



UNIVERSITI PUTRA MALAYSIA

***KNOWLEDGE AND PRACTICE AMONG DEEP FRIED FOOD
OPERATORS REGARDING OIL QUALITY UNDER KAJANG
MUNICIPAL COUNCIL AND DETERMINATION OF PEROXIDE VALUE
IN REPEATEDLY HEATED COOKING OIL***

NURUL NATASHA MOHD JAILANI

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



BY

NURUL NATASHA MOHD JAILANI

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Science (Environmental and Occupational Health) from the Faculty of Medicine
and Health Sciences, Universiti Putra Malaysia.**

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ABSTRACT

KNOWLEDGE AND PRACTICE AMONG DEEP FRIED FOOD OPERATORS REGARDING OIL QUALITY UNDER KAJANG MUNICIPAL COUNCIL AND DETERMINATION OF PEROXIDE VALUE IN REPEATEDLY HEATED COOKING OIL

NURUL NATASHA MOHD JAILANI

Introduction: Night market food operators used the same cooking oil to deep-fry food such as fish ball, nuggets and other processed food. This practice will result in fats and oils undergo thermal and oxidative decomposition which formed toxic and harmful substances called peroxide. Prolong consumption of food that contained peroxide increased the risk of developing atherosclerosis and associated with increased total serum lipid and low density lipoprotein (LDL) level. **Objectives:** This research was conducted to determine the level of knowledge and practice regarding oil quality among deep fried street food operators in Kajang Municipal Council and to determine the peroxide value (PV) in repeatedly heated cooking oil. **Methodology:** This cross-sectional study (January until March 2019) involved a total of 130 deep fried street food operators and they were given a set of modified questionnaire to collect information such as socio-demographic, knowledge and practice on usage of repeatedly heated cooking oil and a total of 100ml of used cooking oil were collected to be analysed for peroxide value using American Oil Chemist Society (AOCS) Cd 8b-90. **Results and Discussion:** It was found that 76.9% of respondents scored high level for knowledge on the use of repeatedly heated cooking oil while 60% of respondents scored moderate level for practice on the use of repeatedly heated cooking oil. For the association between socio-demographic factors with peroxide value, there is no significant association shown. There is a significantly negative and weak association between practice and peroxide value (PV) where $r = -0.299$, $p = 0.001$. Meanwhile, there is no significant association shown between knowledge and practice where $r = -0.002$, $p = 0.986$ and between practice and knowledge with peroxide value (PV) is $r = -0.065$, $p = 0.46$ consecutively. Other than that, Wilcoxon Signed Rank test indicated that the peroxide value is statistically significant higher than AOCS Standard where $Z = -3.162$, $p = 0.002$. It also found that 54.6% which is equivalent to 71 samples from total of 130 sample of cooking oil exceeding the limit (10mEqO₂/kg). **Conclusion:** In conclusion, there is a significant negative association between practice and peroxide value where $p < 0.05$ and Wilcoxon Signed Rank test indicated that the peroxide value is statistically significant higher than AOCS Standard where $Z = -3.162$, $p = 0.002$. The knowledge level of respondents consider high but surprisingly their level of practice is still consider as moderate. Thus, we need to improve their practice especially when frying food. This issue can be a huge concern as the health of the food consumers may be affected if it was not managed properly by the relevant food authorities. Other than that, the local authority should perform surveillance monthly in order to ensure the peroxide value contained in the night market food operators were not exceeding the recommended standard.

Keywords: Peroxide value, knowledge, practice, titration

ABSTRAK

PENGETAHUAN DAN AMALAN DALAM KALANGAN PENGENDALI MAKANAN BERGORENG BERKAITAN KUALITI MINYAK DI BAWAH MAJLIS PERBANDARAN KAJANG DAN PENENTUAN NILAI PEROKSIDA DALAM MINYAK MASAK YANG DIPANASKAN BERULANG KALI

NURUL NATASHA MOHD JAILANI

Pengenalan: Pengendali makanan pasar malam menggunakan minyak masak yang sama untuk menggoreng makanan seperti bebola ikan, tongkol ayam dan lain-lain makanan yang diproses. Amalan tersebut mengakibatkan lemak dan minyak mengalami penguraian haba dan oksidatif lalu membentuk bahan toksik dan bahaya dikenali sebagai peroksida. Kekerapan makan makanan yang mengandungi peroksida meningkatkan risiko mendapat aterosklerosis dan meningkatkan jumlah lipid serum dan kandungan lipoprotein(LDL). **Objektif:** Kajian ini dijalankan untuk menentukan tahap pengetahuan dan amalan dalam kalangan pengendali makanan bergoreng berkaitan kualiti minyak di bawah majlis perbandaran kajang dan penentuan nilai peroksida dalam minyak masak yang dipanaskan berulang kali. **Metodologi:** Kajian ini (Januari hingga Mac 2019) melibatkan seramai 130 orang pengendali makanan bergoreng dan mereka diberikan satu set soal-selidik yang diubahsuai untuk mengumpul maklumat seperti sosio-demografi, pengetahuan dan amalan penggunaan minyak masak yang dipanaskan berulang kali dan sejumlah 100ml minyak masak diambil bagi menentukan nilai peroksida berdasarkan *American Oil Chemist Society (AOCS) Cd 8b-90*. **Keputusan dan Perbincangan:** Kajian mendapati 76.9% responden memperoleh skor tinggi untuk pengetahuan dan 60% responden memperoleh skor sederhana bagi amalan dalam pengguna minyak masa yang dipanaskan berulang kali. Tiada perkaitan signifikan ditunjukkan antara faktor sosiodemografik dan nilai peroksida. Terdapat perkaitan signifikan negatif antara amalan dan nilai peroksida $r=-0.299$, $p=0.001$. Sementara itu, tiada perkaitan signifikan antara pengetahuan dan amalan $r= -0.002$, $p= 0.986$ serta antara pengetahuan dan nilai peroksida $r= -0.065$, $p=0$. Selain itu, Wilcoxon Signed Rank menunjukkan nilai peroksida signifikan lebih tinggi daripada AOCS $Z= -3.162$, $p=0.002$. Kajian ini turut mendapati sebanyak 54.6% daripada 130 sampel minyak telah melebihi paras yang telah dibenarkan ($10\text{mEqO}_2/\text{kg}$). **Kesimpulan:** Terdapat hubungan signifikan antara amalan dan nilai peroksida $p<0.05$ dan perbezaan antara nilai peroksida yang diperolehi dengan standard AOCs $p<0.001$. Tahap pengetahuan responden adalah tinggi tetapi tahap amalan yang masih dianggap sebagai sederhana. Oleh itu, kita perlu memperbaiki amalan mereka terutama apabila menggunakan minyak masak yang sama untuk menggoreng. Isu ini merupakan kebimbangan yang besar kerana kesihatan pengguna makanan mungkin akan terjejas sekiranya tidak diuruskan dengan baik oleh pihak berkuasa berkaitan makanan.

Kata kunci: Nilai peroksida, pengetahuan, amalan, *titration*

TABLE OF CONTENTS

DECLARATION	i
SIGNATURE OF SUPERVISOR/INTERNAL EXAMINER	ii
ACKNOWLEDGEMENT	iii
ABSTRACT	iv
ABSTRAK	v
CONTENTS	vi
LIST OF TABLES	vii
LIST OF FIGURES	viii
LIST OF ABBREVIATIONS	ix
CHAPTER 1: INTRODUCTION	
1.1 Background	1-2
1.2 Justification & Importance	2-4
1.3 Problem Statement	4-5
1.4 Research Question	5-6
1.5 Variable	6
1.6 Objective	6-7
1.6.1 General	
1.6.2 Specific	
1.7 Hypothesis	7-8
1.8 Definition	8-11
1.8.1 Conceptual	
1.8.2 Operational	

1.9 Conceptual Framework	11-13
CHAPTER 2: LITERATURE REVIEW	
2.1 Cooking oil	14
2.2 Palm oil	14-15
2.3 Changes of cooking oil in the deep frying process	16
2.3 Quality Assessment for Cooking Oil	16-20
2.5.1 Peroxide Value	
2.5.2 Iodometric Titration	
2.5.3 Health Risk Associated with High Peroxide	
2.5.4 Deep frying food consumption pattern among Malaysian	
CHAPTER 3: METHODOLOGY	
3.1 Area of Study	21-22
3.2 Study Design	22-23
3.3 Study Sample	23
3.3.1 Sample of Cooking Oil	
3.4 Sampling method	24
3.5 Sampling Size	25
3.6 Study Instrumentation	26-29
3.6.1 Questionnaire	
3.6.2 Measurement of PV in cooking oil	
3.7 Quality Assurance & Quality Control	29
3.71 Laboratory Analysis of Oil Sample	
3.72 Personal Protective Equipment	
3.8 Data Analysis	30-32

3.9 Ethical Consideration	32-33
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CHAPTER 4: RESULT

4.1 Socio-demographic information	36-38
4.2 Knowledge on the use of repeatedly heated cooking oil	38-40
4.3 Practice on the use of repeatedly heated cooking oil	40-41
4.4 Level of knowledge and practice	41-44
4.5 Peroxide value in the cooking oil	45-46

CHAPTER 5:

DISCUSSION,CONCLUSION AND RECOMMENDATION	47-55
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REFERENCES

APPENDICES

LIST OF TABLES

	Page
Table 3.6.1.1 Scoring for knowledge and practice	27
Table 3.6.2.1 List of Equipments and Ingredients	29
Table 3.8.1 Summary of statistical analysis with respective objective and hypothesis	32-33
Table 4.1 Socio-demographic information of respondents	37-38
Table 4.2 Frequency and percentage of knowledge among respondents	38-39
Table 4.3 Frequency and percentage of practice among respondents	40-41
Table 4.4 Knowledge and practice level among respondents	42
Table 4.5 Association between socio-demographic and peroxide value of respondents	43
Table 4.6 Association between knowledge and practice with peroxide value of respondents	44
Table 4.7 Distribution of peroxide value according to the night market	45
Table 4.8 Comparison between concentration of peroxide value with AOCS Standard	46

LIST OF FIGURES

Figure 1.9.1	Conceptual Framework	Page 13
Figure 2.5.1	Reaction scheme in determination of peroxide by using iodometric titration method	18



UPM

LIST OF ABBREVIATIONS

AOCS **American Oil Chemists Society**

PV **Peroxide Value**

KI **Potassium Iodide**

SDS **Sodium Dodecyl Sulphate**

PPE **Personal Protective Equipment**



UPM

CHAPTER 1

INTRODUCTION

1.1 Background

In Malaysia, deep frying is a common cooking method used in preparation of food especially among night market food operators. They prefer deep frying method as they believe it is less expensive and more convenience for them in order to fulfil consumers' satisfaction. Most people who come and visit to the deep fried street food operators consume considerable amount of fried food. According to (Stevenson et al., 1984) the popularity of deep fried food products is due to the way in which they are cooked. Some popular examples of food that used method of deep frying included food such as chicken nuggets, fish balls and many more.

Deep frying method required large amount of cooking oil. It is also the major reason why they keep the used cooking oil and still used them for the next frying usage. According to Weisshaar (2014), deep frying involves simultaneous heat and mass transfers in the food by immersing them as a whole into the hot cooking oil at temperature of 180°C or higher.

As a result, fats and oils will undergo thermal and oxidative decomposition and the polymers formed are harmful and toxic to human health (Debnath et al., 2009). Repeated use of frying oils produces constituents that may pose health hazards

leading to quality and economic loss. This habit is still wide practised in our society with the only thought to reduce the expenditure on preparation of food without taking into consideration the potential harmful effects from the usage of repeatedly-heated cooking oil especially on human health.

Other than that, hydrogenation process occurs when cooking oils are heated to very high temperature especially during frying. It alters chemical composition as well as chemical structure of fats and made our body having some difficulties in order to breakdown them and finally lead to negative health implications. Trans-fat that formed when unsaturated fats undergo hydrogenation is also associated with the increment risk of many chronic non-communicable diseases such as heart disease, obesity and cancer.

1.2 Study Justification

Since we are now live in a fast paced society, people prefer to eat deep-fried food bought at outside rather than cooking at home (Lew & Barlow, 2005). Consequently, the food frying practices of the food operators could have huge influence on the general health of the Malaysian population.

This study was conducted at Kajang, Selangor which has an estimation population of 795,522. It is a large city located in the province of Selangor, Western Malaysia. The target population in this study was among night market food operators who involved in preparation and selling of deep-fried food in the studied area. One of the objectives of this study being conducted is in order to determine association between

the practice of repeatedly heated cooking oils among night market food operators and the quality of cooking oils which is determined by the peroxide value in the oil samples.

Other than that, cooking oil will experience reduced nutritional value due to the accumulation of deterioration products which is caused by prolonged heating time at high temperature. Based on study conducted by (Azman et al., 2012), it concluded that 40-63% of people admitted to use the same portion of cooking oil repeatedly. Therefore, this study needs to be conducted in order to increase knowledge level especially among night market food operators as they are the main contributor which play an important role in influencing our community health.

1.3 Importance of study

Since we are now living in a fast-paced society, people prefer to eat deep-fried food bought outside rather than cooking at home (Lew & Barlow, 2005). Malaysian people consume a considerable amount of deep-fried food bought from street food outlets. Consequently, the food frying practices of the food operators could have a huge influence on the general health of the Malaysian population.

Prolonged consumption of repeatedly heated cooking oil has been shown to increase blood pressure and total cholesterol which can cause vascular inflammation as well as vascular changes that predispose to atherosclerosis (Ng et al., 2014). To our knowledge, there is no attempt that has been made to evaluate the level of knowledge, attitude and practice among street food operators in Malaysia regarding the use of

repeatedly heated cooking oil. Therefore, this study aims to determine the level of knowledge, attitude and practice of night market food operators in Kajang, Selangor regarding the use of repeatedly heated cooking oil. The quality of cooking oil that was used by the street food operators to fry food was also determined by measuring the peroxide value (PV) of the sampled cooking oils.

Therefore, by conducting this research, it might help to increase the knowledge level and improved their practice especially in usage of repeatedly heated cooking oil for frying food by giving them more exposure and enhance their understanding as well as their awareness towards the importance and harmful effects caused by peroxide to human health.

1.4 Problem Statement

Multiple use of the same cooking oil for frying food is a common practice among our deep-fried street food operators in Malaysia. They prefer to use the same cooking oil for multiple times of usage because from their personal perspective, it can help to reduce their expense as we know deep frying method required large quantity of cooking oil. Based on study conducted by (Azman et al., 2012), it concludes that 40-63% of people admitted to use the same portion of cooking oil repeatedly.

Most importantly, deep frying also deteriorates the quality of cooking oil. Deep frying involves simultaneous heat and mass transfers in the food by immersing them as a whole into the hot cooking oil at temperature of 180°C or higher. Heat is one of the significant factors that increase the rate of oxidation process (Choe and Min,

2006). Peroxide value is used as an indicator in order to determine and measure the quality of cooking oils.

The quality of repeatedly heated cooking oil can be influenced by several factors such as temperature, type of oil, heating duration and oil saturation level (Andrikopoulos et al., 2002). Peroxide is from the formation of primary oxidation products which may later decompose to become lower molecular weight compounds which ultimately leading to a rancid product (Zahir et al., 2014). These toxic substances were absorbed by the food and eventually absorbed into gastrointestinal (GI) tract and eventually enter into our systematic circulation.

Other than that, level of knowledge and information among deep fried street food outlet operators on the negative implication towards health when they use repeatedly heated cooking oil is still consider as low. 84% of 215 respondents from 121 night market did not have knowledge about peroxide in the cooking oil (Inarah, 2015).

1.5 Research questions

This study was aimed to answer the following questions as stated below:

1. What is the level of knowledge and practice regarding repeatedly heated cooking oil usage among respondents?
2. What is the socio demographic data of the respondents?
3. What is peroxide value in the repeatedly heated cooking oil used by the respondents?

4. What is the association between practice of repeatedly heated cooking oil and peroxide value among respondents?

5. What is the association between level of knowledge and peroxide value in repeatedly heated cooking oil among respondents?

1.6 Study Variable

Independent variable

Knowledge and practice on the use of repeatedly heated cooking oil

Dependent variable

Peroxide value in cooking oil

1.7 Objective

1.7.1 General objective

To determine level of knowledge and practice among deep-fried food operators in under Kajang Municipal Council and to determine the peroxide values in repeatedly heated cooking oil.

1.7.2 Specific objective

1. To determine the socio-demographic factors among respondents.
2. To determine the concentration of peroxide value in repeatedly heated cooking oil and compare with American Oil Chemist Society Standard.
3. To determine association between socio-demographic with knowledge and practice among respondents.
4. To determine association between knowledge and practice among respondents.
5. To determine association between knowledge and practice with peroxide value among respondents.

1.8 Hypothesis

- 1) There is an association between socio- demographic factors with the knowledge and practice among respondents..
- 2) There is association between concentration of peroxide value with American Oil Chemist Society Standard.
- 3) There is association between knowledge and practice among respondents.
- 4) There is an association between knowledge and practice with peroxide value among respondents.

1.9 Definition

1.9.1 Conceptual definition

i) Knowledge on using repeatedly heated cooking oil

Is a familiarity, awareness or understanding of someone or something such as facts, information, descriptions or skills, which is acquired through experience or education by perceiving, discovering and learning process.

ii) Practice on using repeatedly heated cooking oil.

Deep frying is a cooking process in which water containing foodstuff is immersed into edible oils or fats at temperature between 140°C – 180°C. During this process, most of night market food operators most likely to reuse the same cooking oil until it is discarded and replaced with the new and fresh oil. Oils and fats have a high heat capacity hence it enable transfer of heat at temperature above the boiling point of water. Due to the evaporation in the boundary zone between food and oil, the water bound in the food is gradually transported from the layer inside to the boundary layer and finally into the surrounding oil. The moist released from the food acts a protective shield thus it can prevent direct contact of oxygen to the fat surface. Cooking oil shall be edible which can be used for frying. If the same cooking oil is being used and recycled from the previous cooking process for several times before being discarded, it may result to rancidity of oil.

iii) Peroxide

Lipid peroxide is the primary product of oxidized oils or fats. Oxidation is the loss of electron from atoms or molecules. When a molecule loses its electrons, it becomes a new and different type of molecule. When lipids or phospholipids are exposed to air they react with oxygen. Oxygen is most commonly known as very electro-negative and it tends to be attracted to positively charged atoms or molecules such as hydrogen, leaving other atoms or molecules with their electron exposed. Compounds with two adjacent oxygen atoms and no hydrogen atom or other positively charged atoms to couple to the exposed electrons are called peroxides.

iv) Food operators

Any person who directly handles packaged or unpackaged food, food equipment and utensils, or food contact surfaces and is therefore expected to comply with food hygiene requirements in order to serve safe food for human consumption.

iv) Socio-demographic factors

Refers to a group defined by its sociological and demographic characteristics. Socio-demographic groups are used for analyses in the social sciences. Demographic characteristics can refer to age, sex, place of residence, religion, races, educational level and marital status. Sociological characteristics can refer to objective traits such as membership in an organizations, household status, interests, values and social groups.

Operational Definition

i) Knowledge on using repeatedly heated cooking oil

It was determined through a set of questionnaire in which respondents (N=130) were evaluated based on nine items based on three: Agree, Disagree or Not Sure. A score of one was allocated for correct answer and otherwise no mark was given for both incorrect and not sure answer.

ii) Practice on using repeatedly heated cooking oil

It was determined through a set of questionnaire in which respondents (N=130) were evaluated based on eight items with two choices of answer: Yes or No. A score of one was allocated for each correct answer and otherwise no mark was given for incorrect answer.

iii) Peroxide value (PV)

Peroxide value is an essential indicator in order to determine the rancidity and the quality level of repeatedly heated cooking oil. It is usually carried out by measuring the amount of iodine liberated from potassium iodide by the peroxides in the cooking oil. The peroxide value is also defined as the amount of peroxide oxygen per one kilogram of fat or oil and the unit of milliequivalent has been commonly abbreviated as mequiv or even as meq/kg.

iv) Food operators

Individual who were responsible and involved in preparation and selling any type of deep-fried food products such as chicken nuggets, fish balls and others by using large amount of cooking oil. Their business operation hours were usually from 7pm until 10pm.

v) Socio-demographic factors

The socio-demographic factors being studied were including age, gender, educational status and monthly income of respondents in this study.

1.10 Conceptual framework

Figure 1.10.1 illustrates the conceptual framework for this study. This study is focusing on knowledge and practice related to the usage of repeatedly heated cooking oil among deep fried food operators and determination of peroxide value in their used cooking oil. Based on this framework, there are several factors that can affect knowledge and practice which is socio-demographic backgrounds (gender, age, educational status and monthly income). The knowledge of these night market food operators associated with practice on repeatedly heated the cooking oil. Repeatedly heated cooking oil produces by-product that gives harmful effects to human health. The appearance of by-product varies on several factors, which are temperature, packaging, type of cooking oil, and duration of oil. The current demand of economic growth gives impact to the cost of raw ingredients and cost of living. Therefore, these night market food operators tend to use repeatedly heated cooking oil in order to cut cost. The by-products produce from repeatedly cooking oil are aldehyde, fatty acid, alkene concentration, peroxide value, and iodine level. The pollutant of concern in this study is peroxide value as it shows the deterioration of the cooking oil. Consumers that having long term intake deep fried food with high peroxide value content may increase the risk to develop chronic disease such as obesity, diabetes, high blood pressure, atherosclerosis, and cancer. Figure 1.10.1 summarise the possible link between peroxide value with the risk of developing of several chronic diseases.

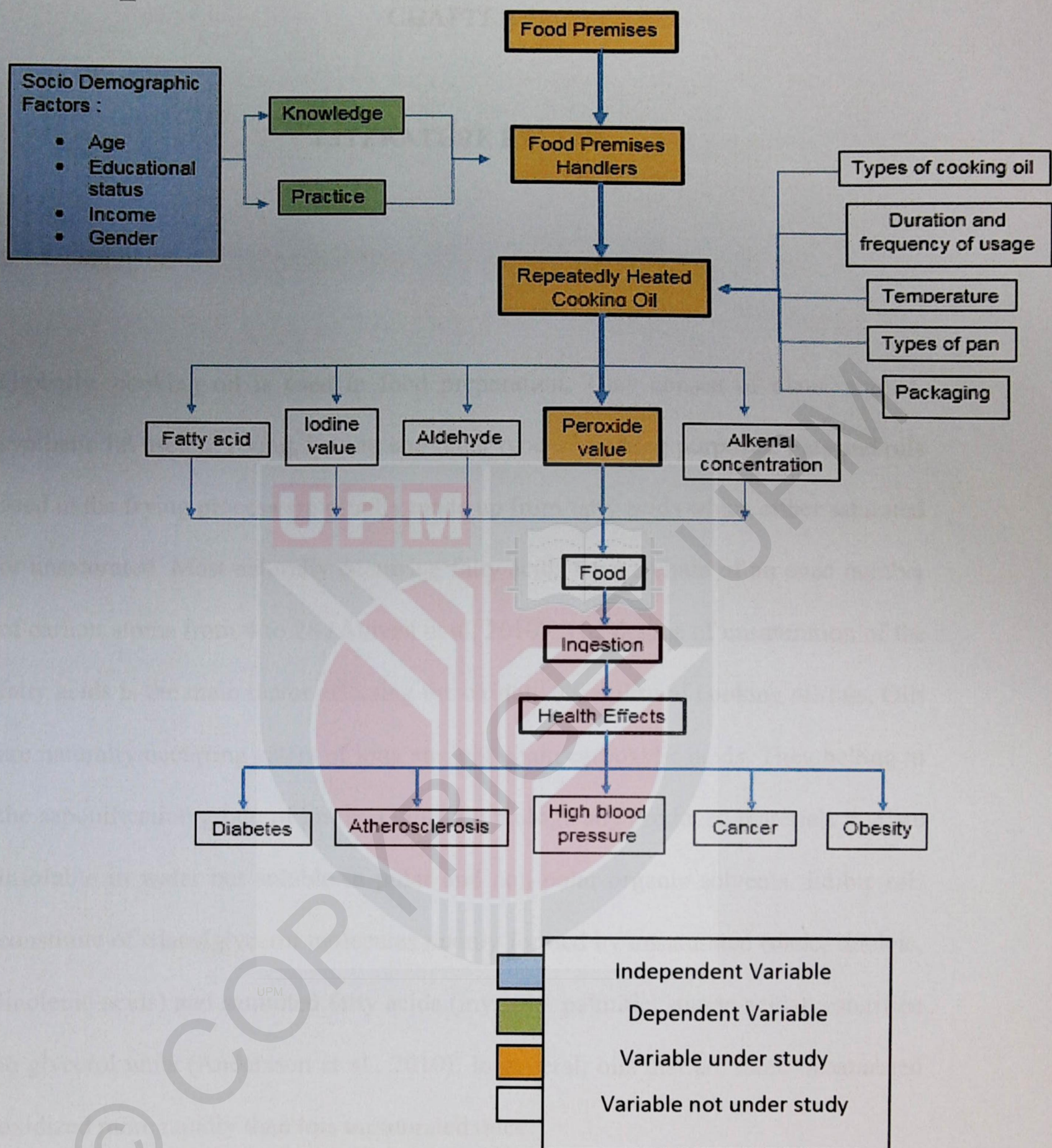


Figure 1.10.1: Conceptual framework

CHAPTER 2

LITERATURE REVIEW

2.1 Cooking oil

Globally, cooking oil is used in food preparation. They consist of plant, animal, synthetic fat used in frying, baking and other type of cooking purposes. Fats and oils used in the frying process are usually made up from fatty acids which either saturated or unsaturated. Most naturally occurring fatty acids have a chain of an even number of carbon atoms from 4 to 28 (Alireza et al, 2010). The degree of unsaturation of the fatty acids is the main factor affecting the oxidative stability of cooking oil/fats. Oils are naturally occurring esters of long straight chain carboxylic acids. They belong to the saponification group of lipids. Lipids are biologically produced materials that are insoluble in water but soluble in polar and non-polar organic solvents. Edible oils constitute of triacylglycerol molecules mainly formed by unsaturated (oleic, linoleic, linolenic acids) and saturated fatty acids (myristic, palmitic, stearic acids), esterified to glycerol units (Andersson et al., 2010). In general, oils that are more unsaturated oxidized more rapidly than less unsaturated ones.

2.2 Palm oil

Palm oil is extracted from the pulp of the fruit of the oil palm. It is good for deep-frying as it maintain the natural taste of food. Palm oil consists mostly of saturated and monounsaturated fatty acids, where it makes them a great choice especially for

deep-frying process. It is a common cooking ingredient in the tropical belt of Africa, Southeast Asia and parts of Brazil. Therefore, palm oil has been used in food preparation for over 5,000 years and it is the most widely produced edible vegetable oil in the world and its nutritional and health attributes have been well documented (Chandrasekharan et al. 2000). They are also cheap and have high smoke point thus it is very useful for deep frying. According to Basirun (2007), palm oil is cheaper and widely used across the globe compared to soy and corn oil. In addition, its unique composition of low level of polyunsaturated fatty acid (PUFA) that is easier to oxidized to form toxic compound during repeatedly heating process, which can result to harmful effects to human health. On the other hands, palm oil compound in which have the ability to tolerate thermal oxidative changes would maintain the Vitamin E quality. According to (Kamsiah & Yusof, 2012), palm oil is a favourable option for food operators than soy oil and corn oil due to the chemical benefits as well as in order to cut cost especially in Malaysia. Deep frying is a dehydration process where water and water soluble substances are extracted from the food product that being deep fried and transferred to the cooking fat (Choe & Min, 2007). As deep fried frying is normally conducted at high temperature between 160°C and 180°C with the presence of air and mixture, oils and fats will undergo physical and chemical deterioration. This will give effect to their frying performances and storage stability of the deep fried foods (Fauziah, Razali and Nor Aini, 2000).

2.3 Changes of cooking oil in the deep frying process

Deep frying method is more efficient than the dry heat of an oven or microwave and it is even faster than boiling by the use of water since the high temperatures increases the penetration rate of heat into the cooked food. The popularity of deep fried food products are due to in part to the basic structure imposed on them by the way in which they are cooked. Even when this cooking method was claimed as a fast, convenient and energy-efficient as well as able to increase the tastiness due to the characteristics of fat absorption, crust formation, and pleasant flavours and odours, this process also undergo chemical process that may alter their characteristics such as thermal oxidation, polymerization and hydrolysis if being heated continuously at high temperature with presence of oxygen and water from the fried food (Jaarin et al., 2011).

2.4 Quality assessment for cooking oil

2.4.1 Peroxide value

This method is carried out by simply dissolving the oil sample in a solvent and potassium iodide and then titrating with sodium thiosulphate and using starch as an indicator (American Oil Chemists' Society, 1998). It is usually use an indicator to the shelf life of cooking oil. Fat oxidation is a process when fats or oils are exposed to the ambient air, sunlight and high temperature. This will result in breakage of fatty acids from glycerine or the addition of oxygen into unsaturated fatty acids and the formation of peroxide was a natural reaction that occurs. Other than that, the type,

form and amount of oils should be taken into consideration in order to determine the concentration of peroxide in the cooking oil.

2.5 Iodometric titration

The iodometric method, based upon the liberation of iodine from potassium iodide is the most reliable procedure for the determination of peroxide-oxygen in cooking oils. The basic principle in iodometric titration method is illustrated in the Figure 2.5.1 below. The oil sample is mixed in solution with a mixture of acetic acid and a suitable organic solvent and then with a solution of potassium iodide. The liberated iodine is titrated with standard solution of sodium thiosulfate. Peroxide and similar products which oxidize potassium iodide under the conditions of the test contribute to the peroxide value. The peroxide value is expressed either in milliequivalent of peroxide/kg or millimoles of peroxide (International Fragrance Association, 2011)

<u>Generation of hydro-peroxide</u>	
$R-H+O_2 \longrightarrow ROOH$	Reaction I
<u>Generation of Iodine</u>	
$KI+CH_3COOH \longrightarrow HI+CH_3COO-K+$	Reaction II
$ROOH+2HI \longrightarrow ROH+H_2O+I_2+ \text{ starch indicator}$	Reaction III
<u>Titration step:</u>	
$I_2 \text{ (purple)}+2Na_2S_2O_3 \longrightarrow Na_2S_4O_6+2NaI(\text{colourless})$	Reaction IV

Figure 2.5.1: Reaction scheme in determination of peroxide by using iodometric titration method (International Fragrance Association, 2011)

2.6 Health risk associated with high peroxide presence in cooking oil

It is not surprising that consumption of deep-fried food is linked to the weight gained, especially in people those who at risk and has family history of obesity. It is true that fried food have unique sensorial properties which make consumers attracted to them. However, the changes take place in oil because of repeated frying are often deteriorative and fatty acids undergo chemical changes and make the fried food an unsuitable product in term of nutritional value (Sabedio et al., 1996). Complex chemical reaction during repeatedly heated cooking oil causing hydrolysis, oxidation, and polymerization of the oil and produces volatile or non-volatile compounds. Some of volatile compound will be undergo further chemical reactions or absorbed in fried food and most of it will be evaporated in the atmosphere with steam (Choe & Min, 2007). Deep-fried food consumption in a long term will give significant health

effects toward consumers. Previous study reported that repeatedly heated cooking oil can give adverse nutritional implications and potential hazards to human health in which it produces constituents that not only influence food quality but also can induces the formation of compounds (Sanibal & Mancini-Filho, 2004).

The quality of oil also deteriorates with the increasing number of frying time that accelerates the formation of oxidized and polymerized lipid. When frying oil is heated at high temperature, hydroperoxides and aldehydes are formed. These toxic substances are absorbed by the food and eventually absorbed into the gastrointestinal tract and will enter our systematic circulation. Intake of repeatedly heated palm oil significantly increased the blood pressure in experimental animals. In addition, (Soriguer et al. 2009) reported that consumption of repeatedly heated frying oils is associated with increased risk of hypertension. Other than that, the potential antherogenic property of heated oil through oral administration of heated palm oil is observed to elevate the level of lipid peroxides in the human plasma, especially in the chylomicrons. The human chylomicrons are obtained after heated oil ingestion. It has shown that the chylomicrons treated with heated oil were degraded more rapidly by cultured mouse macrophages. It is then followed by those which undergo treatment with fresh palm oil. In brief, the uptake of heated oil-treated chylomicrons by macrophage resulted in a 10-fold higher accumulation of cholesterol ester mass in the cells than the incubation with fresh oil-treated chylomicrons after 48 hours period (Parker et al., 2003).

2.7 Deep frying food consumption pattern among Malaysian

Based on previous study by (Ganasegeran et al., 2012), it was found that up to 73.5% among university students had fried food twice a week or more while 26.2% took it less than two times. One of the main concerns pertaining to the consumption of fried food is because of lack of knowledge on healthy food choices that might affect eating habits and nutritional status of an individual. This is also supported by a research in China that revealed young adults especially exposed to developing risk factors for chronic disease due to the poor and unhealthy eating habits such as frequent consumption of fried food (Ku et al., 2014). Thus, as a consumer, we should always monitor and try to limit the intake of fried food to practice a healthy diet in daily life.

CHAPTER 3

METHODOLOGY

3.1 Area of study

Kajang is one of a city with an estimation of population of 795,522. It is a large city located in the province of Selangor, Western Malaysia. Kajang is located in a very densely populated metropolitan area of Kuala Lumpur. The main reason Kajang is selected as the area of study is people live there is currently experiencing development and modernization. According to (Azman et al., 2015), they assumed that the sub-urban population is more aware and knowledgeable compared to rural population on health issue. Therefore, their level of knowledge can be seen as being representative of the knowledge of a typical sub-urban population of a developing country in South-East Asia.

3.2 Study design

This cross sectional study design was carried out starting from January until March 2019 which involving the selected food operators who operate and selling deep fried food as study population in this study. This was also an experimental study design in order to measure the concentration of peroxide in the repeatedly heated cooking oil

used. The selected night markets which involved food outlet under Kajang Municipal Council were assessed throughout the entire month of January 2019. Face-to-face interview with night market food operators were conducted to collect relevant data. The interview sessions were based on structured questionnaire and the obtained information were recorded. At the same time, the oil samples were collected from the food operators who also participated as respondents of the night markets.

3.3 Study sample

The respondents included in this study were among night market food operators. The inclusion criteria for the selected respondents were citizens of Malaysia who live in Kajang area, aged 18 years old and above and the food operators must involve in preparation and selling of any type of deep fried food products. Other than that, information for the most frequently used cooking oil's brand and the type of packaging cooking oil either in bottle or packed was obtained by asking to the respondents for survey purpose. Relevant information and data was also collected through the distribution of questionnaire and also through face to face interview with intention to evaluate on the practice and use of repeatedly heated cooking oil among food operators as well as their knowledge level on effects of peroxide to human health.

3.3.1 Samples of cooking oil

A total of 100 millilitres (100mL) of used oil were collected from each of the respondents using stainless steel tool. The oil was kept in a dark colour bottle and was as soon as possible frozen at -18 °C to -20 °C until analysed. Each sample were triplicates during examination to assure the validity of the measurements and method used. Upon the analysis frozen oil were put at room temperature for 24 hours to thaw.

3.4 Sampling method

A list of registered night market (N=56) located in Kajang was obtained from Kajang Municipal Council was referred for selection of respondents needed for this study. The sampling method used to select the night market in this study was based on a convenience sampling. The total of 13 night markets included in this study were Seksyen 4 Bangi, Seksyen 7 Bangi, Seksyen 9, Bangi Seksyen 16 Bangi, Taman Bandar Seri Putra, Taman Bukit Mahkota, Taman Delima, Taman Kajang Utama, Taman Bukit Mewah, Kompleks Hentian Kajang, Taman Jasmin, Taman Desa Jenaris and Taman Setia Sg. Chua.

For the selection of 130 night market food operators was also based on convenience sampling where all food operators that involved in preparation and selling any type

of deep fried food was included. This method is used as where the respondents were readily available in the selected night market.

3.5 Sample size

The sample size calculation is based on (Lemeshow et al., 1990) in cross sectional study for one group of population. The formula and calculation were as shown below:

$$N = Z^2_{1-\alpha/2} P (1-P) / d^2$$

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

P = anticipated population proportion (86.6% according to the Sivananthan et al., 2013)

D = absolute precision required on either side of the proportion (Margin of error is $\pm 5\%$ or 0.05)

The calculation of estimated sample size:

$$\begin{aligned} N &= (1.96)^2 * (0.25) / (0.09)^2 \\ &= 118.6 \end{aligned}$$

~119 respondents (minimum sample size calculated)

In short, the total number of food operators selected for this study is 130.

3.6 Data collection and instrumentation

3.6.1 Questionnaire

This structured questionnaire was available in English and Malay languages. This questionnaire consists of four parts: (A) Demographic information; (B) Knowledge on the usage of repeatedly heated cooking oil; (C) Knowledge about peroxide; (D) Practice on the usage of repeatedly heated cooking oil, modified from (Azman et al. 2015) and (Adriana et al. 2018). In order to maintain the reliability of the questionnaire, pre-testing has been conducted among ten food operator around Universiti Putra Malaysia and Sri Serdang. The Cronbach's Alpha value obtained was 0.723.

The socio-demographic information obtained was gender, marital status age, race, educational status and monthly income. Other than that, information for the most frequently used cooking oil's brand was obtained by asking to the respondents for survey purpose. Relevant information and data was also collected through the distribution of questionnaire and also through face to face interview with intention to evaluate on the practice and use of repeatedly heated cooking oil among food operators as well as their knowledge level on effects of peroxide to human health.

On the other hand, the level of knowledge on the use of repeatedly heated cooking oil was assessed on nine (9) items based on three: Agree, Disagree or Not Sure. A score of one was allocated for correct and zero score for both incorrect and not sure answer. Meanwhile, the level of practice on the use of repeatedly heated cooking oil was evaluated based on eight (8) items with 2 choices of answer: Yes or No. A score of one (1) was allocated for correct answer, otherwise nil (0) mark was given.

The respondents score for both knowledge and practice were categorized into three level as illustrated in the Table 3.6.1.1 below.

Table 3.6.1.1: Scoring for knowledge and practice (modified from Azman et al., 2012)

Variable	Level	Range
Knowledge	Low	0-2 score
	Moderate	3-5 score
	High	6-8 score
Practice	Poor	0-1 score
	Moderate	2-3 score
	Good	4-5 score

3.6.2 Measurement of peroxide value (PV) in cooking oil

The used cooking oil was collected during the peak hour of night market business operation at the hour between 7pm until 9pm. A total of 100 millilitres (100mL) of used oil were collected from each of the respondents using stainless steel tool. The oil was kept in a dark colour bottle and was as soon as possible frozen at -18 °C to -20 °C until analysed. Each sample was undergo triplicates during examination to assure the validity of the measurements and method used. Upon the analysis frozen oil were put at room temperature for 24 hours to thaw.

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

Next, the oil sample was weighed to 5.00 ± 0.05 g and put into a 250 millilitres (250 mL) Erlenmeyer flask with glass stopper and 50 millilitres (50 mL) of the 3:2 acetic acid–isooctane solution was added. The flask was swirled to dissolve the sample. 0.5 millilitres (0.5 mL) of saturated KI solution was added by using a suitable volumetric pipet. Then, the solution was allowed to stand for exactly 1 min, followed by thoroughly shaking the solution at least three times during the 1 min. After that, 30 mL of distilled water was added. Then, titrate with 0.1N sodium thiosulfate by performed by adding it gradually and with constant and vigorous agitation. Continue the titration until the yellow iodine colour has almost disappeared. After that, add 0.5 mL of 10% SDS was added followed by 0.5 mL of starch indicator solution. The titration was continued with constant agitation, especially near the end point, to liberate all of the iodine from the solvent layer. The thiosulfate solution was added drop by drop until the blue colour just disappears. After the analysis, the amount of titrant used to change the colour were recorded and inserted into formula to obtain peroxide value. The peroxide value then compared with standard from AOCS as an indicator of deterioration for vegetable oil. Thereafter, the following equation was used to determine PV:

Peroxide Value (mEq) = [Volume of thiosulphate titrate (mL) x Concentration of thiosulphate solution (N) x 1000] / Weight of sample (g)

The summary of equipment and reagents involve in laboratory analysis for measurement of peroxide value in oil samples.

Table 3.6.2.1: List of Equipments and Ingredients

Equipments	Reagents
1. 250ml conical stopper flask	1. Glacial Acetic Acid-Chloroform (3:2) by volume
2. 50ml burette	2. KI solution (22g KI and 11ml water)
3. Balance	3. 1% Starch solution
4. Automatic pipette 1ml	4. 0.01M Sodium thiosulphate solution
5. Pasteur pipette	
6. 25ml measuring cylinder	
7. 100ml measuring cylinder	

3.7 Quality assurance and quality control

3.7.1 Laboratory analysis of oil samples

During the collection of cooking oil samples from night market food operators, there are several aspects were taken by which is by using appropriate equipment and procedures in order to analyse and determine the parameter of interest in this study which is peroxide value. Other than that, the volume of cooking oil sample collected must be sufficient in order to perform laboratory analysis. Besides, each containers and equipment that used in this experiment was cleaned and labelled properly as according to the prior analysis.

3.7.2 Personal protective equipment

Individual who responsible and involved must wear goggle, nitrile glove and laboratory coat fully to avoid accidently contact or splash with the chemicals used in this analysis. Other than that, it is also to prevent contamination to the oil samples that might affect the result of measurement reading.

3.8 Data analysis

All data obtained from the questionnaire were statistically analysed with the SPSS version 25. The descriptive statistics such as frequency, percentage, minimum, maximum, median and range were acquired to describe the data. Other than that statistical test used were Spearman Correlation, Kruskal Wallis and Wilcoxon Signed Rank Test. In addition, peroxide value (PV) is determined through AOCS Official Method Cd 8b-90; Peroxide Value: Acetic Acid-isooctane Method (AOCS,2011).

Table below shows the summary of statistical analysis with respective specific objective and hypothesis.

Table 3.8.1 Statistical analysis

Objectives	Hypothesis	Statistical Analysis
1) To determine the socio-demographic factors among respondents.	No hypothesis	1) Descriptive statistic (frequency and percentage)
2) To determine the concentration of peroxide value in repeatedly heated cooking oil and compare with American Oil Chemist Society Standard.	There is association between peroxide value with American Oil Chemist Society Standard.	1) Descriptive statistic (frequency and percentage) 2) Kruskal Wallis 3) Wilcoxon Signed Rank
3) To determine association between socio-demographic with knowledge and practice among respondents.	There is association between socio-demographic factors with knowledge and practice among	1) Descriptive statistic (frequency and percentage) 2) Spearman correlation

	respondents.	
4) To determine association between knowledge and practice among respondents.	There is association between knowledge and practice among respondents.	Spearman correlation.
5) To determine association between knowledge and practice with peroxide value among respondents.	There is association between knowledge and practice with peroxide value among respondents.	Spearman correlation.

3.9 Ethical permission and consideration

The permission to conduct this study was obtained from the Ethics Committee for Research involving Human Subjects Universiti Putra Malaysia (JKEUPM) before this study started. The ref no: UPM/TNCPI/RMC/JKEUPM/1.4.18.2 (JKEUPM). Explanation about the background of this study was given to the respondents for

them to sign the participation consent form as an agreement to involve in this study voluntarily before answering questions based on structured questionnaire. The confidentiality of respondent's personal details remained and was not mentioned or included in any parts of this study and publication.



CHAPTER 4

RESULTS

4.1 Socio-demographic information of respondents

A total of 130 night market food operators under Kajang Municipal Council were recruited in this study. Based on the questionnaire given, there were more male (77.7%) than female for the gender. From this survey, it was found that 100% of the respondents were Malay and 75.4% of them were married. The respondents aged range was between 21 years old until 60 years old. As for the educational status, 90.7% of them received their formal education up to secondary school level (SPM) and last but not least 65.4% of their monthly incomes ranged from RM700-RM1000. Further information was shown in Table 1.

Table 1: Frequency of socio-demographic factors of respondents (N=130)

Variable	Frequency (%)	Minimum	Maximum	Median (25th - 75th)
Gender				
Male	101 (77.7)			
Female	29 (22.3)			
Age (years old)				
≤25	10 (7.7)	20	60	34 (29-43)
26-30	30 (23.1)			
31-35	30 (23.1)			
36-40	15 (11.5)			
41-45	24 (18.5)			
46-50	7 (5.4)			
51-55	10 (7.7)			
56-60	4 (3.1)			
Marital status				
Single	32 (24.6)			
Married	98 (75.4)			
Race				
Malay	130 (100)			
Educational status				
No formal	4 (3.1)			
UPSR	9 (6.9)			
PMR	38 (29.2)			
SPM	71 (54.6)			
Degree	8 (6.2)			
Monthly income				
≤RM500	1 (0.8)			
RM501- RM600	18 (13.9)			
RM601- RM700	23 (17.7)			
RM701- RM800	27 (20.8)			
RM801- RM900	30 (23.1)			
RM901- RM1000	28 (21.5)			
RM1001- RM1100	3 (2.3)			

4.2 Knowledge on using repeatedly heated cooking oil

The frequency and percentage of knowledge on using repeatedly heated cooking oil was shown in Table 2. Out of 130 of respondents, 74.6% of them agreed that usage of repeatedly heated cooking oil is a healthy practice. Meanwhile, 89.2% of them admitted that using heated cooking oil is good for save cost. About 78.5% stated that repeatedly heated cooking oil cause bad effects to human health. Other details about the knowledge using repeatedly heated cooking oil among respondents were presented in the Table 2.

Table 2: The frequency and percentage of knowledge on using repeatedly heated cooking oil among respondents (N=130)

No.	Question	Frequency (%)
1	Usage of repeatedly heated cooking oil is a healthy practice	
	Agree	97 (74.6)
	Disagree	0 (0)
	Not sure	33 (25.4)
2	Usage of repeatedly heated cooking oil is good for save cost	
	Agree	116 (89.2)
	Disagree	1 (0.8)
	Not sure	13 (10)
3	Usage repeatedly heated cooking oil for frying food has no side effect	
	Agree	102 (89.2)
	Disagree	28 (21.5)
	Not sure	
4	The quality of oil used for frying will remain the same even regardless of how many times the oil is reheated	
	Agree	18 (13.8)
	Disagree	80 (61.5)
	Not sure	32 (24.6)
5	We can use the oil for many times and discard it only when it turns dark	
	Agree	129 (99.2)
	Disagree	1 (0.8)
	Not sure	
6	There will be loss in nutrient in the repeatedly heated cooking oil	
	Agree	5 (3.8)
	Disagree	93 (71.5)
	Not sure	32 (24.6)
7	The type of cooking oil does not influence the type of constituents produced from the repeatedly heated cooking oil	
	Agree	120 (78.4)
	Disagree	1 (0.8)
	Not sure	27 (20.8)

8	Will repeatedly heated cooking oil cause bad effects to our health?	
	Agree	102 (78.4)
	Disagree	1 (0.8)
	Not sure	27 (20.8)
9	If answer yes. What type of disease associated with the consumption of repeatedly heated cooking oil	
	Gout	1 (0.8)
	Tuberculosis	1 (0.8)
	Diabetes	1 (0.8)
	Hypertension	72 (55.4)
	Cancer	58 (44.6)

4.3 Practice on using repeatedly heated cooking oil

From this survey, 100% of respondents admitted that they used repeatedly heated cooking oil for frying. In addition, 100% of them were also not monitored the temperature of their cooking oil during the operation hour. Out of 130 respondents participated, 57.7% of them added new oil for 4-6 times of frying. Other detail on the practice of using repeatedly heated cooking oil was presented in the Table 3.

Table 3: The frequency and percentage of practice on using repeatedly heated cooking oil among respondents (N=130)

No.	Question	Frequency (%)
1	Do you use repeatedly heated cooking oil for frying? (If Yes, skip question 2)	
	Yes	130 (100)
	No	
2	What are the reasons for not use repeatedly heated cooking oil for frying?	
	Harmful to health	
	Food will look bad	
	Increase cooking oil cholesterol level	
	Others	
3	Do you add new oil after several times of frying?	
	If yes, how many times?	
	1-3 times	55 (42.3)
	4-6 times	75 (57.7)
	More than 6 times	
	No	
4	How many times do you change the oil during operation?	
	1-3 times	36 (27.7)
	4-6 times	93 (71.5)
	More than 6 times	1 (0.8)
5	Do you measure the temperature of cooking oil during operation?	
	If yes, how much?	
	No	130 (100)
6	How many times the cooking oil reused before discarded?	
	2 times	7 (5.4)
	3 times	23 (17.7)
	4-10 times	100 (76.9)
7	Choose the methods to maintain the cooking oil quality.	
	a) Use fresh oil for every frying	35 (26.9)
	b) Maintaining small flame during frying	48 (36.9)
	c) Using stainless steel utensil	51 (38.5)
	d) Store cooking oil in stainless steel or glass container after used	98 (75.4)
	e) Filter the cooking oil to catch any leftover or foreign matter	88 (67.7)
8	How do you obtained the information regarding the use	

- repeatedly heated cooking oil
- a) Television
 - b) Radio
 - c) Internet
 - d) Magazine
 - e) Newspaper
 - f) No prior knowledge
 - g) Others

4.4 Knowledge and practice level

This study revealed that 76.9% among respondents had high level of knowledge meanwhile for practice level, 60% of them had moderate level. Other detail on knowledge and practice level on repeatedly heated cooking oil was presented in Table 4.

Table 4: The knowledge and practice level of using repeatedly heated cooking oil among respondents (N=130)

Variable	Level	Frequency (%)	Range
Knowledge	Low	0 (0)	0-2 score
	Moderate	30 (23.1)	3-5 score
	High	100 (76.9)	6-8 score
Practice	Poor	0 (0)	0-1 score
	Moderate	78 (60)	2-3 score
	Good	52 (40)	4-5 score

Based on Table 5 below, the socio-demographic factors that were taken into consideration were age, gender, educational status and monthly income. Result shows that there was no significant association between these socio-demographic factors with the peroxide value.



Table 5: Association between socio-demographic and peroxide value among respondents (N=130)

		Peroxide value		Total (N)	χ^2	p	df
		Below < 10mEqO ₂ /kg	Exceed ≥10 mEqO ₂ /kg				
Age	≤ 45 years	51	58	109	0.537	0.464	1
	46 to 61 years	8	13	21			
	Total	59	71	130			
Gender	Male	49	52	101	1.79	0.181	1
	Female	10	19	29			
	Total	59	71	130			
Educational Status	Primary	5	8	13	0.331	0.848	2
	Secondary	50	59	109			
	Tertiary	4	4	8			
	Total	59	71	130			
Monthly Income	RM500 - RM700	19	23	42	1.92	0.383	2
	RM701 - RM900	29	28	57			
	RM901-RM1100	11	20	31			
	Total	59	71	130			

Based on Table 6, there is a significant association between practice and peroxide value (PV) among respondents where $r = -0.299$, $p = 0.001$. Meanwhile, there is no significant association between knowledge and peroxide value where $r = -0.065$, $p = 0.46$ as well as knowledge and practice where $r = -0.002$, $p = 0.986$.

Table 6: Association between knowledge and practice with peroxide value (PV) among respondents (N=130)

Variable	r	p-value
Knowledge	-0.065	0.46
Practice	-0.299	0.001*

*significant value $p < 0.05$

Association between knowledge and practice among respondents (N=130)

Variable	r	p-value
Knowledge	-0.002	0.986

4.5 The peroxide value in repeatedly heated cooking oil

Table 7 shows that there were total of thirteen night market were involved this study.

There were 54.6% which is equivalent to 71 samples from total of 130 sample of cooking oil exceeding the limit (10mEqO₂/kg)

Based on **Table 7** below, the distribution of peroxide value according to night market (N=130) is briefly explained.

Table 7: Distribution of peroxide value according to night market (N=130)

Night Market	N	Sample exceed 10mEqO ₂ /kg (N)	Min-Max	Median (25th-75th)	Kruskal Wallis (df)	p-value
Seksyen 4, Bangi	9	7	8.67-19.33	13.33(10.00-17.00)	6.632 (120)	0.881
Seksyen 16, Bangi	10	6	6.6 -18.67	12.34 (8.17-18.67)		
Seksyen 7, Bangi	11	5	7.33-19.33	9.33 (8.67-18.67)		
Bandar Seri Putra	11	3	6.67-22.67	9.33 (8.46-20.48)		
Seksyen 9, Bangi	10	4	6.67-21.33	9.33 (7.66-12.83)		
Bukit Mahkota	10	5	8.00-20.00	9.00 (8.33- 12.16)		
Taman Delima	11	8	7.33-18.67	10.00 (8.67-13.33)		
Taman Kajang Utama	8	4	6.67-19.33	11.33 (7.66-17.00)		
Taman Bukit Mewah	9	6	6.00-20.67	9.45 (6.75-18.94)		
Kompleks Hentian Kajang	11	7	7.33-21.33	10.67 (8.66-15.66)		
Taman Jasmin	11	5	7.33-21.33	10.67 (8.66-15.66)		
Desa Jenaris	11	6	8.00-20.67	10.67 (7.33-19.52)		
Taman Setia Sg. Chua	11	5	8.67-20.67	11.15 (7.86-21.88)		

Table 8 shows that a Wilcoxon Signed Rank indicated that the concentration of peroxide value obtained is statistically significant higher than AOCS Standard where $Z = -3.162$, $p = 0.002$.

Table 8: Comparison between concentration of peroxide value with AOCS Standard

(10mEqO ₂ /kg)			
Variable	Z	p-value	Mean rank
Peroxide value	-3.162	0.002*	40.36
*significant value <0.005			

CHAPTER 5

5.1 DISCUSSION

This study was conducted to assess the level of knowledge and practice regarding repeatedly heated cooking oil amongst night market food operators under Kajang Municipal Council. This population was interesting to study because they lived in city which experiencing development and modernization. According to (Azman et al., 2015), they assumed that the sub-urban population is more aware and knowledgeable about the health issues compared to a rural population. Therefore, the level of awareness of Kajang sub-urban population regarding this little-known health issue can be seen as being representative of the knowledge of a typical sub-urban population of a developing country in South-East Asia.

Night market is considered as a small scale business takes place only for few hours during the evening and operates only one to a few days in a week despite of selling variety of low-priced products. According to Khalilah (2010), night markets were defined as temporary weekly event that usually takes places at available open spaces and on road parking lots that are temporarily closed to allow for their operations.

A total of 130 night market food operators under Kajang Municipal Council were recruited in this research. All the questionnaires given were successfully returned and answered. Thus, the response rate obtained for this study is 100% with no rejected or drop-out cases. Based on the questionnaire given, there were more male (77.7%) than female for the gender. From this survey, it was found that 100% of the respondents

were Malay and 75.4% of them were married. This situation was not surprising since that the area of Kajang has been the settlement of Malay's population and most of them tend to operate the night market as source of financial income. The respondents aged were between 20 years old up until 60 years old. This situation was not surprising since the age between 18-35 years old tend to go to night market compared to elderly citizens. As for the educational status, out of 130 respondents 90.7% of them received their formal education up to secondary school level (SPM) and last but not least this research revealed that 23.08% of night food operators earned monthly income range from RM801-RM900. Based on the interview conducted, they just prepared a limited variation of food products in order to prevent any waste. This was the reason why majority of respondents only generated a monthly income of RM900 or less.

This study was also supported by (Wai, 2007) where it emphasized on the limited variation of food products offered by the food operators operating a small-medium scale of business. After data collection and analysis of data, we found that there were no association between socio demographic factors with the knowledge and practice of the respondents. The same result was also obtained by a previous study (Azman et al., 2012).

Based on the results obtained from questionnaire, 76.9% of food operators were categorized having a good knowledge related to the use and peroxide contained in repeatedly heated cooking oil. Most of respondents participated in this study were enrolled from secondary education. This is quiet surprisingly as according to (Inarah et al., 2015), they stated that 84% out of 215 respondents from 121 night market did not have knowledge about peroxide in the cooking oil. Based on the result, majority of the respondents were knowledgeable on that the consumption of repeatedly heated

cooking oil is not a good practice. They admitted that long term consumption of repeatedly heated cooking oil can bring harmful effect to human health such as cancer. Unfortunately, they were still used the same cooking oil for several time before discarding it in order to cut cost. If the practice of using oil repeatedly for frying is vital due to economic reasons, then palm oil would be the better choice. As mentioned before, palm oil is cheaper compared to other types of cooking oil. It was proving, despite they have high levels of knowledge about this issues but they did not apply their knowledge towards good practice regarding using of repeatedly heated cooking oil. This means that knowledge do not resemble good practice on repeatedly heated cooking oil.

From this study, 100% among the respondents reported they used palm oil for frying food. This is not surprising since Malaysia is currently the world's largest producer and exporter of palm oil (Basiron, 2007). In fact, the palm oil is cheaper and widely available in Malaysia also helps making it a popular choice of cooking oil. Therefore, most of Malaysian tends to use palm oil as their cooking oil for frying. Palm oil compared to other oil is one of the best for deep-frying because palm oil has almost the same ratio of saturated and unsaturated fatty acids. It is resulted from the triacylglycerols with high melting points were removed and compounds with lower melting points are enriched. Moreover, using palm oil as cooking oil produces better fried food with a better mouthfeel without greasy sensation (Wong et al., 2019). Moreover, palm oil has low proportion of polyunsaturated fatty acid (PUFA) compared to the soy oil but the majority fatty acids form in palm oil are monounsaturated (MUFA) and saturated (Kamisah et al., 2005). Previous studies have shown that PUFA is more easily to oxidize compared to MUFA. The result of toxic compound produce in the repeated heating of vegetable oil that rich in PUFA

tend to increase the risk of hypertension, whereas the oils that rich in MUFA such as palm oil can be resistant to oxidation and formed less degradation products when heated (Soriguer et al., 2006). According to Basirun (2007), palm oil is cheaper and widely used across the globe compared to soy and corn oil and it has been used in food preparation for over 5,000 years. Other type of cooking oil such as corn, olive, soy and peanut oil are not popular amongst the respondents. Palm oil is the most widely produced edible vegetable oil in the world and its nutritional and health attributes have been well documented (Chandrasekharan et al., 2000). Palm oil appears to be persistent towards as heat compared to soy oil in terms repeatedly heated. Based on previous studies have suggested composition of palm oil is unique allowing withstand heat better than soy oil. Moreover, palm oil is also rich in tocopherols and contains an abundant amount of tocotrienols (Kamisah et al., 2005). Tocotrienols have better antioxidants capacity compared to tocopherols. Thus, this may contribute to the better resistance to oxidative changes due to repeated heating of palm oil.

Other than that, 100% of them were found to use the same cooking oil for multiple times for frying. They claimed by practicing that way, it helps to reduce their expense because deep frying method required large quantity of cooking oil and high temperature. By using the same cooking oil for the next frying, they were able to gained extra profit by reducing the cost needed to buy cooking oil. However, this is not too bad since most of them used palm oil for frying, which can withstand thermal oxidation quite well (Pandurangan et al., 2012). Based on previous study conducted in Kuala Lumpur by (Azman et al., 2012), it concluded that 40-63% of people admitted to use the same portion of cooking oil repeatedly. From Kaleem et al., (2015), they found that heating of the oil causes the increase of the index of peroxide

at the beginning of cooking to a maximum value and then there is a decrease. Hydroperoxides is the unsaturated fatty acids that formed by lipid oxidation are very unstable and breakdown into a wide variety of volatile flavour compounds as well as non-volatile compounds. Furthermore, PV is quite high in repeatedly heated oils and may be related with the significant increase in plasma lipid peroxidation that may contribute to pathogenesis of atherosclerosis. In addition 78.5% of respondents had the knowledge that the use of repeatedly heated cooking oil gives bad effect to our health but they still practice by using the same cooking oil for frying. Fried oil that repeatedly heated must store in proper container that do not exposed with light or dark coloured bottle. Exposing used oil to light can further the alteration of the cooking oil and will increases the peroxide value.

A total of 71 out of 130 samples of used cooking oil obtained from respondents exceed the standard of American Oil Chemist Society (AOCS). Peroxide value (PV) indicates the degree of oxidation in the cooking oil and measures the amount of total peroxides as a product of primary oil oxidation (Saad et al., 2006). Other than that, (Soriguer et al., 2009) reported that consumption of repeatedly heated frying oils that contained peroxide is associated with increased risk of hypertension. Free radicals produced during frying process could damage lipid membrane which leads to oxidative stress. Based on previous study, the peroxide value (PV) begins to exceed AOCS standard limit at 5th cycles of frying (Adriana et al., 2018). Peroxide value that exceed standard of AOCS has potential to cause harm to human health when consume in long term. Long term ingestion of food prepared by using repeatedly heated cooking oil which compromise of several antioxidant defense network lead to pathological problem such as hypertension, diabetes and vascular inflammation. Oxidation of lipid possessed high risk of development on coronary heart diseases

(Bora & Rathore, 2015). Practice really plays important roles on determining peroxide value of the repeatedly heated cooking oil as the increasing frequency of using the oil repeatedly it will increase peroxide value of oil.

In addition, 36.9% of the respondents admitted that they used small flame during frying. It was important to always monitor the temperature of the frying oil by using a deep-fry thermometer and maintain them at steady temperature. This practice was able to slow down the process of oxidation that take place inside the fried oil.

Based on the result obtained, there is no significant association between socio-demographic factors (age, gender, educational status and monthly income) with peroxide value. Other than that, there is significantly negative association between practice and peroxide value (PV) where $r = -0.299$, $p = 0.003$. Meanwhile there is no association between knowledge and practice is $r = -0.002$, $p = 0.986$, and association between practice and knowledge with peroxide value (PV) is $r = -0.065$, $p = 0.46$ consecutively. Other than that, Wilcoxon Signed Rank test indicated that the peroxide value is statistically significant higher than AOCS Standard where $Z = -3.162$, $p = 0.002$. It also found that 54.6% which is equivalent to 71 samples from total of 130 sample of cooking oil exceeding the limit (10mEqO₂/kg).

The strength and limitation of study

One of the strength of this study was it able to provide baseline data regarding to the peroxide value in cooking oil used by night market food operators under Kajang Municipal Council since there were still limited studies on this important issue. Moreover, this study assessed the level of knowledge and practice on the use of

repeatedly heated cooking oil among night market food operators so that to ensure good quality of cooking oils were maintained.

For the limitation, this study was a cross-sectional study design where the accuracy of data recorded were effective at the time survey was completed. After some of time, variation will be expected if the same survey was done. This is because of the same night market food operators involved was no longer operate his business due to bankruptcy or death. Inclusion of more participants or respondents will produce better result since more response can be obtained in order to make a concrete conclusion on the topic of repeatedly heated cooking oil. In addition, answer provided by the respondents may be true or may be not because they think there will be a problem later on to their business if they answered the questionnaire negatively. There was probability where they will modify their answer during that time.

Other than that, this study used convenience sampling method, where all available night market food operators were selected as participant. This is due to certain circumstances where there was limited number of night market food operators that involved in preparation and selling deep fried food and also due to the time constraint. This can cause the result obtained was not representative and accurate.

5.2 CONCLUSION

From the results obtained through the distribution of questionnaires, it can be concluded that 76.9% of respondents scored high level for knowledge on the use of repeatedly heated cooking oil while 60% of respondents scored moderate level for practice on the use of repeatedly heated cooking oil. For the association between socio-demographic factors with peroxide value, there is no significant association showed. There is a significantly negative and weak association between practice and peroxide value (PV) where $r = -0.299$, $p = 0.001$. Meanwhile, there is no significant association shown between knowledge and practice where $r = -0.002$, $p = 0.986$ and between practice and knowledge with peroxide value (PV) is $r = -0.0065$, $p = 0.46$ consecutively. Other than that, Wilcoxon Signed Rank test indicated that the peroxide value is statistically significant higher than AOCS Standard where $Z = -3.162$, $p = 0.002$. It also found that 54.6% which is equivalent to 71 samples from total of 130 sample of cooking oil exceeding the limit ($10\text{mEqO}_2/\text{kg}$).

In a nutshell, more proactive steps and action should be taken to increase the awareness on deleterious health impacts result from consumption of rancid oil to human health. Related governmental institutions and organizations are encourages to publicly promoting and sharing relevant knowledge to the night market food operators. Apart from this, agencies and communities must play their responsibility in spreading the information related to this issue to their relatives, friends as well as family members. Last but not least, the relevant local authorities should conducted surveillance monthly in order to ensure the peroxide value in their cooking oil is still

within and below the allowable limit which is mean they are safe for human consumption.

5.3 RECOMMENDATION

For further recommendation, we suggest them to take into consideration on other parameters such as anisidine value, saponification value, iodine value and total polar compound (TPC). All these assessment involved laboratory analysis. However, there are also other methods in assessing quality of cooking oil used such as observing the viscosity, colour changes, foam height and odour. The physical changes could be easily identified even for non-expert which may be helpful in making a decision to discard the frying oil used by the night market food operators. Other than that, it is also suggested to collect the sample of cooking oil before the respondents start to change or discarded their used cooking oil. This is in order to monitor the changes in the concentration of peroxide inside in the cooking oil after being heated for multiple times.

In addition, the government should conducted more awareness campaign in order to give them a clear understanding and better knowledge on the harmful effects that results from the prolong consumption of repeatedly heated cooking oil that contained peroxide. This campaign not only involve the night market food operators but it should include all group age including school children, young adult and adult as they are also the consumer of deep fried food in the night market.

Last but not least, the local authority can improve the level of practice of the night market food operators by conducting a session or class either through one-to-one or as a group which is compulsory for them to attend. This can be done in order upon the licensing application or renewal to reduce or slow down the process of oxidation in the cooking oil during frying upon the licensing application or renewal. The objective of this session is to demonstrate them the correct and good way on how to use cooking oil for frying.



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APPENDICES



UPM

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

Research title	: Level of Knowledge and Practice among Deep Fried Street Food Operators in Kajang, Selangor and Determination of Peroxide Value in Repeatedly heated Cooking Oil
Study Site	: Kajang
JKEUPM Ref No.	: JKEUPM-2018-394
Researcher	: Nurul Natasha binti Mohd Jailani
Supervisor	: Dr. Saliza binti Mohd Elias

Documents received and reviewed with reference to the above study:

1. Ethics Application Form, Version 1 dated 29/10/2018
2. Respondent Information Sheet & Guardian's/Parent's Consent (Malay), Version 1 dated 29/10/2018
3. Respondent Information Sheet & Consent (English), Version 1 dated 29/10/2018
4. Proposal (English), Version 2 dated 28/12/2018
5. Questionnaires/ Interviews (English), Version 1 dated 29/10/2018
6. Questionnaires/ Interviews (Malay), Version 1 dated 29/10/2018
7. Curriculum Vitae of:
 - a. Dr. Saliza binti Mohd Elias
 - b. Dr. Mohd Redzwan bin Sabran

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

Decision by JKEUPM:

☒

Approved

☒

Permission **MUST BE OBTAINED** from the respective hospitals/ institutions before conducting the research

☐

Disapproved

Please note that the approval is **VALID UNTIL 10 JANUARY 2020**

Researchers should comply with the following:

- I. Complete a Study Final Report upon study completion (Form 3.2).

APPENDIX II: QUESTIONNAIRE



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

TITLE: Level of Knowledge and Practice of Deep-Fried Street Food Operators in Kajang and Determination of Peroxide Value in Repeatedly Heated Cooking Oil.

TAJUK KAJIAN: Tahap Pengetahuan dan Amalan Operator Makanan Bergoreng di Kajang dan Penentuan Nilai Peroksida (Tengik) dalam Penggunaan Minyak Masak yang Dipanaskan Berulang Kali.

Introduction: This study is aim to assess the Level of Knowledge and Practice of Deep-Fried Street Food Operators in 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 Operator Makanan Bergoreng di Kajang dan Penentuan Nilai Peroksida (Tengik) 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:

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

Arahan: Isi tempat kosong dan tandakan (/) pada ruangan bersesuaian.

Part A: Demographic information

Bahagian A: Maklumat Demografi

1. Gender/*Jantina*:
Male/ *Lelaki* () Female/ *Perempuan* ()
2. Marital status/ *Status perkahwinan*:
Single/*Bujang* () Married/ *Berkahwin* ()
3. Age/*Umur* :years old/ *tahun*
4. Race/*Bangsa*:
Malay/ *Melayu* () Chinese/ *Cina* ()
India/ *India* () Others/ *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*()
State/*Nyatakan*:_____
7. Temperature of cooking oil/ Suhu minyak masak:_____

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.

1. Usage of repeatedly heated cooking oil is a good practice.
Penggunaan minyak masak yang dipanaskan berulang kali untuk menggoreng makanan adalah amalan yang sihat.
- a. Agree/Setuju ☐ b. Disagree/Tidak Setuju ☐ c. 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.
- a. Agree/Setuju ☐ b. Disagree/Tidak Setuju ☐ c. 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.
- a. Agree/Setuju ☐ b. Disagree/Tidak Setuju ☐ c. 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.
- a. Agree/Setuju ☐ b. Disagree/Tidak Setuju ☐ c. 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 berulang kali dan buang apabila ia bertukar gelap.
- a. Agree/Setuju ☐ b. Disagree/Tidak Setuju ☐ c. Not sure/Tidak Pasti ☐
6. There will be loss in nutrient in the repeatedly heated cooking oil.
Nutrien dalam makanan akan hilang melalui penggunaan minyak masak yang dipanaskan berulang kali.
- a. Agree/Setuju ☐ b. Disagree/Tidak Setuju ☐ c. 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 terhasil daripada penggunaan minyak masak yang dipanaskan berulang kali.

a. Agree/Setuju ☐ b. Disagree/Tidak Setuju ☐ c. Not sure/Tidak Pasti ☐

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

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

a. Yes/ Ya ☐ b. No/ Tidak ☐ c. Not sure/Tidak Pasti ☐

9. If answer **YES** (Refer to question No. 8), what type of disease associate with the consumption of repeatedly heated cooking oil?

Jika "YA" (Rujuk soalan 8), apakah jenis penyakit yang berkaitan dengan penggunaan minyak masak yang sama berulang kali dipanaskan?

Gout/Gout ☐ Tuberculosis/Batuk kering ☐ Diabetes/Kencing manis ☐
Hypertension/Darah tinggi ☐ Cancer/Kanser ☐

Part C: Respondent's knowledge about peroxide

Bahagian C: Pengetahuan responden mengenai peroksida (tengik)

1. Do you know peroxide contain in the repeated heated cooking oil? (If answer **"NO"**, Skip Question 2)

*Adakah anda sedia maklum mengenai peroksida yang terkandung dalam minyak masak yang sama berulang kali dipanaskan? (Jika **"TIDAK"**, langkau Soalan 2)*

Yes/Ya () No/Tidak ()

2. What are the sources of information regarding the peroxide in the repeated heatedly cooking oil/ *Dimanakah anda mendapat maklumat berkaitan peroksida yang terkandung dalam minyak masak yang berulang kali dipanaskan.*

Newspaper/Surat khabar () Magazine/Majalah ()
Television/Televisyen () Radio/Radio ()

Internet/Internet () Other/Lain-lain:
.....

3. What happen if the peroxide values are high in the cooking oil?

Apakah yang akan terjadi jika kadar peroksida tinggi di dalam minyak masak?

- a) The quality of the cooking oil good/ Kualiti minyak masak bagus()
- b) The quality of the cooking oil is bad/ Kualiti minyak masak tidak bagus ()
- c) Need to discard the oil and the use the new cooking oil/ Perlu membuang dan menukarkan minyak yang baru ()
- d) Can still use the same cooking oil/ Masih boleh menggunakan minyak masak tersebut ()

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

Bahagian D: Amalan mengenai penagunaan minyak masak yang dipanaskan

1. Do you use repeatedly heated cooking oil for frying? (If **YES**, skip question 2)
Adakah anda menggunakan minyak masak yang dipanaskan berulang kali untuk menggoreng?(Jika **YA**, langkau Soalan 2)

Yes/Ya ☐ No/Tidak ☐

2. What are the reasons 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/Meningkatkan kadar kolestrol dalam minyak ☐
Others/Lain-lain: _____

3. Do you add new oil after several times of frying? / Adakah anda menambah minyak baru setelah beberapa kali menggoreng?

Yes/Ya ☐ No/Tidak ☐

If **YES, how many times? / Jika **YA**, berapa kali? _____*

3. How many times do you change the oil during operation? / Berapa kali anda menukar minyak semasa berniaga? _____

4. Do you measure the temperature of the cooking oil during frying? / Adakah anda mengukur suhu minyak ketika menggoreng?

Yes/Ya ☐ No/Tidak ☐

***If YES how much? / Jika YA, berapa? _____°C**

5. How many times the cooking oil is reused before discarded?
Berapa kali anda menggunakan minyak tersebut sebelum anda membuangnya?

2 times/2 kali ☐ 3 times/3 kali ☐ 4-10 times/4-10 kali ☐
Others/Lain-lain: _____

6. 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

☐
☐

Gunakan 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 memerangkap sisa makanan atau bahan asing.*

Yes/Ya

☐

No/Tidak

☐

8. How do 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* ☐

9. Do you want to obtain the result for this research/*Adakah anda mahukan keputusan kajian yang dilakukan ini?*

Yes/Ya ☐

No/Tidak ☐

Please contact /*Sila hubungi* : Nurul Natasha binti Mohd Jailani (013-6779097)



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APPENDIX III: CONSENT FORM



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

BORANG 2.5: PENERANGAN DAN PERSETUJUAN IBUBAPA/PENJAGA

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

1.TAJUK KAJIAN: Tahap Pengetahuan dan Amalan Operator Makanan Bergoreng Tentang Penggunaan Minyak Masak di Kajang, Selangor dan Penentuan Nilai Peroksida dalam Penggunaan Minyak Masak 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 pengendali ayam 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?

1. Responden 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 responden sebanyak 50ml untuk dianalisis di makmal. Sampel minyak akan dianalisis untuk menentukan kandungan peroksida di dalam minyak tersebut.
3. Penyertaan responden di dalam kajian ini adalah secara sukarela dan anda boleh menarik diri pada bila-bila masa sepanjang kajian dan tidak akan terkesan kepada lesen meniaga, dikompaun atau didenda.
4. Tiada sebarang token akan diberikan kepada responden.

4. SIAPA YANG TIDAK BOLEH MENYERTA KAJIAN INI?

Mereka yang bukan operator makanan jalanan yang menjual makanan yang bergoreng dan tidak bemiaga di kawasan yang terletak di bawah Majlis Perbandaran Kajang.

5. APAKAH FAEDAH MENYERTA KAJIAN INI?

a) KEPADA ANAK/JAGAAN SAYA SEBAGAI PESERTA?

Kajian ini akan memberi kesedaran tentang penggunaan minyak masak yang dipanaskan berulang kali dan mengambil tindakan bagi mengelakkan diri dari makanan yang mengandungi peroksida yang tinggi.

b) KEPADA PENYELIDIK?

Kajian ini membolehkan penyelidik mengetahui tahap pengetahuan dan amalan berkaitan penggunaan minyak masak yang dipanaskan berulang kali dalam kalangan operator makanan yang menjual makanan gorengan di Kajang, Selangor dan mencadangkan langkah meningkatkan status kesihatan bukan saja dalam kalangan operator makanan jalanan yang menjual makanan gorengan di Kajang bahkan di seluruh Malaysia.

6. ADAKAH IA BERISIKO?

Kajian ini tidak berisiko kepada responden kerana tidak melibatkan sebarang pengambilan sampel manusia seperti contoh sampel darah atau sampel air kencing.

7. ADAKAH MAKLUMAT DAN IDENTITI ANAK/JAGAAN SAYA KEKAL RAHSIA?

Segala yang maklumat berkaitan dengan responden akan dirahsiakan serta dianggap sulit.

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

Sekiranya terdapat sebarang soalan berkenaan kajian ini, sila hubungi Penyelia Kajian, Dr. Saliza Bt Mohd Elias di nombor 03-89472402 (E-mel: saliza_me@upm.edu.my) atau Nurul Natasha binti Mohd Jailani, Penyelidik di nombor 013-6779097 (E-mel: azrinyana1209@gmail.com)

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

9. PERSETUJUAN

Saya..... No Kad Pengenalan.
beralamat.....
.....dengan ini secara sukarela bersetuju membenarkan
*anak / jagaan saya menyertai **penyelidikan tersebut di**
atas *(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 yang tercatat dalam Helaian Penerangan). Saya memahami bahawa *anak / jagaan saya berhak menarik diri dari penyelidikan ini pada bila-bila masa tanpa memberi sebarang alasan. Saya juga memahami bahawa sebarang maklumat yang berkaitan identiti *anak / jagaan saya akan dirahsiakan.

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

I setuju/tidak bersetuju untuk imej/gambar/rakaman video/ rakaman suara berkaitan dengan anak/ jagaan saya digunakan dalam apa jua bentuk penerbitan atau pembentangan. (sekiranya berkaitan).

*potong yang tidak berkenaan

Tandatangan
(Responden)

Tandatangan
(Saksi)

Tarikh :.....

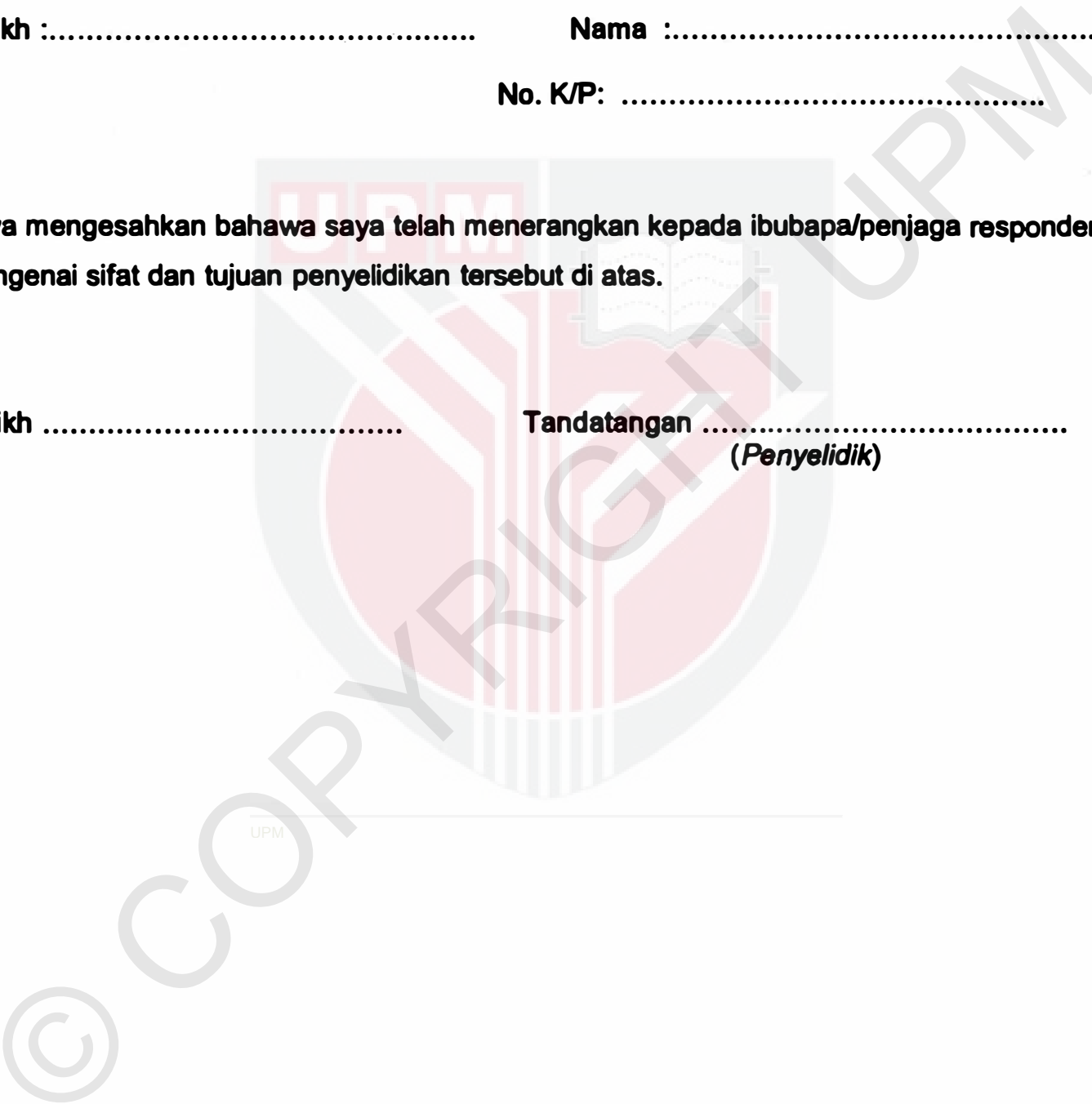
Nama :.....

No. K/P:

Saya mengesahkan bahawa saya telah menerangkan kepada ibubapa/penjaga responden mengenai sifat dan tujuan penyelidikan tersebut di atas.

Tarikh

Tandatangan
(Penyelidik)

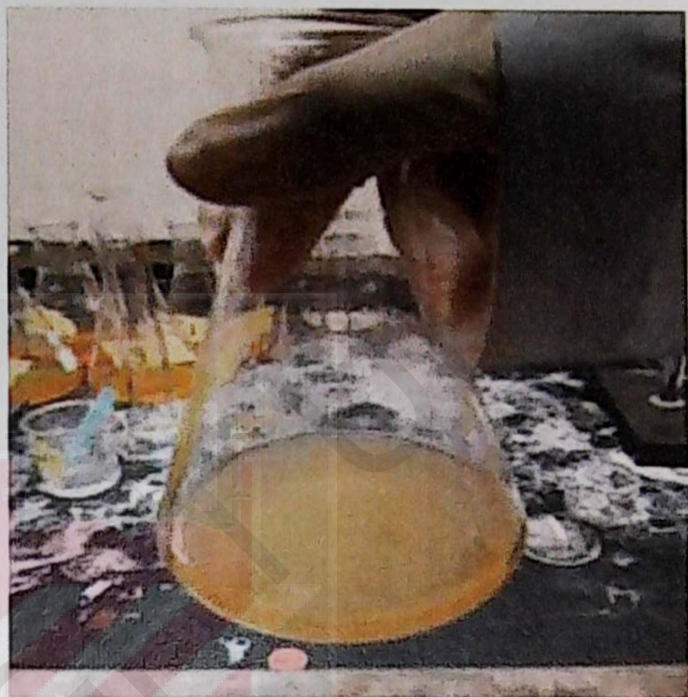


APPENDIX IV: RELATED PICTURES

Process of drying dark coloured bottle



Analysis for peroxide value in the laboratory



Some of the respondents that involved in this study