of knowledge will reflect the poor practice among the respondents since they admitted they used repeatedly heated cooking oil for frying. In addition, majority of them agreed that they could use the oil for many times and discard it when it turns dark. Surprisingly, some of them said that it was alright to use the oil that repeatedly heated as long it could save the operating cost. It may also be assumed that cooking oil quality problems could arise in batch frying operations by unskilled workers.

Most of them did not control the oil temperature using a thermometer and did not consider how long the oil was heated before they were topped-up, replaced or discarded. This visualizes a negative practice on the repeatedly heated cooking oil since they thought this kind of oils has no side effect and the quality will remain the same.

5.2 Conclusion

There were 123 respondents enrolled in this study which consists of 58 male and 65 female. The age of respondents were in the range of 18-56 years old and all of them were Malays. Majority of respondents (92.6%) had secondary education while respondents with tertiary education only 7.3%. Majority of respondents had moderate level for both the knowledge (93.4%) and practice (48.7%) regarding repeatedly heated cooking oil. Next, there was a significant correlation between knowledge and practice ($r = 0.368$, $p = 0.001$) regarding the usage of repeatedly heated cooking oil. This describes that the knowledge of respondents will affect their practice towards the cooking oil. In addition, there was a significant association between knowledge ($\chi^2=6.217$, $p=0.013$) and practice ($\chi^2=6.183$, $p=0.013$) level with the respondent's age. In terms of PV, most of the cooking oil samples were below the standard but 14.6 % of them exceeded the standard prescribed in AOCS standard of 10 meqO₂/kg. Although most of the samples were below the limit recommended by the AOCS, well planned action is needed to ensure all food especially banana fritters, that reach the customer is in high quality and safe for consumption.

5.3 Limitation of study

There were some limitations in this study which are:

- a) This study mainly used questionnaire to access the knowledge and practice of the banana fritter hawkers. This method can affect the validity of the study as some of them may give wrong information about their knowledge and practice on cooking oil since they thought this study will ruin their business. The information from them can be questionable.
- b) The improper way during collecting the cooking oil sample. The samples supposedly to be collected at the closing so that we can obtain the last used cooking oil of that day, however due to time and human resources constraint the samples collection were standardized between 6-8 pm which not represent the whole cooking oil usage for that day.
- c) The starch used to determine the peroxide value was less effective since the concentration was not enough. The starch concentration should be 2% but in this study the starch concentration was 1%. To measure peroxide value suitable starch concentration was needed.

5.4 Recommendation

MPKJ should conduct training to food handler to promote good practice of frying by adding syllabus on food safety on oil quality. In order to prevent more repeatedly heated cooking oil exceed the standard, a standard regulation on food-frying techniques must be enforce on banana fritter hawkers in this country. We can start it by standardized frying temperature as the temperature plays a vital role in peroxide production. The food operator must acquire and make uses of a frying thermometer to measure the cooking oil temperature so that it will complied the standard, thus could potentially enhance the health of the general public. Based on this finding, it is important to improve the respondents practice on cooking oil by educating them on the accurate approaches to preserve desirable quality of cooking oils. To provide more information about repeatedly heated cooking oil, relevant health authorities must conduct awareness campaign so that banana fritter hawkers will have basic knowledge regarding this issue.

The usage of palm oil during food preparation should be remained and recommended to the food operator as the palm oil possibly has better effect on health due to its stability against oxidative insult. Palm oil has unique ability because it is rich in monounsaturated fatty acids (MUFA) but has low level of polyunsaturated fatty acids (PUFA) compared to soy oil. The oils that enriched by MUFA have better strength to withstand oxidation and formed less degradation products when they are heated. Not only that, the use of natural antioxidants in cooking oil as adsorbents can

make the oil safe by retarding the formation of oil deterioration products. One of the antioxidant functions is to add tocopherols, butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT), propyl gallate (PG) and tert-butyl hydroquinone (TBHQ) to reduce oxidation at room temperature.

Particularly during the data collection part, there is room for improvement in this study. We strongly recommend to make sure the device is in good condition and tested before going to sample collection. Additionally, it is possible to measure the other parameters to determine the quality of repeatedly heated cooking oil such as anisidine value, total oxidation value and total polar compound.

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APPENDIX 1
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 :

Level of Knowledge and Practice among Banana Fritter Hawkers in Kajang Municipal Council and Determination of Peroxide Value in Repeatedly Heated Cooking Oil.

2. INTRODUCTION:

Cooking oil is the most crucial thing that should be considered during food preparation. The taste of food is not only based on how fresh the ingredients but also based on the types and how many time we used the oil for cooking. Repeatedly heated cooking oil is not a good practice and it might be hazardous to consumed food that being fried in that oil. This kind of practice is really popular among the banana fritter hawkers in order to cut cost and save money. The oil is discarded only when it becomes foamy, emits bad odour or when the colour turn dark. Consumption of food that is prepared from repeatedly heated cooking oil might increase the risk of developing atherosclerosis and also associated with increased total serum lipid and low density lipoprotein (LDL) levels. This will increase the risk to get heart diseases and cancers.

3. WHAT WILL YOU HAVE TO DO?

To ascertain this study to be success:

1. Banana fritter hawkers will be interviewed by the researcher to obtain background, knowledge and practice information on repeatedly heated cooking oil.
2. A sample of repeatedly heated cooking oil (50 ml) will be taken from each banana fritter hawker to be analysed in the laboratory for peroxide determination.
- 3 The participation in this study is voluntary and the participant can withdraw from this study at anytime without being penalised.

4. WHO SHOULD NOT PARTICIPATE IN THE STUDY?

Those who are not banana fritter hawkers in Kajang Municipal Council.

5. WHAT WILL BE THE BENEFITS OF THE STUDY:

(a) TO YOU AS THE SUBJECT?

Participation in this study will help you to increase the knowledge regarding the health issues of repeatedly heated cooking oil and indirectly will increase the awareness about the harmful effects of peroxide.

(b) TO THE INVESTIGATOR?

This study will provides new updates on the level of knowledge and practice of the food handlers about peroxide in repeatedly heated cooking oil as well as the quality of oil being used for food preparation. These information will help the researcher and the authority in the planning of health awareness and promotion programmes to promote the quality of live of the community.

6. WHAT ARE THE POSSIBLE RISKS?

The banana fritter hawkers of this study are not exposed to any risk since no biological samples will be collected such as blood or urine.

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

All the information of the banana fritter hawkers will be kept private and confidential.

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

Any question can be addressed to Dr. Saliza Bt Mohd Elias, Supervisor of the research at 03-89472402 (email: saliza_me@upm.edu.my) or Che Mohamad Fikri Bin Che Ismail, the researcher at 013-3084867 (e-mail: cmfikri960@gmail.com).

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

9. CONSENT

I Identity Card No.
address.....

.....hereby voluntarily agree to take part in the research stated above *(clinical /drug trial/video recording/ focus group/interview-based/ questionnaire-based).

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

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

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

* delete where necessary

Signature Signature
(Respondent) (Witness)

Date : Name :

I/C No. :

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

Date Signature
(Researcher)



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

Tahap Pengetahuan dan Amalan Penjaja Pisang Goreng di bawah Majlis Perbandaran Kajang dan Penentuan Nilai Peroksida Di Dalam Minyak yang Dipanaskan Berulang Kali.

2. PENGENALAN

Minyak masak adalah suatu bahan yang penting dan perlu diambil perhatian yang serius dalam penyediaan makanan. Rasa dan mutu makanan yang baik bukan hanya bergantung kepada kualiti bahan asas, tetapi juga berdasarkan jenis dan penggunaan minyak untuk memasak. Amalan memanaskan minyak untuk menggoreng makanan secara berulang kali adalah tidak selamat dan boleh membahayakan kesihatan pengguna makanan tersebut. Amalan ini sering dilakukan oleh penjaja pisang goreng sebagai langkah penjimatan kos. Minyak hanya akan diganti apabila sudah berbuih, mengeluarkan bau yang kurang menyenangkan, atau warnanya bertukar menjadi gelap. Pengambilan makanan yang disediakan daripada minyak yang dipanaskan berulang kali boleh meningkatkan risiko untuk pembentukan *atherosclerosis* (pemendapan plak di dalam pembuluh darah) dan juga berkaitan dengan peningkatan jumlah lemak dan lipoprotein berketumpatan rendah dalam darah. Ini akan meningkatkan risiko mendapat penyakit jantung dan kanser.

3. APAKAH YANG PERLU ANDA LAKUKAN?

Untuk menjayakan kajian ini:

1. Penjaja pisang goreng akan ditemuramah oleh penyelidik untuk mengumpulkan maklumat latarbelakang, pengetahuan dan amalan berkaitan penggunaan minyak untuk menggoreng makanan.
2. Sampel minyak masak yang telah digunakan untuk menggoreng makanan akan diambil daripada setiap penjaja pisang goreng sebanyak 50ml untuk dianalisis di makmal. Sampel minyak akan dianalisis untuk menentukan kandungan peroksida di dalam minyak tersebut.

4. SIAPA YANG TIDAK BOLEH MENYERTA KAJIAN INI?

Pengendali makanan yang tidak menjual pisang goreng dan tidak meniaga di pasar malam di bawah Majlis Perbandaran Kajang.

5. APAKAH FAEDAH MENYERTA KAJIAN INI?

a)KEPADA ANDA SEBAGAI PESERTA?

Ia akan membantu anda untuk meningkatkan pengetahuan berkenaan isu kesihatan berkaitan penggunaan minyak yang dipanaskan berulang kali dan secara tidak langsung boleh membantu meningkatkan kesedaran berkenaan kesan merbahaya peroksida.

b) KEPADA PENYELIDIK?

Kajian ini akan dapat memberikan maklumat terkini berkenaan tahap pengetahuan dan amalan pengendali ayam goreng berkenaan peroksida di dalam minyak masak terpakai serta tahap kualiti minyak yang digunakan untuk menggoreng. Maklumat sedemikian akan membantu penyelidik dan pihak berkuasa dalam merangka program kesedaran dan promosi kesihatan yang berkaitan untuk meningkatkan kualiti kehidupan masyarakat.

6. ADAKAH IA BERISIKO?

Penjaja pisang goreng yang menyertai kajian ini tidak terdedah kepada risiko kerana kajian ini tidak melibatkan pengumpulan sampel biologi seperti darah atau urin.

7. ADAKAH MAKLUMAT DAN IDENTITI SAYA KEKAL RAHSIA?

Semua informasi penjaja pisang goreng akan dirahsiakan dan dianggap sulit.

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

Sebarang pertanyaan boleh diajukan kepada Dr. Saliza Bt. Mohd Elias, Penyelia kajian di nombor 03-89472402 (emel: saliza_me@upm.edu.my) atau Che Mohamad Fikri Bin Che Ismail, penyelidik di nombor 013-3084867 (emel: cmfikri960@gmail.com).

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

9. PERSETUJUAN

Saya..... No Kad Pengenalan.
beralamat.....

.....dengan ini bersetuju untuk mengambil bahagian secara sukarela dalam penyelidikan yang tersebut di atas *(kajian klinikal/percubaan ubat-ubatan/rakaman video/kumpulan sasaran/temuduga/ soal selidik).

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

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

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

*potong yang tidak berkenaan

Tandatangan
(Responden)

Tandatangan
(Saksi)

Tarikh :.....

Nama :.....

No. KP:

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

Tarikh

Tandatangan
(Penyelidik)



APPENDIX 2

QUESTIONNAIRE

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DEPARTMENT OF ENVIRONMENTAL AND
OCCUPATIONAL HEALTH,
FACULTY OF MEDICINE AND HEALTH SCIENCES,
UNIVERSITI PUTRA MALAYSIA, 43400 UPM
SERDANG, SELANGOR MALAYSIA

QUESTIONNAIRE / SOAL SELIDIK

TITLE: Level of Knowledge and Practice among Banana Fritter Hawkers in Kajang Municipal Council. and Determination of Peroxide Value in Repeatedly Heated Cooking Oil.

TAJUK KAJIAN: Tahap Pengetahuan dan Amalan Pengguna dalam kalangan penjaja goreng pisang di Majlis Perbandaran Kajang dan Penentuan Nilai Peroksida di dalam Minyak Masak yang di Masak Berulang Kali.

Introduction: This study is aiming to assess the level of knowledge and practice of fried chicken operators Majlis Perbandaran Kajang and determination of peroxide value in repeatedly heated cooking Oil. Please give accurate information as required. All information provided will be used for research purpose only. Thank you for your cooperation

Pengenalan: Kajian ini bertujuan untuk menentukan tahap pengetahuan dan amalan pengendali ayam goreng di Majlis Perbandaran Kajang dan penentuan nilai peroksida di dalam minyak masak yang di masak berulang kali. Sila berikan maklumat yang tepat seperti dikehendaki. Semua maklumat yang diberikan akan digunakan untuk tujuan pengajian sahaja. Terima kasih atas kerjasama anda.

Respondent ID : _____

Responden ID

Date : _____

Tarikh

Part A : Demographic information

Bahagian A : Maklumat Demografi

Instruction: please fill in the blank and tick (✓) where appropriate.

Arahan: Sila isikan tempat kosong dan tandakan (✓) di mana sesuai.

1. Gender: Male/Female

Jantina: Lelaki/Perempuan

2. Marital status: Single/Married

Status Perkahwinan: Bujang/Berkahwin

3. Age (years old):

Umur:

4. Race: Malay () Chinese () India () Others:

Bangsa: Melayu () Cina () India () lain-lain:

5. Education status/ Status Pendidikan: No formal education () UPSR () PMR/SRP () SPM ()

DEGREE () MASTER () PHD ()

Food Operators Information/ Maklumat Pengendali Makanan:

1. Type of deep-fried food/ Jenis makanan bergoreng:

2. Cooking oil brands/Jenama minyak masak:

3. Cooking oil packaging/Bungkusan minyak masak: Bottle/Botol () Packet/paket ()

4. Types of oil used for frying/ Jenis minyak digunakan untuk menggoreng:

Palm Oil/ Minyak kelapa sawit () Peanut oil/ Minyak kacang () Corn oil/ Minyak jagung ()

Soy oil/ Minyak soya () Olive oil/ Minyak zaitun () Coconut oil/ Minyak kelapa ()

Others/ lain-lain : _____

5. Income/ Jumlah pendapatan (RM):

6. Working Status/Status Pekerjaan: Full time/Sepenuh Masa () Part time/Sambilan ()

what/apa: _____

Part B : Respondent's knowledge on the usage of repeatedly heated cooking oil

Bahagian B : Pengetahuan responden mengenai penggunaan minyak masak yang dipanaskan berulang kali.

Instruction: Please fill in the blank and tick (✓) where appropriate.

Arahan: Sila isikan tempat kosong dan tandakan (✓) di mana sesuai.

1. Usage of repeatedly heated cooking oil for frying food is a healthy practice.
Penggunaan minyak masak yang dipanaskan berulang kali untuk menggoreng makanan adalah amalan yang sihat.

Yes/Ya No/Tidak Not sure/Tidak pasti

2. Usage of repeatedly heated cooking oil for frying food is good for saving cost.
Penggunaan minyak masak yang dipanaskan berulang kali untuk menggoreng makanan adalah bagus untuk penjimatan.

Yes/Ya No/Tidak Not sure/Tidak pasti

3. Usage of repeatedly heated cooking oil for frying food has no side effect.
Penggunaan minyak masak yang dipanaskan berulang kali untuk menggoreng makanan tiada kesan sampingan.

Yes/Ya No/Tidak Not sure/Tidak pasti

4. The quality of oil used for frying will remain the same regardless of how many times the oil is reheated.
Kualiti minyak tidak bergantung kepada kekerapan minyak dipanaskan.

Yes/Ya No/Tidak Not sure/Tidak pasti

5. We can use the oil for many times and discard it only when it turns darks.
Kita boleh menggunakan minyak untuk banyak kali dan membuangnya hanya apabila ia bertukar gelap.

Yes/Ya No/Tidak Not sure/Tidak pasti

6. There will be loss in nutrient in the repeatedly heated cooking oil used for frying.
Nutrien dalam makanan akan hilang apabila minyak masak yang dipanaskan berulang kali digunakan untuk menggoreng.

Yes/Ya No/Tidak Not sure/Tidak pasti

7. The type of cooking oil does not influence the type of constituents produced from the repeatedly heated cooking oil.

Jenis minyak masak tidak mempengaruhi jenis produk sampingan yang dihasilkan daripada minyak masak yang dipanaskan berulang kali.

Yes/Ya No/Tidak Not sure/Tidak pasti

8. Will repeatedly heated cooking oil used for frying cause bad effects to our health?

Adakah minyak masak yang dipanaskan berulang kali untuk menggoreng akan membawa kesan buruk kepada kesihatan?

Yes/Ya No/Tidak Not sure/Tidak pasti

Who answered "Ya" to the above question (question no. 8)/ Bagi menjawab "ya" pada soalan di atas (soalan no. 8).

9. What type of disease associate with the consumption of repeatedly heated cooking oil?

Apakah jenis penyakit yang berkaitan dengan penggunaan minyak masak yang dipanaskan berulang kali?

Gout/ Gout

Tuberculosis/ Batuk kering

Diabetes/ Kencing manis

Hypertension/ Darah tinggi

Cancer/ Kanser

*respondents can choose more than one for this question.

*responden boleh memilih lebih daripada satu untuk soalan ini.

Part C: Respondent's knowledge about peroxide

Bahagian C: Pengetahuan responden mengenai peroksida

Instruction: Fill in the blank and tick (✓) where appropriate.

Arahan: Sila isikan tempat kosong dan tandakan (✓) di mana sesuai.

1. Do you know peroxide contain in the repeatedly heated cooking oil?
Adakah anda tahu dalam minyak masak yang dipanaskan berulang kali megnadungi peroksida?

Yes/Ya

No/Tidak

2. If yes, where you get the informations?
Jika ya, dimanakah anda mendapat maklumat tersebut?

Newspaper/Surat khabar

Magazine/Majalah

Television

Radio

Internet

Others/lain-lain : _____

*you can choose more than one answers.

*anda dibenarkan memilih jawapan lebih daripada satu.

3. What will happen when peroxide values are high in the cooking oil?
Apakah yang akan terjadi bila kadar peroksida tinggi dalam minyak masak?

The quality of cooking oil good.
Kualiti minyak masak bagus.

The quality of cooking oil bad.
Kualiti minyak masak tidak bagus.

Need to discard the oil and replace with new cooking oil
Perlu buang dan tukarkan minyak yang baru

The oil is still can be used.
Minyak tersebut masih boleh digunakan.

*you can choose more than one answers.

*anda dibenarkan memilih jawapan lebih daripada satu.

Part D: Respondent's practice regarding the usage of repeatedly heated cooking oil

Bahagian D: Amalan mengenai penggunaan minyak masak yang dipanaskan berulang kali.

Instruction: Fill in the blank and tick (✓) where appropriate.

Arahan: Sila isikan tempat kosong dan tandakan (✓) di mana sesuai.

1. Do you use repeatedly heated cooking oil for frying?
Adakah anda menggunakan minyak masak yang dipanaskan berulang kali untuk menggoreng?
- Yes/ya No/tidak

Who answered "No" to the above question (question no. 1),
Siapa yang menjawab 'Tidak' untuk (soalan no. 1),

2. What are the reason for not use repeatedly heated cooking oil for frying?
Apakah sebab tidak menggunakan minyak masak yang dipanaskan berulang kali untuk menggoreng?

Harmful to health
Bahaya untuk kesihatan

Food will look bad
Makanan akan kelihatan teruk

Increase cooking oil's cholesterol level
Boleh meningkatkan kadar kolestrol dalam minyak

Others () : _____
Lain () : _____

3. How many times the cooking oil is reused before discarded?
Berapa kali anda menggunakan minyak tersebut sebelum anda membuangnya?
- 2 times 3 times 4-10 times Others: _____
2 kali 3 kali 4-10 kali Lain-lain: _____

4. Choose the methods to maintain the cooking oil quality:
Pilih kaedah untuk mengekalkan kualiti minyak:

a) Use fresh oil for every frying. Yes/Ya
Gunakan minyak masak yang baru setiap kali menggoreng. No/Tidak

b) Maintaining small flame during frying. Yes/Ya
Mengekalkan api kecil semasa menggoreng. No/Tidak

c) Using stainless steel utensil. Yes/Ya
Menggunakan perkakasan keluli tahan karat No/Tidak

- d) Store cooking oil in stainless steel or glass container after used.
Simpan minyak masak dalam keluli tahan karat atau bekas kaca selepas digunakan.

Yes/Ya No/Tidak

- e) Filter the cooking oil to catch any food leftover or foreign matter.
Tapis minyak masak untuk menangkap sisa makanan atau bahan asing.

Yes/Ya No/Tidak

5. How you get the information regarding the peroxide in the repeatedly heated cooking oil?

Bagaimanakah anda mendapat maklumat berkaitan peroksida yang terkandung dalam minyak masak yang dipanaskan berulang kali?

Newspaper/Surat khabar Magazine/Majalah Television

Radio Internet Others/lain-lain : _____

No prior knowledge about this issue
Tiada sebarang pengetahuan mengenai isu ini

6. Would like to obtain more informations about the issue?

Adakah anda ingin mendapat maklumat yang lebih lanjut mengenai isu ini?

Yes/Ya No/Tidak

Contact : _____





APPENDIX 3
ETHICAL APPROVAL

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APPENDIX 4
ON-SITE PICTURES &
LABORATORY ANALYSIS

On-site pictures and laboratory analysis

