

## ORIGINAL ARTICLE

# Edible Oil Consumption and Its Associated Factors Among the Dayak Community in Southern Zone of Sarawak

Michael Pui Chia Shin, Cheah Whye Lian

Department of Community Medicine and Public Health, Faculty of Medicine and Health Sciences, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia.

## ABSTRACT

**Introduction:** Edible oil become essential in the Dayak diet and excessive use is associated to health risk. The study aims to determine the edible oil consumption and its associated factors among Dayak communities in southern zone of Sarawak. **Materials and methods:** A cross-sectional study conducted in two randomly selected district from each three divisions: Kuching, Samarahan and Serian. A total of 278 respondents were recruited through cluster sampling. Interview administered questionnaire was used, and anthropometric measurements were recorded. **Results:** The average daily edible oil consumption was 37.50 grams per person, 51.1% exceeded the recommended intake. Respondents with larger household used oil moderately ( $p < 0.05$ ), but they were more likely to reuse the edible oil ( $p < 0.05$ ). Household with a family member having chronic disease, used edible oil at moderate amount ( $p < 0.05$ ). Participant who utilized excess oil were less likely to believe edible oil reduce heart disease ( $p < 0.05$ ) but remain confidence in its ingredient ( $p < 0.05$ ). Their purchase of edible oil was influence by price reduction and promotion ( $p < 0.05$ ). While participants who used oil at moderate amount disagreed with the preferences for shopping lower-priced oil ( $p < 0.05$ ). **Conclusion:** The findings highlight a concerning trend of higher than recommended consumption of edible oil among Dayak communities. Nutritional promotion plays a vital role in empowering public to make well informed decisions in selecting edible oil, taking accounts both nutritional information and price, thereby avoiding excessive consumption while aligning health and environmental sustainability.

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**Keywords:** Dayak, Dietary, Edible oil, Health status, Non-communicable diseases, Sarawak

## Corresponding Author:

Cheah Whye Lian, PhD

Email: wlcheah@unimas.my

Tel : +6082267525

## INTRODUCTION

The prevalence of obesity among Malaysian adults is the highest in all Southeast Asia. 50.1% of our adult population is either overweight (30.4%) or obese (19.9%), according to the 2019 National Health and Morbidity Survey. Obesity is a risk factor for NCDs, particularly type 2 diabetes and cardiovascular disease [1]. The nutritional status of the Dayak communities, whether in the urban or rural areas, should be a primary concern of the public health professionals in Sarawak because their risk of developing non-communicable diseases is high. The "Dayak" is used to refer the indigenous populations in Sarawak, namely the Iban and Bidayuh [2]. In terms of central obesity, elevated blood pressure, elevated triglycerides, and reduced HDL cholesterol levels, the prevalence of metabolic syndrome among native Sarawakian has increased and is

greater than among Chinese [3]. There were reported to be with 43.5% of them were obese, and 54.7% of them were overweight, with females having a considerably higher mean BMI than men, as stated by the findings of a cross-sectional study conducted by Chang et al. carried out in rural and urban regions of Kuching and Samarahan. It is noteworthy that the younger generation of the Dayak community does not engage in a sufficient amount of physical exercise [4]. Moreover, according to the statistics on death in Malaysia for the year 2021, ischemic heart disease is the main cause of death among all men and women, comprising 17% of the 109,155 medically certified deaths in 2021. Kuching division in Sarawak has the highest number of ischemic heart disease-related deaths [5]. Researchers Cheah et al. discovered that despite having comparable levels of physical activity, body mass index categories, body fat, hypercholesterolemia, and hyperglycaemia in both sexes, the Iban and Bidayuh had a considerably greater value of readings in term of the atherogenic index of plasma than that of other ethnic groups [6]. The atherogenic index of plasma, a novel index associated with cardiovascular disease, is the logarithm transformed

of the two variables the triglycerides and high-density lipoprotein cholesterol [7].

Edible oils are basically esters of glycerol and fatty acids, and their macronutrient is essential needs needed for the growth of the body [8]. Though Sarawak ethnic foods cooking process is considered simple and healthy as the method used, such as boiling, roasting on an open flame, baking and fermentation, which make the food less oily, and no artificial heating agents such as microwaves have been used [9] and as Sarawak develops, especially in its rural regions, the communities there are experiencing the effects of urbanization, which result in changes in their lifestyles. There's a noticeable shift towards consuming diets that are richer in calories and fats [10].

In July 2022, Malaysian government removed the cap on the price of pure palm cooking oil in bottles and only subsidizing the 1kg packet of edible oil [11, 12]. Due to pricing consideration, small number people will tend to resort to reuse waste cooking oil as mean for cost savings [13]. Moreover, lower income households spend a larger percentage of their earnings on food than moderate- and high-income households [14]. A typical household size of four in Sarawak uses up to 3.9L of edible oil per month, equivalent to 32.5g/day which is higher when comparing with Chinese Nutritional Society 2016 ranging from 25 to 30 gramme per day [15, 16].

Hence, the objective of this study aims to determine the edible oil consumption and its associated factors among Dayak communities in southern zone of Sarawak. The food preference theoretical framework from Randall and Sanjur had been adapted. This framework considers the characteristics of the individual (sociodemographic and physical health status), food (edible oil and attribute on edible oil consumption), and environmental (household characteristic). These domains are analysed to understand their influence on edible oil preference, which lead to edible oil consumption [17]. The study had obtained approval from the Medical Ethics Committee, Faculty of Medicine and Health Sciences, Universiti Malaysia Sarawak, registered under UNIMAS/TNC(PI)/09-65/02(18).

## **MATERIALS AND METHODS**

### **Samples**

A cross-sectional study design was conducted for a duration of 11 months, commencing from October 2022 and August 2023 in southern zone of Sarawak which consist of Kuching, Samarahan and Serian divisions [18]. The sample size was obtained using open-source software, the Epi Info version 7.2.5.0. The total population of Dayak in Kuching, Samarahan and Serian Division was recorded as 325,400 in the year 2020. The prevalence of household with purchased cooking oil in Sarawak is at 80.1% [15, 19]. A sample size 270 was

derived after adding in 10% attrition.

A multistage sampling combining the simple random sampling and cluster sampling methods. In the initial stage, two district were randomly selected from each of the Kuching division (Kuching and Bau) and Samarahan (Asajaya and Samarahan) division, along with both district from the Serian (Serian and Tebedu) division. For village selection, the top ten villages within each district were organized based on their respective population sizes. Using the random sampling method, six villages were randomly chosen from the Kuching division, while two villages were randomly selected from both the Samarahan and Serian division, totalling to ten villages. Invitations were extended to all households in the selected villages to participate, and only individual meeting the specific inclusion criteria were incorporated into this study.

### **Inclusion and exclusion criteria**

Dayak aged 18 and above who prepared the meal at home and living in the southern zone of Sarawak were included in this study. Exclusion criteria comprised individuals who disagreed to participate in this study.

### **Data collection procedure**

Upon receiving approval from the Ethics Committee of Universiti Malaysia Sarawak (UNIMAS), the line listing of villages was obtained and solely the village heads of the randomly selected villages were contacted, either via phone or in-person meetings. A mutually agreeable date and time were coordinated for the study. Villagers who fulfilled the inclusion criteria were extended invitation to partake in the study.

On the designated data collection day, eligible respondents were documented in the registry. Subsequently, respondents were comprehensively briefed and were requested to provide their informed consent by signing the consent form before proceeding to complete the questionnaire. There were no respondents who refused to participate in this study. The collected responses will be checked for completeness of information on the spot and subsequently transferred into Statistical Package for the Social Sciences (SPSS) version 27.0.1.0 [20].

### **Data collection instrument**

The instruments that were used in this study was a self-administered bilingual questionnaire. The instruments were initially developed in English and subsequently translated into Malay language using the back-translation method. The back-to-back translation were done by a language teacher from a local secondary school. The process followed two steps: First, the original items of all questionnaires were translated into Malay, Second, the Malay version was then translated back into English. If any item exhibited discrepancies in relation to the meaning of the original items, a retranslation was conducted with

same steps. The final version was the one agreed upon by the involved translators. The instruments have three main part or section, namely Part A (Individual data), Part B (Household characteristic) and Part C (Edible oil). Subsection A6 focusing on the individual attribute on edible oil consumption and subsection C2 looking into price attribute on edible oil consumption, each comprises thirteen items. Each of these items employs a 5-point Likert-scale, with the following option: 0 - strongly disagree, 1- disagree, 2 - neither disagree nor agree, 3 - agree and 4 - strongly agree. Each item is distinct and is to be interpreted independently. These items were set by Chepkwony Kipkorir Sammy was adopted into this study, and proper acknowledgment was extended to inform the author of its utilization. In accordance with the food guide pagoda for the Chinese residents developed by the Chinese Nutrition Society in 2016, the recommended daily intake of edible oil should not exceed 30 gramme. Hence, the level of edible oil intake in this study will be categorized into two groups based on respondent consumption of main edible oil: Moderate intake (< 30 g/day) and excess intake (> 31 g/day) [16].

Furthermore, this study involved the measurement and documentation of respondents' height, weight, and waist circumferences in Part A of the questionnaire. This assessment was performed once respondents had completed all three main sections of the study. The measurement of height, weight and waist circumferences was conducted following the WHO STEPS protocol. The anthropometric measurement was performed by the researcher or by the one and only assistance researcher during the entire data collection period [21]. The assistance researcher had undergone training on anthropometric measurement prior going to the field. To ensure accuracy, the same instrument, namely the Seca 217 stable stadiometer, Seca 813 high-capacity digital flat scale were calibrated before each use. Additionally, a consistent measuring tape was employed throughout the process. The BMI for Asian used for the classification of BMI status, with underweight < 18.5 kg/m<sup>2</sup>, ideal BMI range from 18.5 kg/m<sup>2</sup> to 22.9 kg/m<sup>2</sup>, overweight ≥ 23 kg/m<sup>2</sup> and obese range from 27.5kg/m<sup>2</sup> to 40kg/m<sup>2</sup> [22, 23].

#### Pilot/pre-test

A pilot test of the questionnaire was carried out among the villagers of Kampung Grogo, Bau, Kuching. The primary aim of this pre-test was to identify any potential issues such as unclear wording and questions that posed difficulty in comprehension. A total of 30 participants had participated in this pilot test. This preliminary assessment aimed to rectify this concern before embarking a full-scale of study. Additionally, the pilot test was conducted to assess the reliability of items.

On average, respondents required 25 minutes to complete the questionnaire. Respondent did not

encounter any difficulties and able to comprehend all the questions. The reliability test for item within Subsection A6 and C2 showed a Cronbach's alpha of .57 and .47, respectively. Lower Cronbach alpha should not always be taken as indicating an unsatisfactory instrument. Furthermore, authors have employed diverse range of qualitative descriptors to interpret alpha value, with some considering values within the range of 0.45 to 0.98 as acceptable [24].

#### Data analysis

Data was checked manually and confirmed for correctness before being transferred to computer. All the questions were input into SPSS version 27.0.1.0. A thorough process of data cleaning was conducted to detect any error or missing values. No missing values were detected. For descriptive analysis, percentage, mean, and standard deviation used to describe the data. For inferential analysis, univariate analysis was employed. The independent T-test was used for continuous variable, while cross tabulation using the Chi-square test was utilized for qualitative variables. When the assumption of the Chi-Square test is not met, the Fisher's Exact Test will be applied. The dependent variable in this study is the level of edible oil intake, which comprises two categories: moderate intake and excess intake of edible oil. The significance level is set at  $p < 0.05$ .

## RESULTS

### Demographic characteristics of respondents

Table I showed the sociodemographic characteristic of Two-hundred-and-seventy-eight (N=278) respondents in this study and tested using the univariate analysis. The respondents mean age was  $51.03 \pm 14.27$  years. The age ranges from 18 to 85 years old with a range of 67 years. Majority of the respondents were female (89.9%).

**Table I: Socio demographic characteristic**

	Frequency (%)	Mean (SD)
<b>Demographics</b>	N = 270	
<b>Age (years)</b>		51.03 (14.27)
Min-Max in years	18-85	
<b>Gender</b>		
Male	28 (10.1)	
Female	250 (89.9)	
<b>Ethnic</b>		
Bidayuh	229 (82.4)	
Iban	49 (17.6)	
<b>Marital status</b>		
Married	210 (75.5)	
Single/Widowed/Divorced/Separated	68 (24.5)	
<b>Education</b>		
No formal education/Primary school education	45 (16.2)	
Secondary school education	157 (56.5)	
Pre-university/University/Post-graduation education	76 (27.3)	

CONTINUE

**Table I: Socio demographic characteristic. (CONT.)**

	Frequency (%)	Mean (SD)
<b>Employment status</b>		
Employed	116 (41.5)	
Unemployed/retired	162 (58.3)	
<b>Income group</b>		
B40	242 (87.1)	
M40	36 (12.9)	
T20	0	

Majority of the respondents were Bidayuh (82.4%) followed by the Iban by 17.6%. More than half (75.5%) of the respondents were married while the remaining, 68 respondents (24.5%) were either single, widowed, divorced, or separated from their partner. Just slightly above half (56.5%) of the respondents had completed secondary school education, 27.3% of respondents graduated from pre-university, university, or post-graduation education and 16.2% of them had completed primary school education or had not obtained any formal education before.

Majority of the respondents (58.3%) were either unemployed or retired, while 41.5% were employed. Majority of respondents (87.1%) belonged to the low-income group (B40), and only a minority (12.9%) of them were from the middle-income group (M40).

**Physical health status**

Table II showed the details on the physical health status of respondents. The mean height of the respondents was 153.38 ± 7.72 cm, ranging from 137.0 cm to 178.0 cm. The mean weight was 64.06 ± 13.91kg, ranging from 33.00kg to 80.70kg. Two-hundred-and-nineteen (78.8%) respondents were overweight and obese. Majority of the respondents (77.3%) (n = 215) (71.4% among male and 77.3% among female) had abnormal waist circumference.

**Table II: Physical health status of respondents**

	Frequency (%)	Mean (SD)
<b>Height</b>		153.38 (7.72)
Min-max in cm	137.0 - 178.5	
<b>Weight</b>		64.06 (13.91)
Min-max in kg	33.00 - 80.70	
<b>Body mass index</b>		27.17 (5.38)
Underweight (< 18.5 kg/m <sup>2</sup> )	8 (2.9)	
Normal (18.5 – 22.9 kg/m <sup>2</sup> )	51 (18.3)	
Overweight/Obese (≥ 23 kg/m <sup>2</sup> )	219 (78.8)	
<b>Waist circumference</b>		
Normal	63 (22.7)	
Abnormal	215 (77.3)	
<b>Self-reported comorbid</b>	90 (32.4)	
<b>Types of self-reported comorbid*</b>		
Hypertension	75 (27.0)	
Hyperlipidaemia	44 (15.8)	
Type 2 diabetes	32 (11.5)	

CONTINUE

**Table II: Physical health status of respondents. (CONT.)**

	Frequency (%)	Mean (SD)
<b>Types of self-reported comorbid*</b>		
Heart diseases	17 (6.1)	
Stroke	3 (1.1)	
Chronic kidney disease	2 (0.7)	

Cut-off point for waist circumference by gender: Male is 90cm; Female is 80cm.  
\*Sum not equal to N = 278, due to multiple responses.

Approximately one third of respondents (32.4%), self-reported having chronic comorbid. Hypertension was the most prevalent condition at 27%, followed by hyperlipidaemia (15.8%), type 2 diabetes (11.5%), heart disease (6.1%), stroke (1.1%) and chronic kidney disease (0.7%).

**Edible oil preference**

Table III showed that, majority of the respondents has palm edible oil (91.0%) at home, while only minority of respondents also used or simultaneously having different kinds of edible oil in their kitchen, namely corn oil (16.2%), olive oil (15.8), sunflower oil (14.7%), canola oil (11.2%) and soya bean oil (3.2%).

**Table III: Edible oil preferences**

	Frequency (%)
<b>Type of edible oil used*</b>	
Palm oil	253 (91.0)
Corn oil	45 (16.2)
Olive oil	44 (15.8)
Sunflower oil	41 (14.7)
Canola oil	31 (11.2)
Soya bean oil	9 (3.2)
<b>Categories of main edible oil</b>	
Saturated	221 (79.5)
Unsaturated (Monounsaturated and polyunsaturated)	57 (20.5)
<b>Type of main edible oil used</b>	
Palm oil	221 (79.5)
Canola oil	19 (6.8)
Corn oil	14 (5.0)
Sunflower oil	13 (4.7)
Olive oil	9 (3.2)
Soya bean oil	2 (0.7)
<b>Reasons choosing the main edible oil</b>	
<b>Palm oil (n:221)</b>	
Easy to get	169 (40.0)
Low price	145 (34.4)
Health/nutrition	45 (10.7)
Influence by others	28 (6.6)
Packaging	20 (4.7)
Advertisement	15 (3.6)
<b>Canola oil (n:19)</b>	
Health/nutrition	16 (76.2)
Easy to get	4 (19.0)
Low price	1 (4.8)
<b>Corn oil (n:14)</b>	
Health/nutrition	10 (43.5)

CONTINUE

**Table III: Edible oil preferences. (CONT.)**

	Frequency (%)
<b>Corn oil (n:14)</b>	
Easy to get	7 (31.85)
Low price	2 (9.1)
Influence by others	2 (9.1)
Advertisement	1 (4.5)
<b>Sunflower oil (n:13)</b>	
Health/nutrition	8 (53.3)
Low price	3 (20.0)
Easy to get	3 (20.0)
Influence by others	1 (6.7)
<b>Olive oil (n:9)</b>	
Health/nutrition	7 (58.3)
Easy to get	3 (25.0)
Low price	2 (16.7)
<b>Soya bean oil (n:2)</b>	
Low price	1 (33.3)
Health/nutrition	1 (33.3)
Easy to get	1 (33.3)

\* Sum not equal to N = 278, due to multiple responses.

However, majority of respondents (79.5%) choose palm oil as the main edible oil followed by canola oil (6.8%), corn oil (5.0%), and others. The main reason for respondents' choice of palm oil was its easy availability (40.0%), low in pricing (34.4%), health and nutritional aspect (10.7%). The health and nutritional aspect were the main factor behind respondent's choice for other edible oils. Likewise, low pricing, health and nutritional as well as easy availability equally influence respondent used of soya bean oil as the main edible oil.

**Edible oil consumption**

Calculation on the respondent's edible oil consumption were calculated based on the latest weight of the main edible oil purchased, duration of the edible oil lasted and household size.

The mean daily consumption of edible per person was 37.50 ± 26.34g, ranging from 1.85 gramme to 142.86 gramme per day. Slightly above half (51.1%) (n = 142) of the respondents had an excess intake of edible oil (> 31g/day), while the remaining 48.9% (n=136) respondents had a moderate intake of edible oil per day (< 30g/day).

**Reuse of edible oil**

Majority of the respondents (58.6%) claimed reutilize edible oil, 21.2% respondents recycled it once, 29.5% recycled it at least twice, and 7.9% recycle the edible oil three times or even more before discarding.

**Association between household characteristic and the level of edible oil intake among the respondent.**

Inferential statistic shown no significant association between level of edible oil consumption with sociodemographic and physical health status.

However, there is a significant difference between household size with respondent level of edible oil

consumption,  $t(276) = 2.125, p = 0.034$ . Respondent with moderate intake of edible oil tend to have slightly larger household size ( $4.74 \pm 2.20$ ) compared to those with excess intake, while respondent with excess intake, the household tend to be slightly smaller in size ( $4.22 \pm 1.86$ ). Besides that, Chi square test show with family member suffering from chronic disease were more likely to consume edible oil at a moderate level,  $\chi^2(1, N=278) = 5.663, p = 0.017$ . Furthermore, respondent with bigger household ( $4.71 \pm 1.92$ ) were more likely than those with smaller household ( $4.13 \pm 2.16$ ) to reutilized edible oil,  $t(276) = 2.297, p = 0.022$ .

**Association between attribute on edible oil consumption with the level of edible oil intake**

Table IV shows differences in mean score for subitem number two "Edible oil have been linked with a reduced heart risk",  $t(276) = 2.505, p = 0.013$  and subitem number ten "I am confident of the ingredient of edible oil",  $t(276) = -2.115, p = 0.035$  in relation to level of edible oil consumption.

**Table IV: Association between individual attribute on edible oil consumption with level of edible oil intake**

	Level of edible oil consumption		p value
	Moderate intake	Excess intake	
	Mean (SD)	Mean (SD)	
Item 1: Edible oils help support the healthy immune system	2.01(1.00)	1.84(1.00)	.161
Item 2: Edible oils have been linked with a reduced risk heart disease	2.04(1.10)	1.72(1.10)	.013*
Item 3: Edible oil leads to poor health in the society	1.71(0.98)	1.58(1.01)	.311
Item 4: I trust nutrition facts more than health claims	2.58(1.04)	2.46(1.00)	.301
Item 5: I trust nutrition health claim than fact	1.60(1.04)	1.47(0.93)	.298
Item 6: I prefer edible oils that match my tastes rather than just the price	1.99(1.08)	1.94(1.10)	.709
Item 7: I consume what is consumed by people around me	1.74(1.14)	2.01(1.10)	.050
Item 8: The oil brands stimulate my interest in buying	2.13(1.09)	2.02(1.13)	.405
Item 9: I have limited knowledge of edible oils	1.87(0.93)	1.94(0.88)	.484
Item 10: I am confident of the ingredients of edible oils	1.96(0.91)	2.19(0.88)	.035*
Item 11: The availability of edible oil in different flavours influence my consumption	1.99(1.02)	2.11(1.01)	.326
Item 12: Labelling of edible oils ingredient influence my consumption	2.26(1.03)	2.3(1.01)	.753
Item 13: Nutritional information of edible oils strongly influences my purchase decision	2.28(1.03)	2.30(1.02)	.850

\* Statistical significance  $p < 0.05$

Table V shows differences in mean score for subitem number seven "I prefer shopping around for low priced

edible oils”,  $t(276) = -2.18$ ,  $p = 0.030$ , and subitem number eight, “I am attracted by price reduction and promotional deals in buying edible oils”,  $t(276) = -2.08$ ,  $p = 0.038$  in relation to level of edible oil intake.

**Table V: Association between individual attribute on edible oil consumption with level of edible oil intake**

	Health risk		p value
	Moderate intake	Excess intake	
	Mean (SD)	Mean (SD)	
Item 1: Lowering the price may encourage people to buy edible oil as compared to when it is increased	2.59 (0.99)	2.77 (0.87)	.097
Item 2: The high price of edible oil confirms the choices I make in buying the product	1.52 (1.05)	1.61 (1.05)	.474
Item 3: Price does not matter due to my interest in shopping	1.45 (0.96)	1.61 (1.02)	.169
Item 4: The price of edible oils is a major consideration in my purchase	2.81 (1.06)	3.04 (0.92)	.057
Item 5: The ingredient of edible oil is a major consideration	1.44 (1.05)	1.68 (1.08)	.068
Item 6: The price of edible oils is less important as when I sought for convenient store with friendly and helpful employees	1.90 (1.22)	1.87 (1.14)	.787
Item 7: I prefer shopping around for low priced edible oils	2.30 (1.10)	2.57 (1.04)	.030*
Item 8: I am attracted by price reduction and promotional deals in buying edible oils	2.46 (1.04)	2.70 (0.95)	.038*
Item 9: Edible oils are expensive to buy	2.54 (0.95)	2.65 (0.91)	.387
Item 10: Edible oils offer very good value for money	2.15 (0.98)	2.17 (0.85)	.899
Item 11: With a good income, I can afford edible oils different flavours influence my consumption	2.65 (0.85)	2.65 (0.92)	.994
Item 13: I am more uninformed about the price of edible oils	1.55 (1.09)	1.56 (1.05)	.970

Inferential analysis was omitted for subitem number twelve (12) for the overall “Strongly disagreed”.

\* Statistical significance  $p < 0.05$

## DISCUSSION

Malaysia is one the largest production and exports of palm oil accounted 25.8% and 34.3% respectively [25]. Although the government ceased subsidizing cooking in bottles on 1st July 2021, the subsidization for one-kilogram packets of palm oil continue to primarily aid Malaysian families belonging to the low-income group (B40). Therefore, it is unsurprising that palm oil stand as the predominant choice of cooking oil among respondents (79.5%), attributed to its accessibility and the affordability. The average daily consumption of main edible oil per individual is 37.50g, which is higher than the recommended limits, outline in the Chinese and Indian dietary guidelines [16, 26]. Notably, 51.1% (n=142) of respondents had excess intake (> 31 g/day) of the main edible oil.

There is scarcity of empirical studies related to association between sociodemographic factors with the edible oil consumption. Most of the study only evaluate the edible oil nutritional quality which only hold significant interest to consumers and producer. Most of the existing research studies that comparatively analyse and qualitatively describe the type, content, proportion of nutrient in edible oil [27].

Additionally, low, and middle-income countries, the focus of diet-related risks has traditionally been on undernutrition. Nevertheless, the burden of malnutrition in these countries is undergoing a transition due to changing food environments, increasing urbanization, and a shift towards diets high in fats, alongside sugar and salt [28]. Utilizing data primarily from developed countries, particularly those in the Western world, researchers have identified association between dietary fat intake with socio-demographic characteristics and physical health status [29, 30]. However, in this study, we found no significant association between socio-demographic factor and physical health status of respondent with the level of edible oil consumption.

The effect of edible oil alone on health is complex. Cross sectional study conducted in Yangon region of Myanmar on association between various vegetable oils with non-communicable diseases, the use of palm oil shows beneficial effect on men by lowering non-communicable disease risk factor with lower levels of BMI and fasting plasma glucose than those taking peanut oil, unsaturated oil. On the other hand, risk for non-communicable disease (high blood pressure, raise in total cholesterol and triglyceride) were higher among women consuming palm oil than those consuming peanut oil. However, the difference may be possible due to the intake of different kinds of food accompany the oil intake between both genders, which will differently affect the risk of non-communicable diseases. Furthermore, men in Myanmar may be less exposed to food cooked at home due to work [31]. Besides that, men living in rural areas were working as hard manual employment, keeping them at lower risk of hypercholesterolaemia [32]. Alias et al. conducted a community trial involving aboriginal communities residing in Pahang. Individuals were exposed to excess intake of pam oil over an 18-month period. The outcome of the study demonstrated a favourable effect on health of the aboriginal population. Prior to intervention, the fat intake among the study population was low (4.1% to 4.6% of total energy intake), and their primary sources of energy were from tapioca and rice, which are high in carbohydrates. Palm oil serves as a beneficial energy source without adversely impacting their body mass index, waist circumference, and fasting blood sugar. Furthermore, the consumption of palm oil was associated with a reduction in systolic blood pressure, total cholesterol, low density lipoprotein and triglyceride level among the studied aboriginal population [33].

In this study, respondent with moderate intake of edible oil tend to have a slightly larger mean household size compared to those with excess intake, which contrasts with most findings from previous study whereby household expenditure and consumption on oil and fat product was significantly higher in larger households [34, 35]. Similarly, in Canada, it was observed that larger household consumed more high fat-foods due to economies of scale. Based on economy theory, larger household enjoy financial advantages, which allow them to purchase the same quantity of food at a lower price by sharing resources [36]. However, in this study, 87.1% of respondent were from the low-income group. In contrast, this study unveils a compelling association between larger household size and the practice of reutilizing edible oil, potential shedding light on the moderate intake of edible oil within larger household among the Dayak communities.

Respondents who have family members with a history of comorbid are inclined to consume edible oil in a moderate amount. This suggests an awareness on the recommendation intake of edible oil. Family members play an important role and has more significant impact on modifying dietary behaviour than friends [37]. Respondents whom responsible for the food at home act as the ringleader viewing moderate consumption of edible oil as an intervention opportunity, not only to reduce their personal risk to non-communicable disease but also actively involve other family member in the process [38].

It's important to emphasize the frequency of repeated usage, whereby, 22 (7.9%) respondents reused the edible oil at least three times or even more before disposing. This discovery aligns with the findings of Kamilah et al., where a similar pattern was observed among 7% to 9% of respondents in Penang and Kedah who also consumed edible oil up to three times before discarding it [13]. The by-product of recycled edible oil, particularly polycyclic aromatic hydrocarbon, can accumulate in the body through inhalation of fumes or consumption, potentially resulting in cancer beside posing risk to the environment [39].

Divergent opinion exists between two groups of individuals (moderate and excess intake of edible oil) regarding statement two of the item in subsection A6, "Edible oil have been linked with a reduced risk heart disease" and "I am confident of the ingredient of edible oil". Those who excessively consume edible oil were inclined to express disagreement regarding its protective effect against the risk of heart diseases, whereas individual with moderate consumption of edible oil, tend to hold a neutral perspective on this statement.

In this study, majority (79.5%) of them chooses palm oil as their main edible oil in kitchen. The meta-analysis of prospective cohort studies conducted by Sri-Tarino

et al., represents a significant milestone concerning to saturated fat. This was the pioneer in revealing that there is no established link between saturated fat consumption and the development of coronary heart disease, stroke, or cardiovascular disease outcome [40]. Nonetheless, a systematic review carried out by Clifton et al. presented an alternative viewpoint. Their study emphasized that the reduction of saturated fat intake does not lead to decrease in the risk of mortality from cardiovascular heart disease or events associated with coronary heart disease. Instead, a shift toward substituting saturated fat with unsaturated fatty acid has been shown to contribute the reduction of such event [41]. Therefore, the perception of respondents toward this aspect seems to be largely influenced by their individual perspective. This underscores the important of considering individual viewpoints when interpreting these finding, highlighting the absence of a definitive right or wrong stance.

Respondents that fall under group of moderate intakes of edible oil, appear to exhibit lower confidence in the ingredient of edible oil. Likewise, various studies have established connections between edible oil consumption, particularly palm oil and heightened risk of cardiovascular disease, mortality from ischaemic heart disease, and elevated LDL cholesterol level. Conversely, other research contradicts their negative effect, and some even suggest potential benefit associated with palm oil consumption. Notably, Malaysia Palm Oil Board advocated for an increase consumption of palm oil [42]. Research carried out in both China and Malaysia utilized randomized, cross-over, and double-blinded crossover designs to compare saturated palm oil with other unsaturated edible oils. These studies demonstrated comparable advantages, including the reduction of plasma glucose-dependent insulinotropic concentration. Furthermore, there were no significant difference observed in thromboxane and cell adhesion and no discernible variation in the effect on BMI or blood lipids [43-45]. Within the context of the Malaysia Dietary Guideline 2020, a crucial recommendation is put forth for public health professionals. Their role involves advocating for a balance consumption of both saturated and unsaturated edible oil. This is achieved by promoting the practice of mixing equal proportion of palm oil with other polyunsaturated edible oil, which can then be used for all cooking purposes. This guidance carries considerable importance and emphasize the need for equilibrium in dietary oil intake [46].

Looking into the influence of price attribute on the edible oil consumption, two distinct subitems exhibit noteworthy variation in opinions between the two respondents' groups categorized by their level of edible oil intake. These subitems are "I prefer shopping around for lower price edible oil" and "I am attracted by price reduction and promotional deal in buying edible oils. Based on mean score of the five-point Likert scale, respondent with excess intake of edible oil appear to

exhibit a greater attraction toward price offers. This inclination may be influenced by the reduction in cooking oil subsidies by the government as part of strategic to reduce prevalence of obesity and non-communicable diseases outline in the National Plan of Action for Nutritional of Malaysia III (2016-2025). However, it is crucial for public health policies to avoid exacerbating the burden on individual in accessing the essential nutritional resources like edible oil. Heighten prices could potentially impact dietary choices, particularly among low-income population. Potentially leading to substitution of fats with alternative source macronutrients such as proteins or carbohydrates [47]. Increased protein intake is linked to increase likelihood of developing insulin resistance, prediabetes, and type two diabetes mellitus. Conversely, a substantial intake of carbohydrates is associated with an increased risk of mortality and a shorter lifespan [48, 49]. Initiative like “Healthy Eating through Healthy Shopping” could serve a more effective strategy for nutritional education and promotion. This programme would empower individual on how to read and comprehend labels and make healthier food choices, particularly when it comes to selecting edible oil.

However, it's worth noting that the scope of this survey was confined to the southern zone of Sarawak. As a result, the findings might not be fully representative to other zones, particularly central and northern zone of Sarawak. Potential variation in culture and geographic economic should be considered. Suggesting caution when generalizing the result for the entire Sarawak. Secondly, the estimation of edible oil consumption was derived from recall of responses provided by a single respondent per household.

## CONCLUSION

The quantity of edible oil consumption among the Dayak respondents in the southern zone of Sarawak has exceeded the recommended intake, with an average consumption of 37.50 gramme per day. Additionally, a revelation shows that 7.9% of the respondents had practice of recycle the edible oil up to three cycle or more prior to disposal. These edible oil patterns heightened the risk of non-communicable diseases and even cancer. Future study should uncover the underlying factors behind the noticeably high prevalence of overweight and obesity (78.8%) and self-reported comorbid (32.4%) among the respondents. Palm oil shown to have its health benefit with its natural richness in saturated and monounsaturated fatty acids. The controversies surrounding palm oil, especially its use in food, should be address with caution and differentiated from debates about its uses as feedstock for biofuels [50]. Therefore, relying solely on price control, particularly for palm oil, may not be the only ideal solution to reduce the prevalence of obesity and non-communicable disease. In fact, such an approach might inadvertently contribute

to the recycling of edible oil, thereby increasing the risk of diseases. A more effective approach should lie in health promotion that emphasize the importance or need for equilibrium in dietary oil intake.

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