



UNIVERSITI PUTRA MALAYSIA

***FRUIT AND VEGETABLES CONSUMPTION IN ADOLESCENTS: A
COMPARISON OF A FFQ AND 3-DAY FOOD RECORD***

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Abbreviations

Fruit and vegetables – F&V

FFQ – Food Frequency Questionnaire

3-day food record – FR

Abstract

FRUIT AND VEGETABLES CONSUMPTION IN ADOLESCENTS: A COMPARISON OF A FFQ AND 3-DAY FOOD RECORD

VOON YIROU

Introduction: Despite the broad usage of a Food Frequency Questionnaire (FFQ) in estimating food intakes, only a few studies have examined the usefulness of the FFQ to estimate fruit and vegetables (F&V) intakes as opposed to other methods such as food record in adolescents. This study aimed to examine whether F&V intakes observed using a FFQ is comparable to that of a 3-day food record (FR) in adolescents.

Method: A secondary school at Seri Kembangan, Selangor was selected using multistage sampling. Out of 150 questionnaires that were distributed, 97 adolescents aged 16-17 returned complete questionnaires. The questionnaires consisted of three parts including socio-demographic information, FFQ & FR.

Results: In general, a higher median intakes of F&V was observed using FR. A weak, negative correlation was found between total fruit intakes reported by FFQ and FR ($r = -0.04, p = 0.684$). There was a weak, positive correlation between total vegetables intakes assessed using two methods ($r = 0.08, p = 0.465$). The tertile agreement for

being in the same and adjacent cells between FFQ and FR was 74.2% for total fruit intakes and 78.4% for vegetables intakes. It was found that many participants reported low F&V intakes assessed using both FFQ and FR. Using Bland-Altman plots, mean difference of 90.54 g (95% CI = -209.88 g, 390.96 g) were indicated for fruit intakes and mean difference of -9.46 g (95% CI = -333.84 g, 310.92 g) for vegetables intakes. No significant association was found between agreement of F&V intakes per day and socio-demographic factors reported by adolescents aged 16-17 using both methods.

Conclusion: FFQ showed moderate comparability against FR in assessing F&V intakes among adolescents aged 16-17. Low consumption of fruit and vegetables among the adolescents was found in current study. Therefore, intervention programs encouraging F&V intakes should be carried out in the future.

Abstrak

PENGAMBILAN BUAH-BUAHAN DAN SAYUR-SAYURAN DI KALANGAN REMAJA: PERBANDINGAN FFQ DAN REKOD MAKANAN TIGA HARI

VOON YIROU

Pengenalan: Walaupun FFQ banyak digunakan untuk menganggar pengambilan makanan, hanya beberapa kajian telah mengkaji kegunaan FFQ untuk menganggarkan pengambilan buah-buahan dan sayur-sayuran (F & V) berbanding dengan kaedah lain seperti rekod makanan di kalangan remaja. Kajian ini bertujuan untuk mengkaji sama ada pengambilan F & V dikaji menggunakan FFQ adalah setanding dalam makanan 3 hari rekod (FR) di kalangan remaja.

Kaedah: Sebuah sekolah menengah di Seri Kembangan, Selangor telah dipilih menggunakan persampelan berbilang. Daripada seratus lima puluh soal selidik telah diedarkan, 97 remaja yang berumur 16-17 mengembalikan soal selidik yang lengkap. Soal selidik tersebut terdiri daripada tiga bahagian, iaitu info sosio-demografi, FFQ & FR.

Hasil: Secara amnya, pengambilan median F & V yang lebih tinggi telah dinilai menggunakan FR. Korelasi yang lemah dan negatif telah didapati antara pengambilan semua buah-buahan yang dilaporkan menggunakan FFQ dan FR ($r = -0.04, p = 0,684$). Terdapat korelasi yang lemah dan positif antara pengambilan semua sayur-sayuran dinilai menggunakan dua kaedah ($r = 0.08, p = 0.465$). Persetujuan tertile kerana dalam sel-sel yang sama dan bersebelahan antara FFQ dan FR adalah 74.2% bagi pengambilan semua buah-buahan dan 78.4% untuk pengambilan sayur-sayuran. Adalah didapati bahawa ramai peserta dilaporkan pengambilan F & V yang rendah apabila dinilai menggunakan kedua-dua FFQ dan FR. Dengan menggunakan plot Bland-Altman, perbezaan bermakna, iaitu 90.54 g (95% CI = -209,88 g, 390,96 g) telah ditunjukkan untuk pengambilan buah-buahan dan perbezaan bermakna, iaitu -9,46 g (95% CI = -333,84 g, 310,92 g) untuk pengambilan sayur-sayuran. Tiada persetujuan yang ketara di antara pengambilan F & V sehari dan faktor-faktor sosio-demografi yang dilaporkan oleh remaja berusia 16-17 menggunakan kedua-dua kaedah tersebut.

Kesimpulan: FFQ menunjukkan perbandingan yang sederhana terhadap FR dalam menilai pengambilan F&V di kalangan remaja berusia 16-17. Pengambilan buah-buahan dan sayur-sayuran yang rendah di kalangan remaja telah didapati dalam kajian semasa. Oleh itu, program menggalakkan pengambilan F & V perlu dilakukan pada masa hadapan.

CHAPTER 1

INTRODUCTION

1.1 Background

Fruit and vegetables are part of healthy diet because they are rich in fiber, micronutrients and other components with functional properties (WHO, 2003). World Health Organization (WHO)/Food and Agriculture Organization of the United Nations (FAO) reported that adequate fruit and vegetables consumption defined as a minimum intake of 400 grams per day excluding potatoes and other starchy tubers are necessary to prevent chronic diseases (WHO, 2003). Based on the report by World Cancer Research Fund (WCRF) and American Institute for Cancer Research (AICR) in 2007, the average intake of fruit and non-starchy vegetables such as spinach and cabbage for the public should be at least 600g per day for health purposes. For individual recommendations, WCRF and AICR suggested at least five servings per day or at least 400 g of a variety of non-starchy vegetables and of fruit per day (WCRF & AICR, 2007). While in Malaysia, the Malaysian Dietary Guidelines (2010) suggested at least five servings per day of fruit and vegetables as

daily requirement. Malaysian Food Pyramid suggested public to take at least two servings of fruits and at least three servings of vegetables per day.

In many surveys, different types of dietary assessment methods, for example, the 3-day food record (FR), 24 hour dietary-recall, food checklist and food frequency questionnaire (FFQ) are used to estimate food intakes (Norimah et al., 2008).

In the current study, fruit and vegetables consumption estimated by using FFQ will be compared against FR and the extent of socio-demographic factors having an influence on the fruit and vegetables consumptions among adolescents will be estimated. According to Willett (1998), assessment of long-term dietary intake using self-reporting methods has generally been related with imprecision. These methods often challenge participants' memory and ability to include the variability of dietary intake, from day to day or by season (Carlsen et al., 2010). However, FFQ is easy to administer and are less burdensome (Agudo, 2005). FFQ are widely used in many nutrition studies in adults (Willett, 1998). In children, the FFQ has been acknowledged as a suitable method for collecting data in epidemiological studies from the age of 10 years, when the cognitive ability of children become more developed (Hammond et al., 1993; Baranowski & Domel, 1994; Livingstone & Robson, 2000). Although FFQ is commonly used to identify food intake over an extended periods of time, dietary data estimated using FFQ still suffer from random and systematic error and may not represent the actual diet intakes (Marks, Hughes, & van der Pols, 2006).

Multiple-day food records such as FR have been used generally to validate methods like food frequency questionnaires (Kristjansdottir et al., 2006). A diet record usually does not depend on memory nor does it rely on individuals'

perception of portion sizes (Willett, 1990; Cade et al., 2002). The food records should be assessed for a sufficient number of days to represent the average intake of an individual (Cade et al., 2002). Thus, cost and respondent burden has to be considered and Stram et al. (1995) have found that in most settings the optimal study design require no more than 4- or 5-day diet records per individual. Prolonged recording has been found to diminish recorded intakes, and the amount of fruit and vegetables recorded after 4 days of recording was found decreasing (Andersen et al., 2002).

1.2 Literature Review

1.2.1 Estimation of food intake using different dietary methods

Dietary assessment methods such as FFQ, food record, and 24-hour dietary recall have been used in many studies to estimate the participants' food intake. For instance, a study by Marks et al. (2006) among 96 Australian adults investigated the validity of food intake estimates using a modified FFQ and weighed food records (WFR). Participants in this study completed a FFQ and two non-consecutive days of WFR every two months over a period of 12 months (total 12 days) (Marks et al., 2006). Results indicated that estimated intakes for 21 out of the 37 food groups measured by the FFQ were significantly higher than WFR (Marks et al., 2006). Concurrently, mean and SD (in grams) for FFQ intakes (932.8 ± 445.1) of all fruit and vegetables food groups were significantly higher than WFR (486.1 ± 232.3) (Marks et al., 2006). Five out of ten vegetables food groups showed Spearman rank correlations $p \leq 0.30$ (Marks et al., 2006). A *t*-test was run and the FFQ was observed doubled the WFR for the estimations of three fruit groups, two vegetables group, rice, pasta and noodles with mean ratio > 2.00 g per day (Marks et al., 2006).

A FFQ was developed by Carlsen et al. in 2010 to evaluate the relative validity of FFQ measuring the energy, food and nutrients intake. Out of 346 participants recruited, only 232 participants' results were finally included in this study (Carlsen et al., 2010).

The FFQ was self-administered by participants at home and attended the physical examination together with the FFQ within two weeks (Carlsen et al., 2010). During the physical examination, the participants were randomly divided into either assessment of energy expenditure using the ActiReg® system (motion detection) (n=64), or to complete the 7-days WFR (n=168) (Carlsen et al., 2010). The assessment of energy expenditure and 7-days WFR were initiated three to four weeks after the participants completed the FFQ (Carlsen et al., 2010).

In this study, energy intakes of participants estimated by FFQ were compared with independent measures of energy expenditure using the ActiReg® system (motion detection) (Carlsen et al., 2010). The correlation coefficient between energy intakes and energy expenditure was 0.54, and the energy intake underestimated by FFQ was 10.6% on the average (Carlsen et al., 2010).

On the other hand, 7-days WFR were used to study the relative validity of food and nutrients intake (Carlsen et al., 2010). FFQ underestimated the percentages of energy from fat and added sugar as compared to the WFR, whereas the percentage of energy from total carbohydrates and protein were slightly overestimated by FFQ (Carlsen et al., 2010). The intakes of antioxidants-rich food did not show significant difference between the FFQ and WFR (Carlsen et al., 2010). Only berries, coffee, tea and vegetables were overestimated by FFQ (Carlsen et al., 2010). Spearman's Rank Order Correlations between FFQ and WFR were 0.41 for berries, 0.78 for coffee,

0.74 for tea, and 0.38 for vegetables (Carlsen et al., 2010). There were no significant differences observed for the fruit, fruit juices and berry juices consumptions (Carlsen et al., 2010). Carlsen et al. (2010) concluded that this FFQ developed has a good estimation for average energy intake, only underestimating 5% of energy intake as compared to the WFR.

In 1998, Ling et al. measured consumption of cereal foods, fruit and vegetables among 81 Singaporean Chinese adults with mean age 42.6 years old by using a 16-item FFQ and three 24-hour dietary recalls.

The FFQ used in this study was designed to measure the usual intake of cereal foods, fruit and vegetables for the past three months (Ling et al., 1998). The participants completed the FFQ twice, at the beginning and at the end of a six-week period (Ling et al., 1998). At the same time, the participants were provided three 24-hour dietary recalls which were for two week-days, and one week-end day, and were spaced over two to three week (Ling et al., 1998). Dietary estimates from the FFQ were compared with the intakes from diet recalls (Ling et al., 1998). Out of 81 participants recruited, 77 participants completed the first FFQ and three diet recalls and only 70 of them returned the second FFQ.

Ling et al. (1998) measured the repeatability and validity of the short FFQ developed. For repeatability, no significant mean difference was observed between FFQ1 and FFQ2 for cereal foods, fruit or vegetables (Ling et al., 1998). However, Ling et al. (1998) reported a significant ($p=0.02$) but small difference (mean difference = -0.14 serving) when the fruit and vegetables were combined. Total fruit and vegetables were lower by 1.12 servings or higher by 0.84 servings between repeat administrations of FFQ (Ling et al., 1998).

For validity, Ling et al. (1998) found no significant differences in mean fruit and vegetables intakes between the FFQ and 24-hour dietary recalls, neither separately nor combined. The mean difference was $p=0.95$ for fruit and $p=0.13$ for vegetables. The magnitude of differences between FFQ1 and FFQ2 was represented by the limits computed from the actual data (Ling et al., 1998). For actual values, the FFQ may over-estimate or under-estimate total fruit and vegetables intakes by 1.25 servings when compared with diet recall (Ling et al., 1998). For FFQ, the mean fruit and vegetables consumptions in the highest quartiles were 215% higher than the lowest quartiles (Ling et al., 1998). For diet recalls, the mean individual fruit and vegetables intakes in the highest quartiles were 292% higher than the lower quartiles (Ling et al., 1998).

Although the between-quartile contrasts are more modest for the FFQ, the difference in intake from the lowest to highest quartiles proposed that the FFQ could distinguish the participants into participants have high or low fruit and vegetables consumption (Ling et al., 1998). Therefore, Ling et al. (1998) concluded that the short FFQ cannot replace the three-day diet recalls for individual's intake assessment, but it could assess mean food group intake in a population and rank individuals into general categories of food group intake.

1.2.2 Socio-demographic Factors

1.2.2.1 Age, ethnics, gender

Quantitative research examining contributing factors of fruit and/or vegetables intakes among children and adolescents aged 6–18 years were conducted by Rasmussen et al. in 2006. In a review paper by Rasmussen et al. (2006), majority of the studies (nine out of ten studies) identified a negative relationship between age

and fruit and vegetables intakes estimated by using FFQ. At the same time, this review did not identify any relationship between age and fruit and vegetables intakes (six out of nine papers) in 24-hour dietary recalls.

According to Xie, Gilliland, Li, and Rockett (2003), ethnic difference was reported in a cohort study conducted in 12 Southern California communities among adolescents aged 11 to 20 years. In this study, non-Hispanic Whites were found to have the lower vegetables intakes than Asians and Blacks. A cross-sectional study involving 4746 middle and high school students from Minneapolis/St. Paul public schools was conducted to assess relationships between family meal pattern, socio-demographic factors and dietary intake (Neumark-Sztainer et al., 2003). From the findings, it was reported that race (Asian American) was associated with more frequent family meals which has positive association with fruit and vegetables intakes (Neumark-Sztainer et al., 2003).

Females were more likely to meet the recommendations of fruit (21.5 vs 14.5%) and vegetables (7.9 vs 5.0%) than males in a study conducted in Southern California (Xie et al., 2003). Out of 49 papers reviewed by Rasmussen et al. (2006), 27 of the papers reported that girls have a higher intake of fruit and/or vegetables than boys and this conformed to the findings by Xie et al. in 2003.

1.2.2.2 Household income

According to Rasmussen et al. (2006), seven out of 14 papers reported that low socioeconomic status (SES) or low family income have positive association with low or less frequent intake of fruit and vegetables among children and adolescents aged 6-18 years. Out of the 31 studies included in a review paper by Hanson and Chen (2007), 25 showed negative associations between low SES backgrounds and

intakes of fruit and vegetables. There were three studies found no significant relationship between SES and diet (Lytle et al. 2003; Roos et al. 2004).

1.2.2.3 Maternal factors

Parental occupation (positive association in nine out of 11 papers) and parental education (positive association in 11 out of 11 papers) were related with fruit and vegetables intake among children and adolescents aged 6-18 years (Rasmussen et al., 2006). However, two other papers did not observe any relationship between maternal occupation and children's fruit and vegetables intakes. Four in eight papers in this review reported higher intakes of fruit and/or vegetables in children whose mothers have higher educational level (Rasmussen et al., 2006). A longitudinal study conducted in China reported a negative association between mothers' educational level and their children's fruit and vegetables intakes (Rasmussen et al., 2006). Family structure also found to have an influence on fruit and vegetables intake among children (Rasmussen et al., 2006). Children from two-parent families had higher fruit and/or vegetables consumption compared to children from single-parent families (Rasmussen et al., 2006).

1.3 Gaps in the Evidence

Despite the broad usage of FFQ in estimating food intakes, only a few studies have examined the usefulness of FFQ to estimate fruit and vegetables intakes as opposed to other methods such as FR and 24-hour dietary recall in adolescents. A highly comparable estimation of fruit and vegetables intakes from FFQ would support the usefulness of FFQ in examining associations with any health outcomes. Interestingly, no study has compared the intakes of fruit and vegetables estimation from a FFQ and FR among adolescents in Malaysia.

Besides, the present study examined the relationships between socio-demographics associated with fruit and vegetables consumption among adolescents. In addition to that, this current study examined the associations between socio-demographics factors agreement of fruit and vegetables intakes per day. This information may provide appropriate nutrition education or plan intervention programs such as seminar or exhibition among adolescents to help develop healthy dietary habits.

1.4 Conceptual Framework

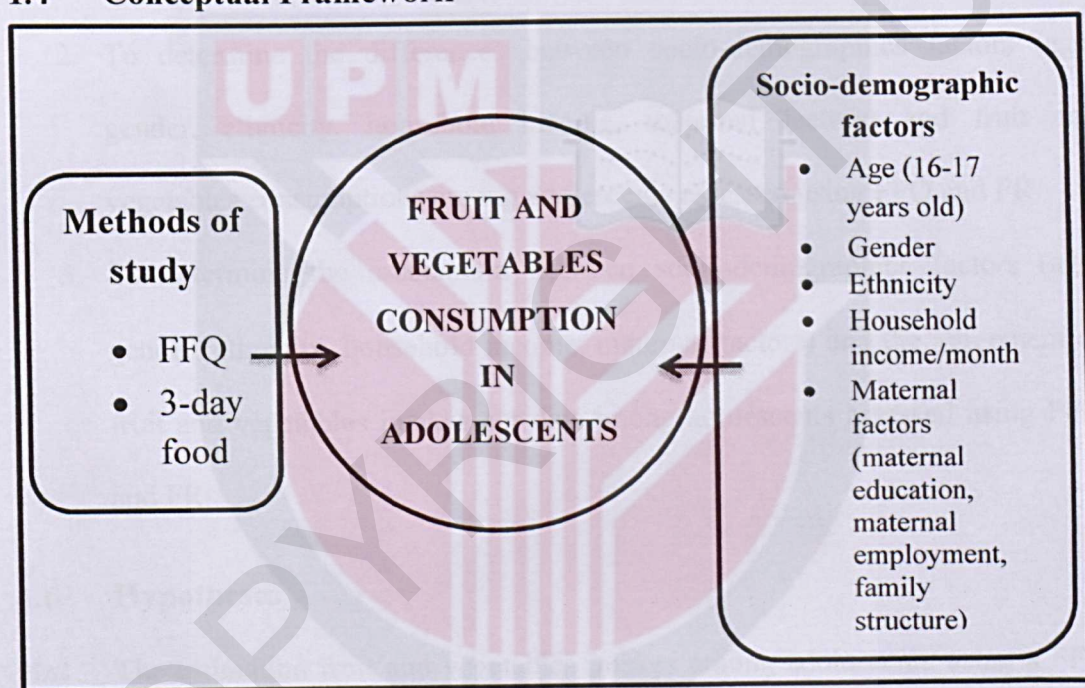


Figure 1.0: Conceptual Framework

The present study examined the fruit and vegetables consumption in adolescents aged 16 to 17 years old at SMK Seri Kembangan, Selangor by using two dietary assessment methods which were FFQ and FR. At the same time, socio-demographic factors included age, gender, ethnicity, household income per month, and maternal factors were assessed in current study.

1.5 Study Objectives

1.5.1 General Objective

To determine fruit and vegetables intakes among adolescents.

1.5.2 Specific Objectives

1. To examine whether fruit and vegetables intakes observed using a FFQ is comparable to that in a 3-day food record in adolescents.
2. To determine the differences between socio-demographics factors (age, gender, ethnicity, household income, maternal factors) and fruit and vegetables consumptions among adolescents assessed using FFQ and FR.
3. To determine the association between socio-demographics factors (age, gender, ethnicity, household income, maternal factors) and the agreement of fruit and vegetables intakes per day among adolescents assessed using FFQ and FR.

1.6 Hypotheses

- HA1. The estimation fruit and vegetables intakes among adolescents using a FFQ and 3-day food record will be broadly similar.
- HA2. Socio-demographics factors such as age, gender, ethnicity, household income, maternal factors can influence fruit and vegetables consumption among adolescents assessed using FFQ and FR.
- HA3. There are associations between socio-demographic factors (age, gender, ethnicity, household income, maternal factors) and agreement of fruit and vegetables intakes per day assessed using FFQ and FR.

CHAPTER 2

METHODOLOGY

2.1 Study Design

This was a cross-sectional study.

2.2 Study Location

This study was conducted in one of the secondary schools at SMK Seri Kembangan, Selangor. Selangor is the most crowded state in Malaysia with 5.46 million people (Department of Statistics Malaysia, 2011) where 19.6% of the country's population in year 2010 lived. Selangor covers an area of 8153 km². It is a state located on the west coast of Peninsular Malaysia and is bordered by Perak in the north, Pahang in the east, Negeri Sembilan in the south and the Strait of Malacca in the west (Department of Statistics Malaysia, 2011).

2.3 Sample Size Determination

This Correlation formula used to calculate sample size required was developed by Cole (1997).

$$n = \frac{(Z_{1-\alpha/2} + Z_{1-\beta})^2}{(d^2/(1-d^2))} + 5$$

$$n = \frac{(1.96 + 1.28)^2}{(0.135/0.865)} + 5$$

$$n = 72 + 20\% \text{ drop out}$$

$$n = 86$$

Whereby,

n = minimum sample size

$Z_{1-\alpha/2}$ = level of significance

$Z_{1-\beta}$ = power

d = correlation

At power 90%, level of significance 5%

The mean r value of total fruit and vegetables (included fruit, cruciferous vegetables, dark-yellow vegetables, tomatoes, green, leafy vegetables, and other vegetables) estimated using diet record and second FFQ by Hu et al. (1999) were used to calculate the sample size needed for present study. Thus, the participants required for this study is at least 86 adolescents aged 16-17.

2.4 Sampling Design

Multistage sampling method was used for this study. A list of secondary schools in Seri Kembangan was identified and only one of the schools was randomly selected for this study, which was SMK Seri Kembangan. All students aged 16-17 in the selected school were screened based on inclusion and exclusion criteria. Those who fulfilled the study requirement were invited to participate.

2.5 Inclusion and Exclusion Criteria

Table 2.0: Inclusion and Exclusion Criteria of the Participants

Inclusion criteria	Exclusion criteria
Malaysian	Individuals who refused to participate
Aged 16 to 17 years old	Individuals who experienced chronic illnesses, inability to give consent form and inability to complete the questionnaire given
Boys and girls	Individuals who were unable to read, write and understand Bahasa Malaysia very well
Individuals who were able to read, write and understand Bahasa Malaysia	-

The inclusion criteria for the participants involved in this study were Malaysian aged 16 to 17 years old, boys and girls, and individuals who were able to read, write and understand Bahasa Malaysia.

2.6 Measures

2.6.1 Food Frequency Questionnaire (FFQ)

The FFQ used in this study was adapted from the Malaysian Adults Nutrition Survey (MANS) (Ministry of Health Malaysia, 2008). The validated FFQ consisted of 126 food items and were originally listed into 15 food groups. The whole sets of FFQ were given to the participants. However, due to the particular interest on fruit and vegetables consumption, this study only examined the intakes of all types of fruit and vegetables (Group G and H listed in the FFQ).

The FFQ was self-administered, where participants recorded the frequencies of intakes of each food item (Ministry of Health Malaysia, 2008). Information on the portion sizes were also collected in the FFQ (Ministry of Health Malaysia, 2008). The frequency of consumption represented the habitual intake of the past one year (Ministry of Health Malaysia, 2008).

There were four main columns in the FFQ (Ministry of Health Malaysia, 2008). The first column was the list of food items while the second column described the various categories of frequency of intake (Ministry of Health Malaysia, 2008). The third column was the serving size of each food item while the fourth column was the number of servings consumed each time the food item consumed (Ministry of Health Malaysia, 2008). However, in order for the FFQ to be comparable to 3-day food record, the second column was changed to frequency of intake for past three days.

2.6.1.1 Conversion of food frequency to amount of food intake

In this study, the serving size was referred as to the serving size and weight table in MANS. The serving size was set to medium size (Ministry of Health Malaysia, 2008).

The frequency fruit and vegetables intakes were converted to the amount of fruit and vegetables consumed per day (averaged over the past three days) using the following formula:

Amount of fruit and vegetables consumed per day (g) = frequency of intake for past three days multiply by number of serving each time consumed multiply by the weight of fruit/vegetables in one serving divided by three days

2.6.2 3-day food record (FR)

A 3-day food records were self-administered by the participants. Participants were required to write down all food and drinks for three days where each day started from 12.00a.m. and ended at 11.59p.m. The FR consisted of three consecutive days, including two weekdays and one weekend day.

The meal, food/beverage item, details/ingredients/preparation and amount of food were recorded by participants. Meal included breakfast (BF), morning tea (MT), lunch (L), afternoon tea (AT), dinner (D), and supper (S). Food/beverage item was used to record what types of foods and drinks the participants consumed for the past 24 hours. Details/ingredients/preparation further described the details for any side dish, sauces or condiments consumed or ingredients used during the preparation. The amount were described and recorded in terms of household measures such as scoops, plate, bowl, glass, and others. Pictures of the household measurements and the

weights in grams/millilitres based on *Atlas Makanan Saiz Pertukaran & Porsi Edisi Kedua* (Atlas of Food Exchanges & Portion Sizes Second Edition) were provided to guide the participants about the amount of food or drinks recorded (Suzana et al., 2009). The frequency of fruit and vegetables intakes for past three days were summed up and divided by three to determine the fruit and vegetables intakes per day (grams).

2.6.3 Socio-demographic

This study was conducted among boys and girls aged between 16 and 17 years in SMK Seri Kembangan, Selangor.

2.6.3.1 Ethnicity

The present study involved only two main ethnic groups in Malaysia, which were Chinese and Indians. This was due to the geographical area of the study location, where Seri Kembangan is a place crowded with Chinese population.

2.6.3.2 Household income

Household income was divided into less than RM1500 per month, RM1500-RM3500 per month, and more than RM3500 per month (Norimah et al., 2008).

2.6.3.3 Maternal employment

Maternal employment was divided into unemployed and employed.

2.6.3.4 Maternal education

Maternal education was divided into no formal education, primary school, lower secondary school, upper secondary school, matriculation/Form 6, and college/university.

2.6.3.5 Family structure

The family structure was divided into single-parent family and two-parent family (Rasmussen et al., 2006).

2.7 Pre-testing

Pre-test was carried out on eight participants (10% of the sample size) from SMK Seri Kembangan but excluded the classes which were included in the data collection. This was to ensure that the questionnaire is appropriate, readable, and understandable. The time required to complete the FFQ and socio-demographic questionnaire was estimated. The socio-demographic questionnaire was amended based on the feedback received from the participants of pre-testing prior to data collection. Besides, the participants were given the FR template to fill in their dietary intakes for three days. The participants filled in the FR for three consecutive days, including two weekdays and one weekend day.

2.8 Procedures/Data Collection

Data collection was conducted in January 2014. Prior to the commencement of the study, ethical clearance was sought from the Jawatankuasa Etika Universiti untuk Penyelidikan Melibatkan Manusia, JKEUPM. The approval of the study protocol was obtained from the Ministry of Education, Malaysia. Approval letter to enter SMK Seri Kembangan was obtained prior to data collection. Questionnaires were distributed to 150 participants aged 16-17. Questionnaire consisted of three parts: socio-demographic factors (age, gender, ethnicity, household income/month, maternal employment, maternal education, family structure), FFQ & FR. Ninety-seven participants returned completed questionnaires. Participants were given

information sheets explaining the purpose of the study and consents to participate were sought prior to the administration of the questionnaires, FFQ and FR. The participants were also given another information sheets and parent's consent forms to inform their parents about this study.

2.9 Data Analysis

All the statistical analysis was performed using IBM SPSS Statistics 22. Dietary intakes were assessed using FFQ and FR. Only fruit and vegetables intakes were taken for analysis in the present study. Univariate analysis was used to analyse descriptive data and the results were presented as frequencies and percentages for categorical variables (gender, ethnicity, socioeconomic status, family structure, and maternal factors) and as means and standard deviations for continuous variables (age, fruit and vegetables intake).

Mann-Whitney U tests were used to determine median differences of fruit and vegetables intakes estimated (in grams) using FFQ and FR. Mann-Whitney U tests were also be used to determine differences of age, gender, maternal employment, and family structure in affecting the total fruit and vegetables intakes when assessed using FFQ and FR. Kruskal-Wallis tests were used to determine differences of ethnicity, household income and maternal education in affecting the total fruit and vegetables intakes when assessed using FFQ and FR.

Spearman correlation was used to determine the associations between fruit and vegetables intake measured using FFQ and using FR. Crude agreements were done to identify the agreement of fruit and vegetables intakes measured using FFQ and FR. Bland-Altman graphs were plotted to determine the agreement of fruit and vegetables intakes assessed using both methods. Finally, Chi-square tests were done

to determine the association between agreement of fruit and vegetables intakes using both methods and socio-demographic factors. All the statistical significance level was set at $p < 0.05$. All the results were presented as fruit and vegetables intakes per day.

CHAPTER 3



CHAPTER 3

RESULTS

3.1 Socio-demographic Characteristics

This research was carried out among students aged 16-17 at SMK Seri Kembangan which located at Seri Kembangan, Selangor. Out of 150 sets of questionnaires that were distributed, 97 students completed the questionnaires.

The distribution of participants according to the socio-demographic factors was presented in Table 3.0. The mean age of the study participants was 16.25 ± 0.43 years old. Greater number of girls (66%) than boys (34%) participated in this study. As majority of Chinese live in Seri Kembangan, this study was largely predominant by Chinese (95.9%) as shown in Table 3.0.

Table 3.0 shows that out of 86 (88.7%) participants who reported their household income per month, six (6.2%) reported RM1500, 46 (47.4%) participants recorded RM1500-3500, followed by 34 (35.1%) participants with household income of more than RM3500. Thirty-four per cent of participants' mothers were employed while 67% were unemployed as shown in Table 3.0.

Table 3.0 shows that almost half of the participants' mothers (45.4%) attended upper secondary school (Form 4 and Form 5), followed by 24 (24.7%) for college/university and 20 (20.6%) participants' mothers attended lower secondary school (Form 1, Form 2 and Form 3). Three out of 97 participants reported the maternal education as primary school and only one reported as Matriculation/Form 6. Most of the participants (96.9%) came from two-parent family.

Self-demographic factors	Frequency (n)	Percentage (%)
Gender		
Male	1	1.0
Female	96	99.0
Ethnicity		
Malay	97	100.0
Chinese	0	0.0
Indian	0	0.0
Religious background		
KMISBM	97	100.0
RAKISBM (SNB)	0	0.0
Others	0	0.0
Maternal employment		
Employed	97	100.0
Unemployed	0	0.0
Not specified	0	0.0
Maternal education		
Primary	3	3.1
Upper secondary	44	45.4
College/university	24	24.7
Matriculation/Form 6	1	1.0
Lower secondary	20	20.6
Family structure		
Two-parent	94	96.9
Single-parent	3	3.1

3.2 Fruit and Vegetable Intakes

As shown in Table 3.1, most of the fruit items except pineapple, star fruit, jack fruit, durian, and fresh peaches were reported to have higher median intakes among FR in current study. Total fruit intakes were reported to have higher but slightly lower median intakes among FR (Median = 14.1 / g, IQR = 1.9) than in comparison

Table 3.0: Socio-demographic characteristics of the study participants, SMK Seri Kembangan, Seri Kembangan (n = 97)

Socio-demographic factors	Frequency (n)	Percentage (%)
Gender		
Boys	33	34.0
Girls	64	66.0
Ethnicity		
Malay	0	0.0
Chinese	93	95.9
Indians	4	4.1
Household income/month		
RM1500	6	6.2
RM1500-3500	46	47.4
More than RM3500	34	35.1
Not stated	11	11.3
Maternal employment		
Employed	33	34.0
Unemployed	43	44.3
Not specific	21	21.6
Maternal education		
Primary	3	3.1
Lower secondary	20	20.6
Upper secondary	44	45.4
Matriculation/Form 6	1	1.0
College/University	24	24.7
Not specific	5	5.2
Family structure		
Single-parent family	3	3.1
Two-parent family	94	96.9

3.2 Fruit and Vegetables Intakes

As shown in Table 3.1, most of the fruit items except pineapple, star fruit, jack fruit, durian, and fresh lychee were reported to have higher median intakes using FR in current study. Total fruit intakes were reported to have similar but slightly higher median intakes using FFQ (*Median* = 142.17 g, *IQR* = 150.24 g) as compared to FR (*Median* = 140.00 g, *IQR* = 123.33 g).

Interestingly, star fruit, jack fruit, durian, and fresh lychee were reported as no intake at all using FR which were different from the measurements observed in FFQ. One of the participants reported honeydew intakes using FR but zero intakes was found when assessed using FFQ.

Consumption of local citrus and rambutan had the largest median difference comparing FFQ and FR which were 286.00 g and 277.00 g respectively. Next, papaya, watermelon, jack fruit, apple, orange/mandarin orange, pear/lai, grapes, and honeydew were reported to have a large median difference of around 100 g between both methods. Fruit items with smaller median difference between two methods (around 50 g) included guava, pineapple, banana, star fruit, durian, fresh lychee, and dried fruits. Mango and total fruit intakes had the smallest median difference of less than 10 g when assessed using FFQ and FR. Papaya, orange, apple, durian and total fruit intakes were reported with significant difference between FFQ and FR.

Table 3.1: Median fruit intakes assessed using the FFQ and FR among the participants from SMK Seri Kembangan, Seri Kembangan

Fruit groups	FFQ					FR					Median Difference (FR-FFQ)	*p-value
	n	Median	IQR	min	max	n	Median	IQR	min	max		
Papaya	19	46.67	46.66	23.33	116.67	6	211.00	211.00	211.00	422.00	164.33	<0.001
Guava	4	32.00	29.34	21.33	53.33	3	75.00	75.00	75.00	150.00	43.00	0.118
Local citrus	1	26.00	0.00	26.00	26.00	1	312.00	0.00	312.00	312.00	286.00	0.970
Mango	4	28.00	14.00	9.33	28.00	1	30.00	0.00	30.00	30.00	2.00	0.197
Pineapple	7	70.67	35.34	35.33	106.00	3	20.00	20.00	20.00	142.00	50.67	0.211
Banana	7	28.67	14.34	14.33	193.50	4	64.00	53.50	62.00	132.00	35.33	0.428
Watermelon	16	26.67	26.67	13.33	160.00	6	185.00	377.50	120.00	1240.00	158.33	0.052
Star fruit	3	58.00	58.00	58.00	120.00	0	0.00	0.00	0.00	0.00	58.00	0.088
Jack fruit	2	154.67	135.33	135.33	174.00	0	0.00	0.00	0.00	0.00	154.67	0.165
Apple	43	55.67	55.66	27.83	556.67	10	150.00	150.00	30.00	525.00	94.33	<0.001
Orange/mandarin orange	34	40.00	40.00	40.00	400.00	12	137.00	137.00	110.00	274.00	97.00	0.003
Pear/lai	2	78.50	52.33	52.33	104.67	1	197.00	0.00	197.00	197.00	118.50	0.595
Grapes	5	26.67	57.33	2.67	80.00	2	132.50	92.00	92.00	173.00	105.83	0.291
Durian	4	34.67	54.16	8.67	69.33	0	0.00	0.00	0.00	0.00	34.67	0.048
Rambutan	4	40.00	98.33	6.67	133.33	1	317.00	0.00	317.00	317.00	277.00	0.197
Fresh longan	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	1.000
Fresh lychee	1	40.00	0.00	40.00	40.00	0	0.00	0.00	0.00	0.00	40.00	0.327
Honeydew	0	0.00	0.00	0.00	0.00	4	0.00	0.00	0.00	175.00	175.00	0.148
Canned fruit	0	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	1.000
Dried fruits	1	3.33	0.00	3.33	3.33	1	63.00	0.00	63.00	63.00	59.67	0.970
Total fruit	97	142.17	150.24	13.33	594.33	97	140.00	123.33	21.67	850.00	2.17	<0.001

*Significant at $p < 0.05$ using Mann-Whitney U tests

Table 3.2 shows that median total vegetables intakes were higher when assessed using FR (*Median* = 420.00 g, *IQR* = 370.00 g) as compared to FFQ (*Median* = 154.67 g, *IQR* = 138.67 g). Both FFQ and FR reported green leafy vegetables had the highest median values when assessed using FFQ (*Median* = 106.67 g, *IQR* = 106.67 g) and FR (*Median* = 347.50 g, *IQR* = 377.50). Similarly, cabbage was recorded second highest median intakes assessed using FFQ (*Median* = 66.67 g, *IQR* = 66.67 g) and FR (*Median* = 67.50 g, *IQR* = 240.00). None of the participants reported intakes of 'sayuran asin'/dried vegetables when assessed using FFQ while there was an intake (*Median* = 245.00 g, *IQR* = 40.00 g) reported using FR.

Green leafy vegetables and 'sayuran asin'/dried vegetables had largest median difference of 240.83 g and 245.00 g respectively when assessed using FFQ and FR. Moderate median difference of 89.33 g was found in tubers type vegetables when assessed using both methods.

Most of the vegetables except 'ulam-ulam' and bean sprout reported to have higher median intakes using FR. Green leafy vegetables, tubers type vegetables, bitter gourd/pumpkin/cucumber, cabbage and total vegetables intakes were reported to have significant difference between the FFQ and FR.

Table 3.2: Median of vegetables intakes assessed using the FFQ and FR among the participants from SMK Seri Kembangan,

Seri Kembangan

Vegetables groups	N	FFQ				FR				Median Difference (FR-FFQ)	p-value
		Median	IQR	min	max	Median	IQR	min	max		
Green leafy vegetables	83	106.67	106.67	26.67	480.00	347.50	377.50	40.00	1060.00	240.83**	<0.001
Beans type vegetables	14	24.00	24.00	24.00	72.00	30.00	20.00	20.00	150.00	6.00	0.118
Tubers type vegetables	6	60.67	60.67	30.33	91.00	150.00	170.00	10.00	600.00	89.33*	0.025
Cabbage	19	66.67	66.67	33.33	400.00	67.50	240.00	20.00	1050.00	0.83*	0.028
Bitter gourd/pumpkin/cucumber	7	29.33	7.33	7.33	58.67	20.00	20.00	20.00	150.00	9.33**	<0.001
'Sayuran asin'/dried vegetables	0	0.00	0.00	0.00	0.00	245.00	40.00	40.00	450.00	245.00	0.148
'Ulam-ulam'	1	5.67	0.00	5.67	5.67	0.00	0.00	0.00	0.00	5.67	0.327
Baby corn	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.000
Dried/wet mushroom	17	58.67	36.67	4.89	117.33	15.00	30.00	10.00	119.00	43.67	0.989
Bean sprout	5	48.00	24.00	24.00	60.00	30.00	10.00	30.00	60.00	18.00	0.109
Total vegetables	97	154.67	138.67	26.67	880.00	420.00	370.00	65.00	2550.00	265.33**	<0.001

*Significant at $p < 0.05$ using Mann-Whitney U test

**Significant at $p < 0.001$ using Mann-Whitney U test

3.3 Socio-demographic Characteristics and Total Fruit and Vegetables

Intakes Assessed using FFQ and FR

Table 3.3 shows that Mann-Whitney U test was done to test differences between socio-demographic factors in the assessment of total fruit intakes using FFQ and FR. There was an inconsistent result found between fruit intakes reported using both methods. Results indicated that girls (*Median* = 94.50 g) reported higher median fruit intakes than boys (*Median* = 80.00 g) when assessed using FFQ. On the other hand, boys showed a higher median fruit intakes (*Median* = 156.67 g) than girls (*Median* = 123.33 g). There were no significant difference in fruit intakes measured by FFQ (*IQR* = 196.83, *U* = 927.50, *z* = -0.989, *p* = 0.323) and FR (*IQR* = 123.33, *U* = 907.50, *z* = -1.131, *p* = 0.258).

Indians showed higher median fruit intakes (*Median* = 182.51 g) than Chinese with median fruit intakes (*Median* = 80.00 g) when assessed using FFQ. Similarly, Indians showed higher median fruit intakes (*Median* = 213.34 g) than Chinese (*Median* = 140.00 g). No significant difference was found between Chinese and Indians in total fruit intakes assessed using FFQ (*IQR* = 196.83, *p* = 0.067) and FR (*IQR* = 123.33, *p* = 0.272).

For maternal employment, those participants whose mothers were employed reported higher median fruit intakes (*Median* = 142.00 g) compared to those whose mothers were unemployed with median intakes (*Median* = 55.67 g) when assessed using FFQ. When FR was used, inversed result showed in which participants whose mothers were unemployed had slightly higher median intake (*Median* = 150.00 g) than those whose mothers were employed (*Median* = 140.00 g). There was no significant difference for those participants whose mothers were employed or

unemployed in total fruit intakes when assessed using both FFQ ($IQR = 196.83, p = 0.082$) and FR ($IQR = 123.33, p = 0.733$).



Table 3.3: Socio-demographic characteristics and total fruit intakes per day assessed using FFQ and FR

Socio-demographic characteristics (N = 97)	FFQ						FR					
	Median	IQR	U	Z	X ²	p-value	Median	IQR	U	Z	X ²	p-value
*Gender												
Boys	80.00	196.83	927.50	-0.989	-	0.323	156.67	123.33	907.50	-1.131	-	0.258
Girls	94.50						123.33					
*Ethnicity												
Chinese	80.00	196.83	86.00	-1.834	-	0.067	140.00	123.33	125.50	-1.098	-	0.272
Indians	182.51						213.34					
*Maternal employment												
Employed	142.00	196.83	545.50	-1.740	-	0.082	140.00	123.33	677.00	-0.341	-	0.733
Unemployed	55.67						150.00					
Missing data	69.34						110.00					

Table 3.4 shows that when assessed using FFQ, participants from single-parent family showed higher median fruit intakes of 95.67 g than participants from two-parent family with median intakes of 90.99 g. On the other hand, participants from single-parent family reported similar median fruit intakes of 140.00 g with participants from two-parent family with median intakes of 140.84 g when investigated using FR. No significant difference were reported between participants either from single-parent or two-parent families where total fruit intakes assessed using FFQ was ($IQR = 196.83, p = 0.992$) and FR was ($IQR = 123.33, p = 0.827$).

In order to test the median difference between socio-demographic factors and total fruit intakes assessed using FFQ and FR, a Kruskal-Wallis test was run. Participants with a household income more than RM3500 recorded a higher median intakes ($Median = 132.51$ g) than the other two income groups when assessed using FFQ. On the other hand, those with household income between RM1500 and RM3500 recorded a higher median intakes ($Median = 161.67$ g) when investigated using FR. There was a significant difference in fruit intakes across the income groups measured using FFQ ($IQR = 196.83, p = 0.031$) but no significant difference in fruit intakes assessed using FR ($IQR = 123.33, p = 0.166$).

When maternal education was tested, college/university group showed highest median FFQ fruit intakes ($Median = 172.59$). In contrast, matriculation/Form 6 group showed highest median FR fruit intakes ($Median = 150.00$ g). No significant difference was found in fruit intakes across maternal education groups measured using FFQ ($IQR = 196.83, p = 0.166$) assessed using FR ($IQR = 123.33, p = 0.922$).

Table 3.4: Socio-demographic characteristics and total fruit intakes per day assessed using FFQ and FR

Socio-demographic characteristics (N = 97)	FFQ					FR						
	Median	IQR	U	Z	X ²	p-value	Median	IQR	U	Z	X ²	p-value
*Family structure												
Single-parent	95.67	196.83	140.50	-0.011	-	0.992	140.00	123.33	130.50	-0.219	-	0.827
Two-parent	90.99						140.84					
**Household income/month												
RM1500	117.17	196.83				0.031	150.00	123.33			3.597	0.166
RM1500-3500	55.67						161.67					
More than RM3500	132.51						110.00					
Missing data	106.66						106.67					

**Maternal education	151.33	196.83	-	12.193	0.016	131.67	123.33	-	0.920	0.922
Primary	55.67					145.00				
Lower secondary	69.17					145.84				
Upper secondary	0.00					150.00				
Matriculation/ Form6	172.59					133.34				
College/ University	0.00					56.67				
Missing data										

*Mann-Whitney U Test

**Kruskal-Wallis Test

Significant at $p < 0.05$

Table 3.5 shows differences between socio-demographic factors and total vegetables intakes assessed using FFQ and FR. Result indicated that boys (*Median* = 138.67 g) had higher median vegetables intakes per day than girls (*Median* = 111.16 g) when assessed using FFQ. Similarly, boys also had a higher median vegetables intakes (*Median* = 470.00 g) than girls (*Median* = 370.00 g) when assessed using FR. There were no significant difference between girls and boys in total vegetables intakes when assessed using FFQ (*IQR* = 123.12, *U* = 900.00, *z* = -1.190, *p* = 0.234) and FR (*IQR* = 370.00, *U* = 907.50, *z* = -1.131, *p* = 0.258).

Indians had higher median vegetables intakes (*Median* = 258.84 g) than Chinese with median vegetables intakes (*Median* = 112.99 g) when assessed using FFQ. Likewise, Indians had higher median vegetables intakes (*Median* = 640.00 g) than Chinese (*Median* = 420.00 g) when investigated using FR. There was a significant difference found between Chinese and Indians in total vegetables intakes measured using FFQ (*IQR* = 123.12, *U* = 51.00, *z* = -2.454, *p* = 0.014) but no significant difference found when vegetables intakes were assessed using FR (*IQR* = 370.00, *U* = 125.50, *z* = -1.098, *p* = 0.272).

For maternal employment, participants whose mothers were employed had slightly higher median vegetables intakes (*Median* = 133.33 g) as compared to those whose mothers were unemployed with median intakes (*Median* = 112.99 g) when assessed using FFQ. When FR was used, opposite finding showed in which participants whose mothers were unemployed had slightly higher median intake (*Median* = 450.00 g) than those whose mothers were employed (*Median* = 420.00 g). There were no significant difference for those participants whose mothers were employed or unemployed in total vegetables intakes when assessed using both FFQ

($IQR = 123.12$, $U = 670.00$, $z = -0.415$, $p = 0.678$) and FR ($IQR = 370.00$, $U = 677.00$, $z = -0.341$, $p = 0.733$).



Table 3.5: Socio-demographic characteristics and total vegetables intakes per day assessed using FFQ and FR

Socio-demographic characteristics (N = 97)	FFQ					FR						
	Median	IQR	U	Z	X ²	p-value	Median	IQR	U	Z	X ²	p-value
*Gender												
Boys	138.67	123.12	900.00	-1.190	-	0.234	470.00	370.00	907.50	-1.131	-	0.258
Girls	111.16						370.00					
*Ethnicity												
Chinese	112.99	123.12	51.00	-2.454	-	0.014	420.00	370.00	125.50	-1.098	-	0.272
Indians	258.84						640.00					
*Maternal employment												
Employed	133.33	123.12	670.00	-0.415	-	0.678	420.00	370.00	677.00	-0.341	-	0.733
Unemployed	112.99						450.00					
Missing data	133.33						330.00					

Table 3.6 shows that when assessed using FFQ, participants from single-parent family had slightly higher median vegetables intakes (*Median* = 133.33 g) than participants from two-parent family (*Median* = 132.00 g). On the other hand, participants from two-parent family had slightly higher median vegetables intakes (*Median* = 422.50 g) with participants from single-parent family (*Median* = 420.00 g) when investigated using FR. However, no significant difference were reported between participants either from single-parent or two-parent families where total vegetables intakes assessed using FFQ (*IQR* = 123.12, *U* = 136.50, *z* = -0.094, *p* = 0.925) and FR (*IQR* = 370.00, *U* = 130.50, *z* = -0.219, *p* = 0.827).

Kruskal-Wallis tests were run to test median difference between household income, maternal education and total vegetables intakes assessed using FFQ and FR. Participants with household income more than RM3500 recorded a higher median intakes (*Median* = 163.33 g) than the other two income groups when assessed using FFQ. On the other hand, participants with household income between RM1500 and RM3500 recorded a higher median intakes (*Median* = 485.00 g) when investigated using FR. However, no significant difference was reported in total vegetables intakes across the household income groups using FFQ (*IQR* = 123.12, *p* = 0.257) and FR (*IQR* = 370.00, *p* = 0.166).

Participants with maternal education of lower secondary and matriculation/Form 6 group were both reported to have highest median vegetables intakes (*Median* = 160.00 g) when assessed using FFQ. On the other hand, those with maternal education of matriculation/Form 6 showed highest median vegetables intakes (*Median* = 450.00 g) when assessed using FR. However, no significant difference was found in total vegetables intakes across the maternal education groups

when assessed using FFQ ($IQR = 123.12$, $p = 0.356$) and FR ($IQR = 370.00$, $p = 0.922$).



Table 3.6: Socio-demographic characteristics and total vegetables intakes per day assessed using FFQ and FR

Socio-demographic characteristics (N = 97)	FFQ						FR					
	Median	IQR	U	Z	X ²	p-value	Median	IQR	U	Z	X ²	p-value
*Family structure												
Single-parent	133.33	123.12	136.50	-0.094	-	0.925	420.00	370.00	130.50	-0.219	-	0.827
Two-parent	132.00						422.50					
**Household income/month												
RM1500	96.50	123.12		-	2.716	0.257	450.00	370.00		-	3.597	0.166
RM1500-3500	106.67						485.00					
More than RM3500	163.33						330.00					
Missing data	106.67						320.00					

**Maternal education	80.00	123.12	-	4.389	0.356	395.00	370.00	0.920	0.922
Primary	160.00					435.00			
Lower secondary	110.67					437.50			
Upper secondary	160.00					450.00			
Matriculation /Form6	136.00					400.00			
College/ University	80.00					170.00			
Missing data									

*Mann-Whitney U Test

**Kruskal-Wallis Test

Significant at $p < 0.05$

3.4 Correlation between Fruit and Vegetables Intakes Assessed Using FFQ and FR

As shown in Table 3.7, associations between fruit and vegetables intakes per day measured by using FFQ and FR were investigated using Spearman correlations. For total fruit intakes, there was a weak, negative correlation between intakes reported by two methods, $r = -0.04$, $p = 0.684$ (95% confidence interval = -0.257, 0.176). A weak, positive correlation was found between total vegetables intakes assessed using FFQ and FR, $r = 0.08$, $p = 0.465$ (95% confidence interval = -0.139, 0.274).

Table 3.7: Results of Spearman correlations between measures of total fruit and vegetables intakes per day using FFQ and FR

	Correlations between FFQ and FR	95 % Confidence interval	
		Lower bound	Upper bound
Total fruit	-0.04	-0.257	0.176
Total vegetables	0.08	-0.139	0.274

Significant at $p < 0.05$

3.5 Agreement of Fruit and Vegetables Intakes Assessed Using FFQ and FR

3.5.1 Crude Agreement

The fruit and vegetables intakes per day were divided into tertiles (T1, T2, T3) to test the agreement of fruit and vegetables intakes measured using FFQ and FR as shown in Table 3.8 and Table 3.9. Agreement occurred when the fruit and vegetables intakes measured by FFQ and FR were in the same tertile. A higher percentage of agreement indicates high agreement between FFQ and FR.

Table 3.8 and Table 3.9 show that the agreement of total fruit and vegetables intakes for being in the same and adjacent cells was 74.2% and 78.4% between the FFQ and FR, respectively. Although the agreement was high in fruit and vegetables intakes, many participants reported low fruit and vegetables intakes (T1) assessed using both methods.

Table 3.8: Agreement of fruit intakes assessed using FFQ and FR

Agreement (n)		FFQ			Total
		1 st	2 nd	3 rd	
FR	1 st	24	20	20	64
	2 nd	1	0	0	1
	3 rd	5	15	12	32
	Total	30	35	32	97

T1: Tertile 1, T2: Tertile 2, T3: Tertile 3

Table 3.9: Agreement of vegetables intakes assessed using FFQ and FR

Agreement (n)		FFQ			Total
		1 st	2 nd	3 rd	
FR	1 st	12	9	10	31
	2 nd	10	13	11	34
	3 rd	11	10	11	32
	Total	33	32	32	97

T1: Tertile 1, T2: Tertile 3, T3: Tertile 3

3.5.2 Bland-Altman Plots

In Figure 3.0 and Figure 3.1, Bland-Altman plots showed mean fruit and vegetables intakes against differences. The middle line represented mean difference and the other two lines were 95% confidence interval between fruit and vegetables intakes in the FFQ and FR.

Total vegetables intakes showed better agreement than fruit intakes between FFQ and FR because the mean difference (-9.46 g) in vegetables was smaller than mean difference in fruit (90.54 g). The 95% confidence interval represented limit of agreement and those participants within the limit indicated agreement of intakes measured using FFQ and FR. Most of the participants were within 95% confidence interval, only few of them were not in range when their intakes when assessed using both methods indicated high agreement between two assessment methods (95% confidence interval for fruit: -209.88, 390.96; 95% confidence interval for vegetables: -333.84, 310.92).

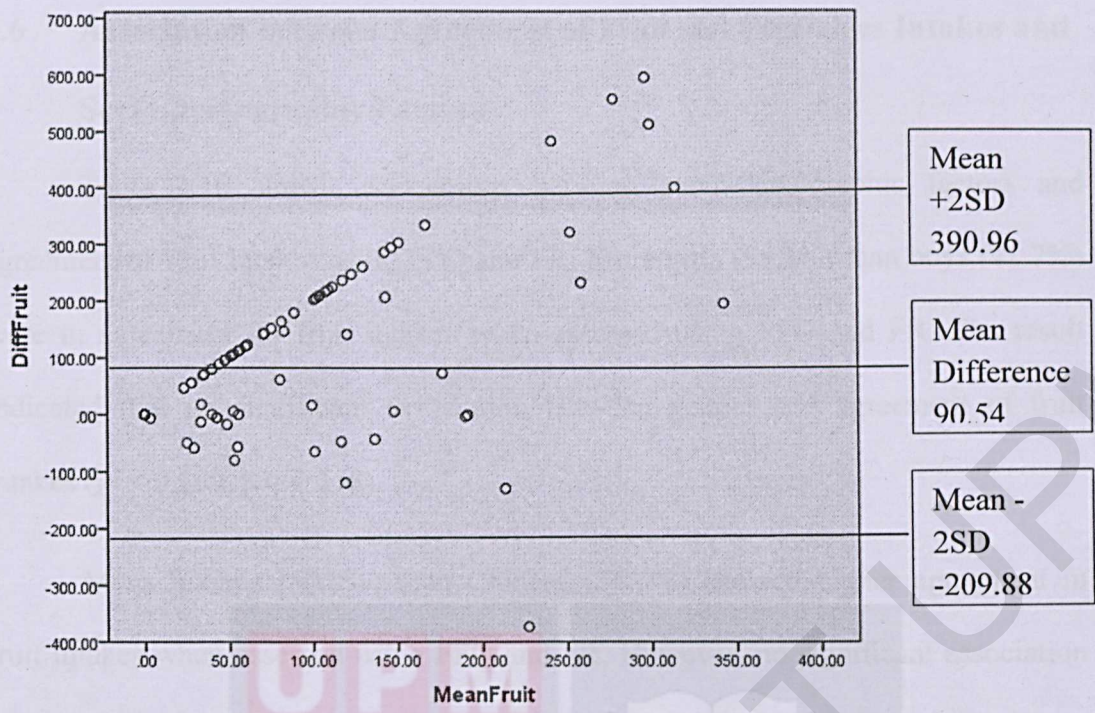


Figure 3.0: Bland Altman Plot of Total Fruit Intakes Assessed Using FFQ and FR

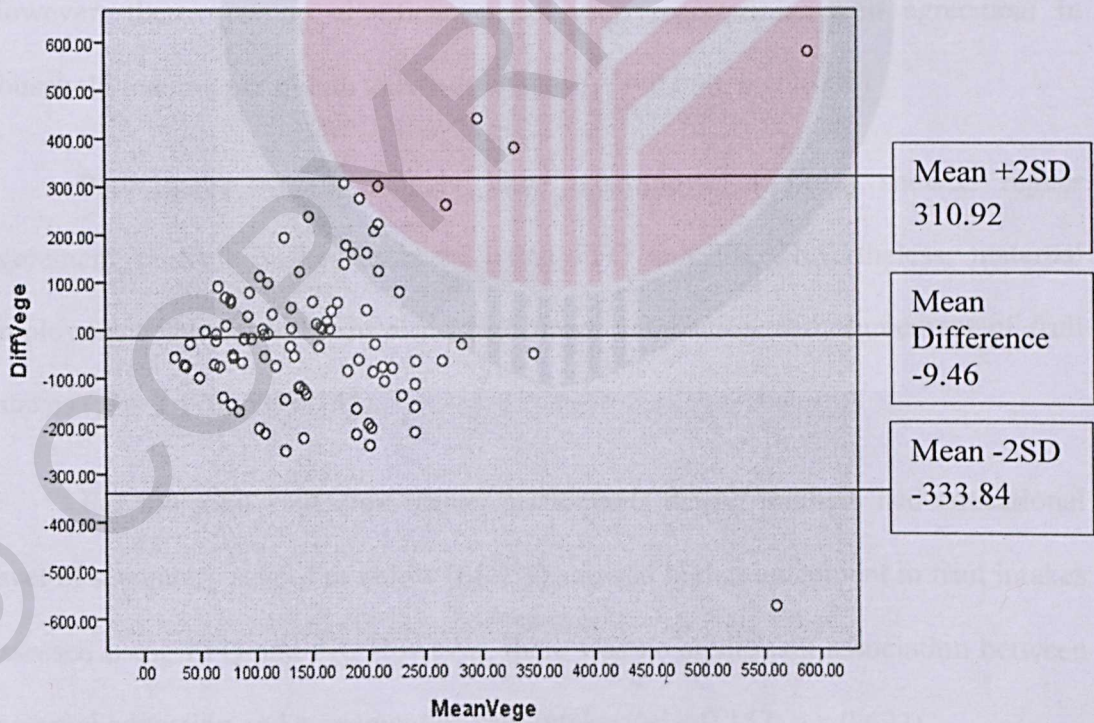


Figure 3.1: Bland Altman Plot of Total Vegetables Intakes Assessed Using FFQ and FR

3.6 Association between Agreement of Fruit and Vegetables Intakes and Socio-demographic Factors

Table 3.10 shows associations between socio-demographic factors and agreement of fruit intakes using FFQ and FR. More girls (58.3%) than boys (41.7%) were in agreement for fruit intakes when assessed using FFQ and FR. The result indicated that no significant association between gender and agreement of fruit intakes ($\chi^2 = 0.999, p = 0.318$).

More Indians (50.0%) than Chinese (36.6%) showed higher agreement in fruit intakes when assessed using FFQ and FR. However, no significant association was found between agreement of ethnicity and fruit intakes ($\chi^2 = 0.000, p = 0.626$).

More participants (50.0%) with household income of RM3500 or less per month showed higher agreement in fruit intakes when assessed using FFQ and FR. However, there was no significant association reported between agreement in household income per month and fruit intakes ($\chi^2 = 0.000, p = 1.000$).

Participants whose mothers were unemployed (55.6%) showed higher agreement in fruit intakes assessed using FFQ and FR. Nevertheless, maternal employment was found to have no significant association with agreement of fruit intakes ($\chi^2 = 2.170, p = 0.141$).

For maternal education factor, participants whose mothers had educational level of secondary school or below (61.1%) showed higher agreement in fruit intakes assessed using FFQ and FR. However, there was no significant association between maternal education and agreement of fruit intakes ($\chi^2 = 0.157, p = 0.692$).

None of the participants from single-parent family had agreement in fruit intakes assessed using FFQ and FR. Thirty-six out of 97 participants from two-parent family were found to have agreement in fruit intakes when assessed using FFQ and FR. Table 3.8 shows there was no significant association was found between family structure and agreement of fruit intakes ($\chi^2 = 0.555, p = 0.293$).

Gender	Agree	Disagree	Total	p-value
Male	15 (20.5)	15 (20.5)	30 (41.0)	0.990
Female	41 (20.5)	31 (15.5)	72 (36.0)	0.134
Total	56 (41.0)	46 (36.0)	102 (100.0)	
Ethnicity	Agree	Disagree	Total	p-value
Chinese	39 (96.7)	36 (91.4)	75 (74.1)	0.660
Malay	2 (5.1)	2 (5.1)	4 (3.9)	0.999
Indonesian	2 (5.1)	2 (5.1)	4 (3.9)	0.999
Household Income (monthly)	Agree	Disagree	Total	p-value
< RM1500	1 (2.6)	1 (2.6)	2 (2.0)	0.999
RM1500 - RM2500	1 (2.6)	1 (2.6)	2 (2.0)	0.999
> RM2500	41 (20.5)	31 (15.5)	72 (36.0)	0.134
Marital employment	Agree	Disagree	Total	p-value
Employed	1 (2.6)	1 (2.6)	2 (2.0)	0.999
Unemployed	41 (20.5)	31 (15.5)	72 (36.0)	0.134
Missing data	1 (2.6)	1 (2.6)	2 (2.0)	0.999
Marital education	Agree	Disagree	Total	p-value
Secondary or below	1 (2.6)	1 (2.6)	2 (2.0)	0.999
High school	41 (20.5)	31 (15.5)	72 (36.0)	0.134
University	1 (2.6)	1 (2.6)	2 (2.0)	0.999
Family structure	Agree	Disagree	Total	p-value
Single-parent	0 (0.0)	0 (0.0)	0 (0.0)	0.293
Two-parent	56 (41.0)	46 (36.0)	102 (100.0)	

Table 3.10: Associations between agreement of fruit intakes and socio-demographic factors (N = 97)

Socio-demographic (N = 97)	Agreement n (%)		X^2	<i>p</i>
	Disagree	Agree		
Gender				
Boys	18 (29.5)	15 (41.7)	0.999	0.318
Girls	43 (70.5)	21 (58.3)		
*Ethnicity				
Chinese	59 (96.7)	34 (94.4)	0.000	0.626
Indians	2 (3.3)	2 (5.6)		
Household income/month				
≤ RM3500	34 (47.9)	18 (50.0)	0.000	1.000
> RM3500	23 (32.4)	11 (30.6)		
Missing data	4 (5.6)	7 (19.4)		
Maternal employment				
Employed	24 (39.3)	9 (25.0)	2.170	0.141
Unemployed	23 (37.7)	20 (55.6)		
Missing data	14 (23.0)	7 (19.4)		
Maternal education				
Secondary or below	45 (73.8)	22 (61.1)	0.157	0.692
Tertiary	15 (24.6)	10 (27.8)		
Missing data	1 (1.6)	4 (11.1)		
*Family structure				
Single-parent	3 (4.9)	0 (0.0)	0.555	0.293
Two-parent	58 (95.1)	36 (100.0)		

*Fisher's Exact Test

Significant at $p < 0.05$ using Chi-square

Table 3.11 shows associations between socio-demographic factors and agreement in vegetables intakes assessed using FFQ and FR. Females (61.1%) were found to have a higher agreement as compared to males (38.9%) in vegetables intakes assessed using FFQ and FR. The result indicated that no significant association between agreement of vegetables intakes and gender ($\chi^2 = 0.309, p = 0.578$).

Ninety-four percent Chinese and 5.6% Indians were found to have agreement in vegetables intakes when assessed using FFQ and FR. However, no significant association was found between agreement of vegetables intakes and ethnicity ($\chi^2 = 0.000, p = 0.626$).

The participants (50.0%) with household income of RM1500 or less per month showed higher agreement in vegetables intakes assessed using FFQ and FR. The result indicated that no significant association between agreement in vegetables intakes and household income per month ($\chi^2 = 0.013, p = 0.911$).

More participants whose mothers were unemployed (52.8%) showed higher agreement in vegetables intakes than participants whose mothers were employed (30.6%) when assessed using FFQ and FR. Maternal employment was found to have no significant association with agreement of vegetables intakes ($\chi^2 = 0.522, p = 0.470$).

Table 3.9 shows more participants whose mothers had educational level of secondary or below (64.7%) to have a higher agreement in vegetables fruit intakes assessed using FFQ and FR. There was no significant association between maternal education and agreement of vegetables intakes ($\chi^2 = 0.157, p = 0.692$).

About 97.2% of the participants from two-parent family and 2.8% of participants from single-parent family showed agreement in vegetables intakes when assessed using FFQ and FR. No significant association was reported between agreement of vegetables intakes and family structure ($\chi^2 = 0.000, p = 1.000$).

In short, there was no significant association found between agreement of fruit and vegetables intakes and socio-demographic factors reported by adolescents aged 16-17 using both FFQ and FR. There were limited studies reported association between agreement of fruit and vegetables intakes and socio-demographic factors.



Table 3.11: Associations between agreement of vegetables intakes and socio-demographic factors (N = 97)

Socio-demographic (N = 97)	Agreement n (%)		X^2	P
	Disagree	Agree		
Gender				
Boys	19 (31.1)	14 (38.9)	0.309	0.578
Girls	42 (68.9)	22 (61.1)		
*Ethnicity				
Chinese	59 (96.7)	34 (94.4)	0.000	0.626
Indians	2 (3.3)	2 (5.6)		
Household income/month				
≤ RM3500	34 (55.7)	18 (50.0)	0.013	0.911
> RM3500	21 (34.4)	13 (36.1)		
Missing data	6 (9.8)	5 (13.9)		
Maternal employment				
Employed	22 (36.1)	11 (30.6)	0.522	0.470
Unemployed	24 (39.3)	19 (52.8)		
Missing data	15 (24.6)	6 (16.7)		
Maternal education				
Secondary or below	45 (71.4)	22 (64.7)	0.157	0.692
Tertiary	15 (23.8)	10 (29.4)		
Missing data	3 (4.8)	2 (5.9)		
*Family structure				
Single-parent	2 (3.3)	1 (2.8)	0.000	1.000
Two-parent	59 (96.7)	35 (97.2)		
Total	61 (62.9)	36 (37.1)		

*Fisher's Exact Test
Significant at $p < 0.05$ using Chi-square

4.1 Socio-demographic Characteristics and Total Fruit and Vegetables Intakes Assessed using FFQ and WFR

Current study was in keeping with previous studies which found inconsistent findings as shown in Table 3.1. Out of 49 papers reviewed by Eastman et al. (2006), 27 of the papers reported that girls have a higher intake of fruit and vegetables than boys while 22 studies reported the opposite finding. However, 11 studies reported girls tended to have higher fruit intakes. A study in Southern California reported that females were more likely to consume more fruits and vegetables than males (18% of the total energy intake).

CHAPTER 4

DISCUSSION

4.1 Fruit and Vegetables Intakes

Table 3.1 shows that the total fruit intakes were higher when assessed using FFQ which was consistent with Marks et al. 's (2006) study. Current study found similar result to Marks et al. 's (2006) study in which significant difference was reported between total fruit intakes assessed using FFQ and WFR.

Table 3.2 shows that current study reported a contrast finding to previous study where Marks et al. 's (2006) study showed that the total vegetables intakes were higher when assessed using FFQ. However, the present study showed consistent result with previous study which reported significant differences between total vegetables intakes when assessed using FFQ and WFR (Marks et al., 2006).

4.2 Socio-demographic Characteristics and Total Fruit and Vegetables

Intakes Assessed using FFQ and FR

Current study was in keeping with previous studies which found inconsistent findings as shown in Table 3.3. Out of 49 papers reviewed by Rasmussen et al. (2006), 27 of the papers reported that girls have a higher intake of fruit and/or vegetables than boys while 22 studies reported the opposite findings. However, more studies reported girls tended to have higher fruit intakes. A study conducted in Southern California reported that females were more likely to meet the recommendations of fruit (21.5 vs 14.5%) than males (Xie et al., 2003). Another study conducted at twenty-four secondary schools in Belgian found that girls aged 12-17 years had significantly higher daily fruit consumption (61%) as compared to boys (47%) when assessed using a 57-item FFQ (Paulus et al., 2001).

Table 3.3 shows that current study reported a difference in median fruit intakes between Chinese and Indians. Likewise, the study by Xie et al. (2003) also found difference in fruit intakes among different races which the non-Hispanic Whites had a lower vegetables intakes than Hispanic, Blacks, and Asians.

Table 3.3 shows that there was no significant difference for those participants whose mothers were employed or unemployed in total fruit intakes using both FFQ and FR. In a review paper by Rasmussen et al. (2006), two papers reviewed also did not observe any relationship between maternal occupation and children's fruit intakes. However, current study showed that participants whose mothers were employed reported higher median fruit intakes when assessed using FFQ. This may be due to mothers who were employed usually had higher educational level which they

can educate their children about the importance of fruit acting as antioxidant and rich in vitamins.

Refers to Table 3.4, the present study showed an opposite finding with review paper by Rasmussen et al. (2006) which reported that children from two-parent families had higher fruit consumption compared to children from single-parent families. Although the current study showed participants from single-parent families reported higher median fruit intakes, there were actually similar median fruit intakes by participants from single-parent families and two-parent families.

Table 3.4 shows that participants with higher household income reported higher median fruit intakes which corresponded to a review paper reported that seven out of 14 studies showed that low socioeconomic status or low family income have positive association with low or less frequent intake of fruit and vegetables among children and adolescents aged 6-18 years (Rasmussen et al., 2006). Likewise, adolescents grades 7-12 in Minneapolis with middle and upper socio-economic status reported higher fruit intakes when fruit and vegetables consumptions when assessed using a 10-item FFQ (Neumark-Sztainer et al., 1996).

In current study, both FFQ and FR reported high fruit intakes when maternal education level was high as shown in Table 3.4. This is because mothers with higher education level may have more knowledge about nutrition and may educate their children to increase the fruit intakes due to the beneficial values of fruit.

Table 3.4 shows inconsistent findings were found in the present study when the associations of socio-demographic factors were tested with fruit intakes assessed using FFQ and FR. This might mainly due to few participants reported fruit as their

intakes using FR in current study because of there was lack of fruit example in FR questionnaire.

Refers to Table 3.5, current study showed inconsistent result with previous study conducted in Southern California which reported that females were more likely to meet the recommendations of vegetables (7.9 vs 5.0%) than males (Xie et al., 2003). A study conducted by Paulus et al. (2001) at twenty-four secondary schools in Belgian found that girls aged 12-17 years had significantly higher (46%) daily vegetables consumption as compared to boys (35%) when assessed using a 57-item FFQ.

There was a difference in median vegetables intakes of different ethnic groups found in current study as shown in Table 3.5. Similarly, the study by Xie et al. (2003) also found difference in vegetables intakes among the different races in which the non-Hispanic Whites had lower vegetables intakes than Blacks and Asians but higher intakes than Hispanic.

Table 3.5 shows that both FFQ and FR reported similar median intakes for participants with mothers employed or unemployed in the present study. This may due to mothers who unemployed may have more time at home and prepare food for their children which may increase the vegetables consumption among participants. At the same time, mothers who are employed usually have certain education level which means they may convey the message about the importance of vegetables consumption to their children.

In a review paper by Rasmussen et al. in 2006, children from two-parent families were found to have higher vegetables consumption compared to children from single-parent families which corresponded to the result assessed using FR in the

present study as shown in Table 3.6. This may be because the children from single-parent families usually will eat outside and consume more convenient food such as fast food because the mother or father needs to work. On the other hand, the children from two-parent families may have more vegetables access because they most probably eat at home as compared to children from single-parent families.

Table 3.6 shows that both FFQ and FR recorded participants with higher household income reported higher vegetables intakes. The present study corresponded to Neumark-Sztainer et al. (1996) study among adolescents grades 7-12 in Minneapolis which reported that participants with middle and upper socioeconomic status had higher vegetables intakes when fruit and vegetables consumption was assessed using a 10-item FFQ.

Current study showed that participants with higher maternal education had higher median vegetables intakes assessed using both methods as shown in Table 3.6. Similar finding was found by Roos et al. (2001) that reported participants (mean aged 15.3 years) with higher household educational level had higher raw vegetables intakes than those with lower household educational level when raw vegetables intakes were measured using 15-item FFQ. When the mothers have more knowledge, they may also acquire the knowledge on nutrition and understand the importance of taking vegetables as fiber intake. Thus, the mothers with higher educational level may educate their children to consume more vegetables.

4.3 Correlation between Fruit and Vegetables Intakes Assessed Using FFQ and FR

Table 3.7 shows that current study reported similar findings with previous studies where by Marks et al. (2006) found positive correlation between FFQ and FR

for all fruit and all vegetables intakes measured using FFQ and 12-day WFR. Besides, Carlsen et al. (2010) reported positive correlation between FFQ and FR for both fruit and vegetables intakes. Opposite findings for correlation of fruit intakes with Marks et al. (2006) and Carlsen et al. (2010) studies might due to few participants recorded fruit intakes using FR in the present study. There might be more lists of fruit and vegetables items in Marks et al. (2006) and Carlsen et al. (2010) studies.

4.4 Agreement of Fruit and Vegetables Intakes Assessed Using FFQ and FR

4.4.1 Crude Agreement

In contrast to the results shown in Table 3.8 and Table 3.9, previous study by Marks et al. in 2006 reported lower agreement (79%) for fruit and (69%) for vegetables, assessed as a food group or as individual foods when intakes were measured using FFQ and WFR. However, Marks et al. (2006) study had more lists of fruit and vegetables items which had to be interpreted with caution.

4.4.2 Bland-Altman Plots

In contrast to the findings shown in Figure 3.0 and Figure 3.1, Ling et al. (1998) reported small values which 95% confidence interval (mean difference) for fruit were -1.12, 0.98 (0.07) assessed using FFQ1 and -1.08, 1.07 (0.00) assessed using FFQ2 as compared to 24-hour diet recalls. For vegetables intakes, the 95% confidence interval (mean difference) were -0.67, 0.66 (-0.01) using FFQ1 and -0.84, 0.70 (-0.07) using FFQ2 (Ling et al., 1998). However, the findings by Ling et al. (1998) must be interpreted with caution. This is because of different instruments included short FFQ and 24-hour dietary recalls were being used in Ling et al. (1998) study.

4.5 Strengths of the Study

This study determined the fruit and vegetables intakes among adolescents which there were limited research done on this topic previously in Malaysia. Besides, the present study examined the agreement of fruit and vegetables intakes between FFQ and FR. Since there is still a lack of studies on methods of comparability to assess fruit and vegetables intakes, especially among adolescents in Malaysia, current study can be used as baseline information for further research.

4.6 Limitations of the Study

However, results of the present study cannot be generalized to the whole population in Malaysia because this study was only being carried out at one of the school in Seri Kembangan, Selangor. In addition to that, there were not even distribution of participants by ethnicity, household income per month, maternal education, and family structure.

Besides, the questionnaires were long and only distributed to the students by teachers because face-to-face explanation required a time slot which could affect the class. There might be misreporting occurred because the questionnaires were self-administrated and relied on participants' honesty and understanding. The food example in FR did not include fruit and thus many participants did not report fruit as their daily intakes. Dishes prepared by ingredients of fruit or vegetables such as apple pie were not studied in current research which may not represent the entire fruit and vegetables intakes of participants.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This study examined whether fruit and vegetables intakes observed using a FFQ is comparable to that in a FR in adolescents. Results from the study showed that FFQ had moderate comparability against FR in assessing fruit and vegetables intakes among adolescents aged 16-17. This is because of significant median difference of fruit intakes such as papaya, apple, orange/mandarin orange, durian and total fruit intakes assessed using FFQ and FR. Significant median difference of vegetables intakes was found in green leafy vegetables, tubers type vegetables, cabbage, bitter gourd/pumpkin/cucumber, bean sprout and total vegetables intakes when assessed using FFQ and FR. On the other hand, weak correlation was found between FFQ and FR for fruit and vegetables intakes. Negative correlation was found between fruit intakes reported using FFQ and FR while positive correlation was found between vegetables intakes assessed using both methods. The tertile agreement of fruit and

vegetables intakes assessed using both methods was high. This indicated a good agreement between FFQ and FR in assessing fruit and vegetables intakes. Most of the participants showed high agreement for mean fruit and vegetables intakes plotted using Bland-Altman graphs.

Socio-demographic factors included household income and maternal education showed significant difference across the groups which indicated that these factors affected total fruit intakes measured using FFQ. Higher household income and high maternal education may represent that the family have more nutrition knowledge and thus may educate the children to consume more fruit and vegetables. There was a significant difference between Chinese and Indians when total vegetables intakes was measured using FFQ. This indicated that different ethnic groups have different amount of vegetables intakes. On the other hand, there is no significant association found between socio-demographic factors and fruit or vegetables intakes when assessed using FR.

No significant association was found between agreement of fruit and vegetables intakes per day and socio-demographic factors reported by adolescents aged 16-17 using both methods.

Regardless of the methods used to measure fruit and vegetables intakes, low consumption of fruit and vegetables among the adolescents aged 16-17 was found in current study. Therefore, intervention programs considering the importance of fruit and vegetables intakes should be carried out among adolescents in the future to encourage fruit and vegetables intakes among adolescents.

5.2 Recommendations

Further studies involving larger sample population are required to examine the comparability of FFQ against other methods such as FR in measuring fruit and vegetables intakes so that the study can be generalised to Malaysia population. Larger sample population also secures a more even distribution of participants in terms of socio-demographic factors.

This kind of comparison study with long questionnaires requires a good cooperation from schools' authority. It is recommended to search for study location much earlier and communicate with the school authority to make it possible to have a face-to-face explanation of questionnaires with students. Fruit items such as orange should be included in the example of FR to remind participants about fruit record. Future research can also include more fruit and vegetables items to assess more accurate fruit and vegetables intakes.

Besides, low fruit and vegetables intakes among adolescents were found in the present study. Thus, it is important to organise more intervention programs to promote the importance of fruit and vegetables consumptions among adolescents in the future. The intervention programs such as health fair or health talk should be given to the adolescents to encourage the consumptions of fruit and vegetables so that their health awareness can be raised.

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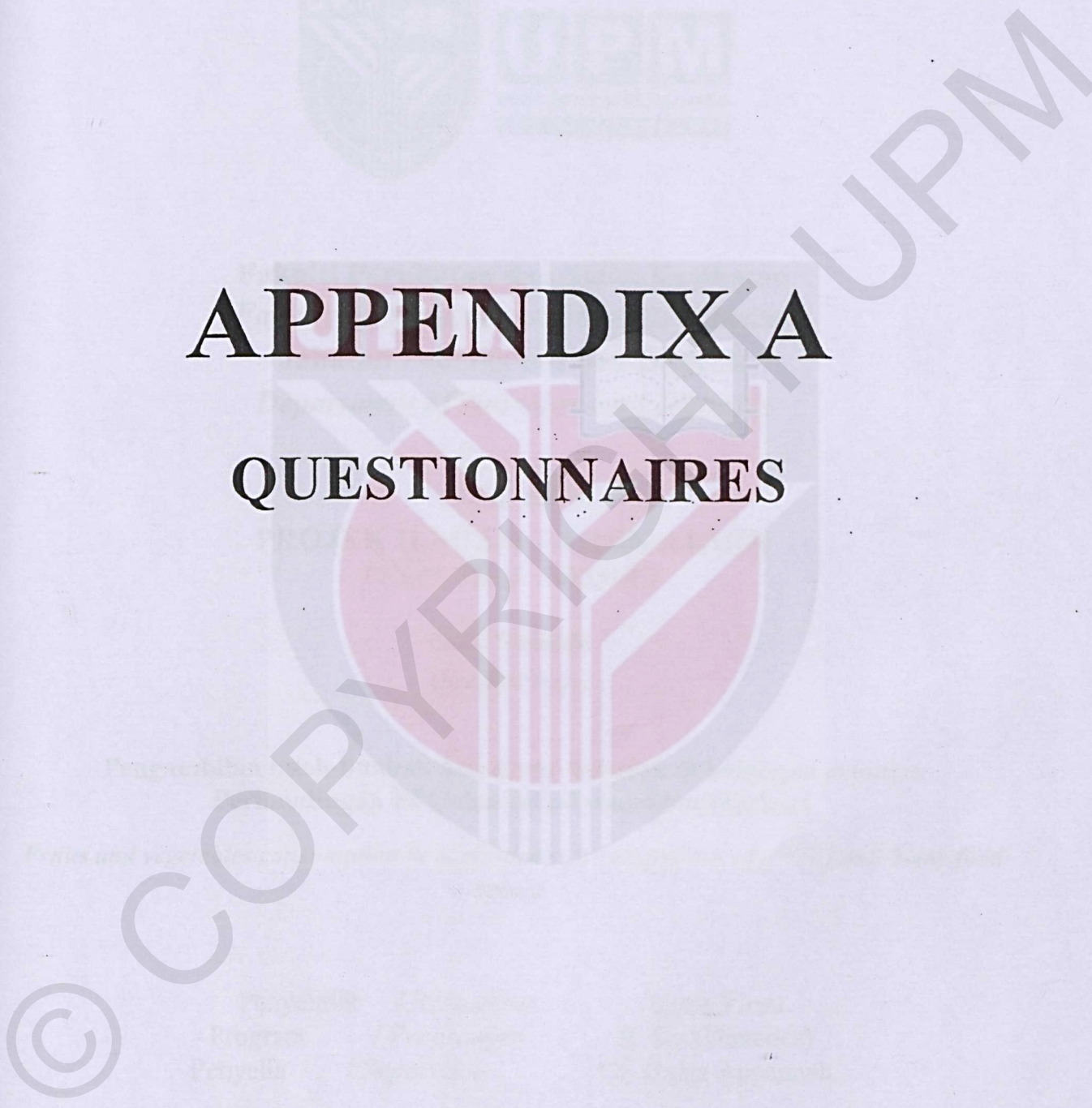
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APPENDICES

APPENDIX A

QUESTIONNAIRES



No Rujukan

Reference Number

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Fakulti Perubatan dan Sains Kesihatan
Faculty of Medicine and Health Sciences
Jabatan Pemakanan dan Dietetik
Department of Nutrition and Dietetics

DTK 4999

PROJEK ILMIAH TAHUN AKHIR
FINAL YEAR PROJECT

Soal Selidik
Questionnaire

Pengambilan buah-buahan dan sayur-sayuran di kalangan remaja:
Perbandingan FFQ dan rekod makanan tiga hari

Fruits and vegetables consumption in adolescents: A comparison of a FFQ and 3-day food record

Penyelidik / *Researcher* : Voon Yirou
Program / *Programme* : B. Sc. (Dietetics)
Penyelia / *Supervisor* : Dr. Geeta Appannah

Semua maklumat yang diberikan di sini adalah dirahsiakan dan hanya digunakan untuk tujuan akademik sahaja. Kejayaan kajian ini amat bergantung kepada kerjasama pihak tuan/puan dalam menjawab kesemua soalan yang dikemukakan. Segala kerjasama yang tuan/puan berikan saya dahului dengan ribuan terima kasih.

Your personal information given in this questionnaire is for research purpose only. It will be kept strictly confidential. I would be very grateful if you could help me by completing this questionnaire.

Bahagian A

Part A

No.	Informasi / Information	Pilihan / Options
1	Umur / Age	<input type="text"/> <input type="text"/> tahun / years old
2	Jantina / Gender	<input type="checkbox"/> Lelaki / Boy <input type="checkbox"/> Perempuan / Girl
3	Kaum / Ethnicity	<input type="checkbox"/> Melayu / Malay <input type="checkbox"/> Cina / Chinese <input type="checkbox"/> India / Indian <input type="checkbox"/> Lain-lain / Others, Nyatakan / Please state:
4	Pendapatan isi rumah / Household income	<input type="checkbox"/> RM 1500 sebulan / RM 1500 per month <input type="checkbox"/> RM 1500-RM3500 sebulan / RM 1500-RM3500 per month <input type="checkbox"/> Lebih daripada RM 3500 sebulan / More than RM 3500 per month
5	Status bekerja ibu / Employment status for mother	<input type="checkbox"/> Bekerja / Employed <input type="checkbox"/> Tidak bekerja / Unemployed
6	Tahap pendidikan tertinggi ibu / Highest level of education for mother	<input type="checkbox"/> Tiada pendidikan formal / No formal education <input type="checkbox"/> Sekolah Rendah / Primary School <input type="checkbox"/> Sekolah Menengah Rendah / Lower Secondary School <input type="checkbox"/> Sekolah Menengah Atas / Upper Secondary School <input type="checkbox"/> Matrikulasi/Tingkatan6 / Matriculation/Form6 <input type="checkbox"/> Kolej/Universiti / College/University
7	Struktur keluarga / Family structure	<input type="checkbox"/> Keluarga ibu atau bapa tunggal / Single- parent family <input type="checkbox"/> Keluarga dua ibu bapa / Two-parent family

Bahagian B

Part B

FFQ

Kami berminat tentang pengambilan makanan anda. Sila jawab ke semua soalan-soalan ini sendiri dengan mengisi nombor di dalam kotak yang disediakan. Sila isikan kotak berapa banyak sajian setiap kali makan yang paling sesuai bagi anda. Tiada jawapan "betul" atau "salah". Maklumat yang anda berikan akan dirahsiakan.

We are interested in your food consumption. Please answer all of the questions yourself by writing the number in the boxes provided. Please fill in the box of portion size when food consumed each time that best applies to you. There are no "right" or "wrong" answers. The information that you provide will remain strictly confidential.

Kod	Jenis makanan	Kekerapan pengambilan		Ukuran sajian (Pilih satu jenis ukuran sahaja)	Berapa banyak sajian setiap kali makan
		Berapa kali dalam tiga hari lepas	Tidak makan dalam tiga hari lepas		
A1	*Nasi			Pinggan Mangkuk cina Cawan Senduk	
A2	Bubur nasi			Mangkuk Sedang Cawan Senduk	
A3	*Pulut			Mangkuk cina Cawan Senduk	

A4	Mee kuning/mee siput/mee segera			Pinggan lengkung Pinggan Mangkuk cina Senduk	
A5	Mihun/kueh teow/laksa/laksam			Pinggan lengkung Pinggan Mangkuk cina Senduk	
A6	<i>Loh shi fun</i>			Mangkuk cina	
A7	*Pasta			Pinggan Senduk	
A8	*Sagu			Potong Cawan Sudu	
A9	*Roti			Keping	
A10	Roti bun			Biji	
A11	*Roti canai			Keping	
A12	Capati			Keping	
A13	Tosai			Keping	
A14	*Bijirin sarapan pagi			Cawan Mangkuk cina	
A15	*Bijirin tersedia perlu dibancuh			Mangkuk cina Cawan	
A16	Pizza			Potong	
A17	*Jagung			Tongkol Cawan	

Kod	Jenis makanan	Kekerapan pengambilan		Ukuran sajian (Pilih satu jenis ukuran sahaja)	Berapa banyak sajian setiap kali makan
		Beberapa kali dalam tiga hari lepas	Tidak makan dalam tiga hari lepas		
B1	Ayam			Ketul	
B2	Lembu/kerbau			Kotak mancis	
B3	Kambing			Kotak mancis	
B4	Daging burger			Keping	
B5	Sosej/hotdog/ frankfurter			Ketul	
B6	Nugget			Ketul	
B7	Bebola ayam/ketam/ udang			Ketul	
B8	Itik			Ketul	
B9	*Ham			Keping	
B10	*Bacon			Keping	
B11	*Luncheon			Keping	
B12	meat			Kotak mancis	
	*Babi (bagi peserta bukan Islam)				

Kod	Jenis makanan	Kekerapan pengambilan		Ukuran sajian (Pilih satu jenis ukuran sahaja)	Berapa banyak sajian setiap kali makan
		Berapa kali dalam tiga hari lepas	Tidak makan dalam tiga hari lepas		
C1	C. *Ikan dan makanan laut *Ikan laut			Keping Ekor Keping Ekor Sudu makan	
C2	*Ikan air tawar				
C3	*Ikan bilis				
C4	*Ikan dalam tin			Ekor Sudu makan	
C5	*Kekerang				
C6	Udang basah			Ekor sederhana Ekor sederhana	
C7	Sotong basah				
C8	Sotong kering			Keping sederhana Potong sederhana Ekor	
C9	Ketam				
C10	*Ikan kering			Keping Ekor Bebola Ketul Ketul	
C11	Bebola ikan/kek ikan				
C12	Keropok lekor				

Kod	Jenis makanan	Kekerapan pengambilan		Ukuran sajian (Pilih satu jenis ukuran sahaja)	Berapa banyak sajian setiap kali makan
		Beberapa kali dalam tiga hari lepas	Tidak makan dalam tiga hari lepas		
D1	Telur ayam	Berapa kali dalam tiga hari lepas	Tidak makan dalam tiga hari lepas	Biji	
D2	Telur itik				
D3	Telur puyuh				
D4	Telur masin				

Kod	Jenis makanan	Kekerapan pengambilan		Ukuran sajian (Pilih satu jenis ukuran sahaja)	Berapa banyak sajian setiap kali makan
		Beberapa kali dalam tiga hari lepas	Tidak makan dalam tiga hari lepas		
E1	*Kecacang	Berapa kali dalam tiga hari lepas	Tidak makan dalam tiga hari lepas	Sudu makan	
E2	Tauhu				
E3	Tempe				
E4	Kacang tanah				

Kod	Jenis makanan	Kekerapan pengambilan		Ukuran sajian (Pilih satu jenis ukuran sahaja)	Berapa banyak sajian setiap kali makan
		Beberapa kali dalam tiga hari lepas	Tidak makan dalam tiga hari lepas		
F1	F. Susu dan hasil tenusu Susu segar/UHT	Beberapa kali dalam tiga hari lepas	Tidak makan dalam tiga hari lepas	Cawan Gelas	

F2	Susu tepung				Sudu makan	
F3	Susu sejat/cair				Sudu makan	
F4	Susu pekat manis				Sudu makan Cawan	
F5	Yogurt/lassi/tairu				Sudu makan	
F6	Keju				Keping	

Kod	Jenis makanan	Kekerapan pengambilan		Ukuran sajian (Pilih satu jenis ukuran sahaja)	Berapa banyak sajian setiap kali makan
		Beberapa kali dalam tiga hari lepas	Tidak makan dalam tiga hari lepas		
G1	*Sayuran berdaun hijau			Cawan	
G2	*Sayuran kacang			Cawan	
G3	*Sayuran berubi			Cawan	
G4	*Sayuran kobis			Cawan	
G5	*Petola / labu /			Cawan	
G6	timun *Sayuran asin/kering			Cawan	
G7	Ulam-ulam			Cawan	
G8	Putik jagung			Sudu makan	
G9	*Cendawan basah / kering			Cawan	
G10	Taugeh			Cawan	

Kod	Jenis makanan	Kekerapan pengambilan		Ukuran sajian (Pilih satu jenis ukuran sahaja)	Berapa banyak sajian setiap kali makan
		Beberapa kali dalam tiga hari lepas	Tidak makan dalam tiga hari lepas		
H1	Betik			Potong	
H2	Jambu batu			Keping	
H3	Limau manis			Biji	
H4	tempatan			Potong	
H5	Manga			Potong	
H6	Nenas			Biji	
H7	*Pisang			Potong	
H8	Tembikai			Biji	
H9	Belimbing			Ulas	
H10	Nangka			Biji	
H11	Epal			Biji	
H12	Oren/mandarin			Biji	
H13	Pir/lai			Biji	
H14	Anggur			Biji	
H15	Durian			Ulas	
H16	Rambutan			Biji	
H17	Longan segar			Biji	
H18	Laici segar			Biji	
H19	Tembikai susu			Potong	
H20	*Buahan dalam tin			Potong	
	*Buahan kering			Potong	

Kod	Jenis makanan	Kekerapan pengambilan		Ukuran sajian (Pilih satu jenis ukuran sahaja)	Berapa banyak sajian setiap kali makan
		Beberapa kali dalam tiga hari lepas	Tidak makan dalam tiga hari lepas		
I1	Air kosong			Gelas	
I2	The			Cawan	
I3	*Kopi			Cawan	
I4	*Minuman bercoklat			Cawan	
I5	*Minuman bermalt (horlick/nesto malt)			Cawan	
I6	*Sirap cordial			Gelas	
I7	*Jus buah-buahan			Cawan	
I8	Minuman bergas			Gelas/Tin	
I9	Air kacang soya			Gelas	
I10	*Minuman botani/herba			Kotak	
I11	*Minuman bertenaga			Gelas	
				Kotak	

Kod	Jenis makanan	Kekerapan pengambilan		Ukuran sajian (Pilih satu jenis ukuran sahaja)	Berapa banyak sajian setiap kali makan
		Beberapa kali dalam tiga hari lepas	Tidak makan dalam tiga hari lepas		
J1	Syandi			Tin	
J2	Bir			Gelas	
J3	Wain			Tin	
J4	*Spirit			Botol	
J5	*Likeur			Gelas wain	
				Gelas	
				Gelas	

Kod	Jenis makanan	Kekerapan pengambilan		Ukuran sajian (Pilih satu jenis ukuran sahaja)	Berapa banyak sajian setiap kali makan
		Beberapa kali dalam tiga hari lepas	Tidak makan dalam tiga hari lepas		
K1	*Kuih tempatan			Ketul	
K2	Kek			Potong	
K3	Biskut			Keping	
K4	Gula-gula			Ketul	
K5	Aiskrim (susu)			Potong	
				Cawan	
				Scoop	
K6	*ABC (air batu campur) / ais / lollipop			Mangkuk	
				Batang	

K7	Agar-agar / jeli / kastard				Cawan	
K8	Snek / keropok / kerepek				Potong Keping	

Kod	Jenis makanan	Kekerapan pengambilan		Ukuran sajian (Pilih satu jenis ukuran sahaja)	Berapa banyak sajian setiap kali makan
		Berapa kali dalam tiga hari lepas	Tidak makan dalam tiga hari lepas		
L1	Jem			Sudu teh	
L2	Sri kaya			Sudu teh	
L3	Mentega			Sudu teh	
L4	Majerin			Sudu teh	
L5	Mentega kacang			Sudu teh	
L6	Krim keju			Sudu teh	

Kod	Jenis makanan	Kekerapan pengambilan		Ukuran sajian (Pilih satu jenis ukuran sahaja)	Berapa banyak sajian setiap kali makan
		Berapa kali dalam tiga hari lepas	Tidak makan dalam tiga hari lepas		
M1	*Gula			Sudu teh	
M2	*Madu			Sudu teh	
M3	*Sambal belacan			Sudu makan	
M4	*Budu			Sudu teh	
M5	*Cencalok			Sudu teh	
M6	*Kicap pekat			Sudu teh	
M7	*Kicap cair			Sudu makan	
M8	*Sos cili/tomato			Sudu makan	
M9	*Sos tiram			Sudu teh	
M10	*Sos ikan			Sudu teh	
M11	*Petis/*heko/*Otak udang			Sudu teh	

Bahagian C

Part C

Rekod Makanan Tiga Hari / Three-Day Food Diary Record

Name:

ID:

Kelas / Class:

Arahan / Instructions

- Sila tuliskan semua makanan dan minuman yang diambil sebanyak tiga kali dalam tempoh masa 24 jam. Setiap hari bermula pada pukul 12.00 a.m. dan berakhir pada 11.59 p.m. Pilih **tiga hari berturut-turut**, termasuk **dua hari biasa dan satu hujung minggu**.

*Please write down all foods and beverages consumed for three 24-hour time periods. Each day starting at 12.00 am and ending at 11.59 pm. Choose **three consecutive days, including two weekdays and one weekend.***

- Senaraikan Masa anggaran makanan itu dimakan (sarapan pagi, makan tengah hari, makan malam atau lain-lain).

List the approximate Time the meal was consumed (breakfast, lunch, dinner or other).

- Senaraikan setiap **Makanan / Minuman** anda ambil, termasuk makanan yang dimakan antara waktu makan dan minuman, walaupun ia adalah perkara yang bukan kalori seperti air, kopi, dan teh.

List each Food/Beverage Item you consumed, including foods eaten between meals and all drinks, even if it is a non-caloric item like water, coffee and tea.

- Nyatakan **Butiran / Bahan / Penyediaan** bagi setiap makanan atau minuman yang diambil. Lihat borang "Senarai Semak Rekod Makanan Tiga Hari " di bawah untuk maklumat lanjut.

Specify Details/Ingredients/Preparation of each food or beverage consumed. See the "Three-Day Food Record Checklist" form for details.

Contoh (Senarai Semak Rekod Makanan Tiga Hari) / Example (Three-Day Food Record Checklist)

Masa Time	Makanan/ Minuman Food/Beverage Item	Butiran/Bahan/Penyediaan Details/Ingredients/Preparation	Kuantiti Amount
Sarapan / Breakfast	Oat / Oatmeal	Masak dengan air, tambah susu pekat / Made with water, condensed milk added	2 sudu makan oat + 1 sudu makan susu pekat / 2 dessert spoons oat + 1 dessert spoons condensed milk
Makan tengah hari / Lunch	Nasi putih / White rice	-	3 senduk / 3 scoops
Minum petang / Afternoon tea	Roti canai / Roti canai	Roti canai telur dengan kuah kacang dhal/ Roti canai with egg and dhal.	2 keping / 2 pieces
Makan tengah hari / Lunch	Nasi goreng / Fried rice	Ayam dan kangkung / Chicken with swamp cabbage	1 piringan / 1 plate 1 bungkus / 1 pack

- Rekod **Kuantiti** makanan atau minuman. Porsi makanan boleh dicatatkan dalam pelbagai cara, sila gunakan kaedah yang paling sesuai untuk anda.

Record the Amount of each food or beverage consumed. Portion sizes can be recorded in a variety of ways, please use the method that works best for you.

- Berat dalam gram / Weight in grams
- Makanan pepejal – isi padu dalam cawan, sudu makan atau sudu teh / Solid foods – use volume in cup, dessert spoon or tea spoon
- Cecair – isi padu dalam ml / Liquids – use volume in ml
- Pecahan keseluruhan (cth: 1/8 daripada 9" pie / Fraction of the whole (e.g. 1/8 of 9" pie)

Sila rujuk kepada gambar yang diberikan sebagai rujukan untuk mengisi Kuantiti.

Please refer to the diagram provided as reference to fill in the Amount column.

Hari 1/ Day 1

Tarikh Rekod/ Date of Record:

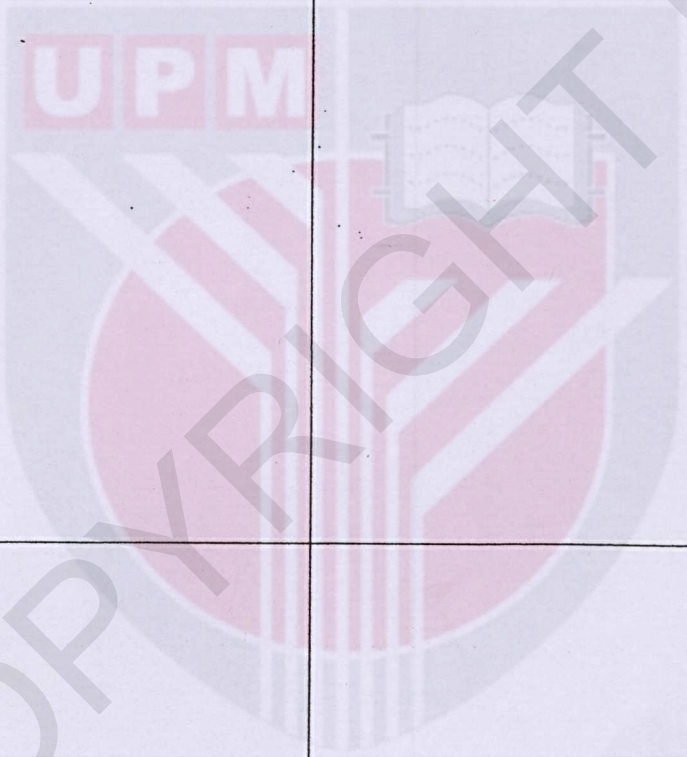
Hari Rekod/ Record day: Sila bulatkan. Please circle.

Isnin / Selasa / Rabu / Khamis / Jumaat / Sabtu / Ahad
Monday / Tuesday / Wednesday / Thursday / Friday / Saturday / Sunday

Masa Time	Makanan/Minuman Food/Beverage Item	Butiran/Bahan/Cara penyediaan Details/Ingredients/Preparation	Kuantiti Amount
Sarapan Breakfast			
Minum pagi Morning tea			

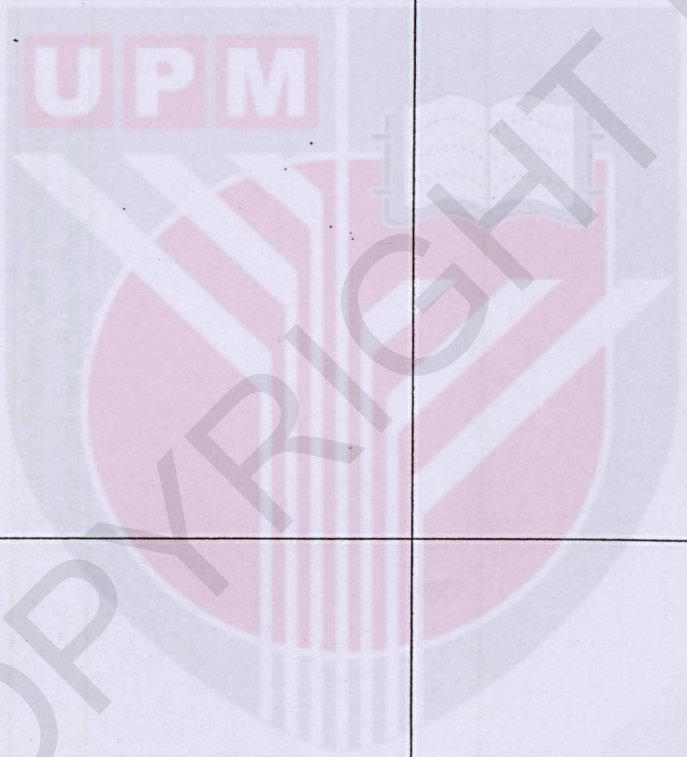
Makan
tengah
hari
Lunch

Minum
petang
*Afternoon
Tea*



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<p>Makan malam <i>Dinner</i></p>			
<p>Makan lewat malam <i>Supper</i></p>			



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Hari 2/ Day 2

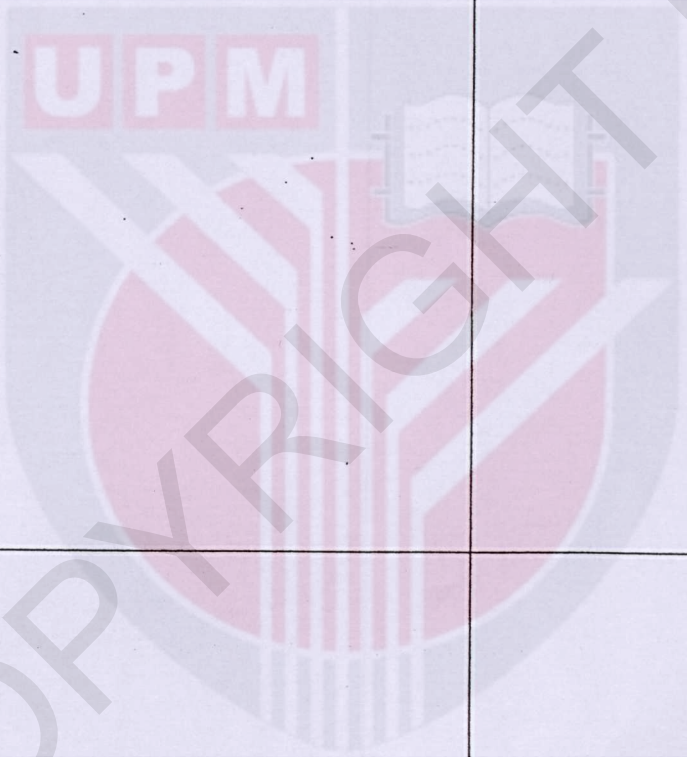
Tarikh Rekod/ Date of Record:

Hari Rekod/ Record day: Sila bulatkan. Please circle.

Isnin / Selasa / Rabu / Khamis / Jumaat / Sabtu / Ahad
Monday / Tuesday / Wednesday / Thursday / Friday / Saturday / Sunday

Masa Time	Makanan/Minuman Food/Beverage Item	Butiran/Bahan/Cara penyediaan Details/Ingredients/Preparation	Kuantiti Amount
Sarapan Breakfast			
Minum pagi Morning tea			

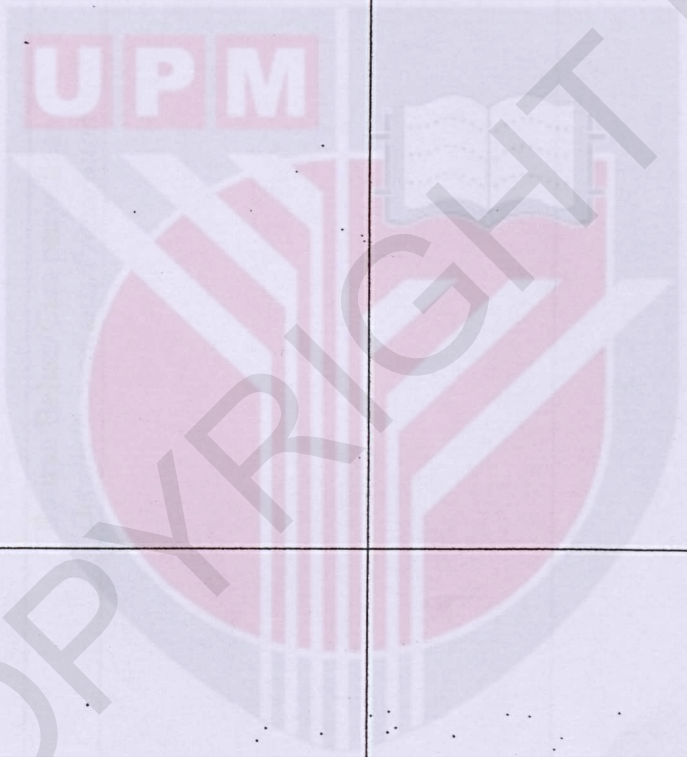
Makan tengah hari <i>Lunch</i>	Minum petang <i>Afternoon</i> <i>tea</i>



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Makan
malam
Dinner

Makan
lewat
malam
Supper



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Hari 3 / Day 3

Tarikh Rekod/ Date of Record:

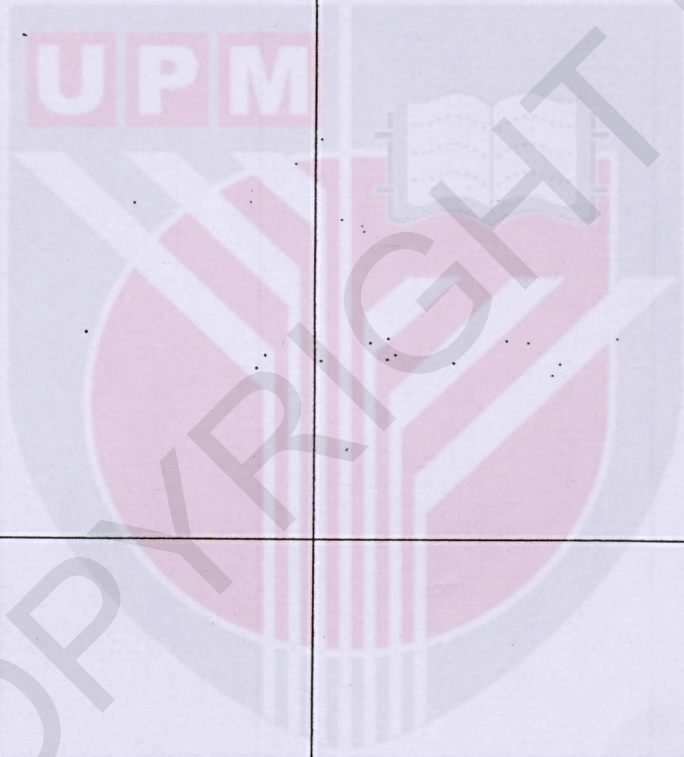
Hari Rekod/ Record day: Sila bulatkan. Please circle.

Isnin / Selasa / Rabu / Khamis / Jumaat / Sabtu / Ahad
Monday / Tuesday / Wednesday / Thursday / Friday / Saturday / Sunday

Masa Time	Makanan/Minuman Food/Beverage Item	Butiran/Bahan/Cara penyediaan Details/Ingredients/Preparation	Kuantiti Amount
Sarapan Breakfast			
Minum pagi Morning tea			

Makan
tengah
hari
Lunch

Minum
petang
Afternoon
tea



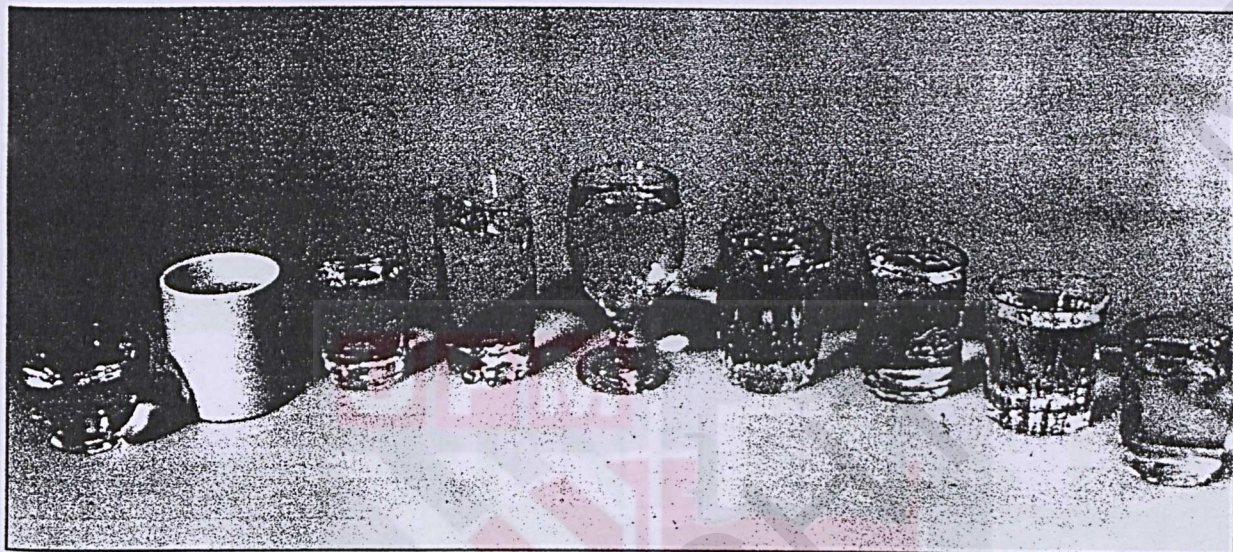
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Makan malam <i>Dinner</i>			A. CAWAI, KOLIF DAN GELAS CUPS, MUGS AND GLASSES
Makan lewat malam <i>Supper</i>			

Adakah rekod makanan ini mewakili pengambilan diet biasa anda? Yes () No ()
Is this food record represents your usual diet intake? Yes () No ()

-Terima kasih atas kerjasama anda-
-Thank you for your cooperation-

A. CAWAN, KOLE DAN GELAS
CUPS, MUGS AND GLASSES



150ml 280ml 200ml 350ml 300ml 300ml 250ml 200ml 200ml

B. SUDU DAN SENDUK
SPOONS AND LADLES



Sudu teh	Sudu makan	Sudu sup	Senduk nasi	Senduk nasi	Senduk	Sudu cina
Tea spoon	Dessert spoon	Soup spoon	Rice scoop	Rice scoop	Ladle	Chinese scoop
5ml	10ml	10ml	30ml	15ml	80ml	20ml

C. PINGGAN DAN MANGKUK
PLATES AND BOWLS

Piring kuih
Side plate
D=19.5cm

Pinggan makan
Plate
D=27.5cm

Mangkuk
Bowl
D=20cm



Piring sos
Sauce plate
D=9.5cm

Mangkuk cina kecil
Small chinese bowl
D=9cm
V=150ml

Mangkuk cina sederhana
Medium chinese bowl
D=11cm
V=250ml

Mangkuk cina besar
Large chinese bowl
D=13cm
V=450ml

NOTA: *D = Diameter*
V = Isipadu (Volume)



UPM

FAKULTI PERUBATAN DAN SAINS
KESEHATAN
FACULTY OF MEDICINE AND HEALTH
SCIENCES
UNIVERSITI PUTRA MALAYSIA (UPM)
SERDANG, SELANGOR, MALAYSIA

RESPONDENT'S INFORMATION SHEET AND CONSENT

APPENDICES B

RESPONDENT'S INFORMATION SHEET AND CONSENT





**FAKULTI PERUBATAN DAN SAINS
KESIHATAN**
*FACULTY OF MEDICINE AND HEALTH
SCIENCES*

**UNIVERSITI PUTRA MALAYSIA, 43400 UPM
SERDANG, SELANGOR, MALAYSIA**

RESPONDENT'S INFORMATION SHEET AND CONSENT

Please read the following information carefully and do not hesitate to discuss any questions you may have with the researcher.

1. STUDY TITLE:

Fruits and vegetables consumption in adolescents: A comparison of FFQ and 3-day food record

2. INTRODUCTION:

This study will be carried out to examine whether fruit and vegetables intakes observed using a FFQ is comparable to that in a 3-day food record in adolescents. The information collected will also be able to determine the relationship between socio-demographics factors (age, gender, ethnicity, household income, maternal factors) with fruit and vegetables consumption among adolescents.

3. WHAT WILL YOU HAVE TO DO?

You will be required to complete a set questionnaire which includes information regarding socio-demographic characteristics (age, gender, ethnicity, household income, maternal education, maternal occupation, family structure). Besides, you will need to fill in the FFQ and a 3-day food record.

4. WHO SHOULD NOT PARTICIPATE IN THE STUDY?

Only Malaysians are allowed to participate in this study. Those who are less than 16 or above 17 years old are not allowed to participate. Individuals who experience chronic illnesses, unable to give consent form and unable to complete the questionnaire given or complete the interview session will be excluded. Consent form will be given to make sure those who participate are willing to do so.

9.
CONSENT

I
Identity Card
No.
address

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

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

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

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

* delete where necessary

Signature

Signature

.....

.....

.....
(Respondent)

.....
(Witness)

Date :

Name :

I/C No. :

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

Date

Signature

(Researcher)

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

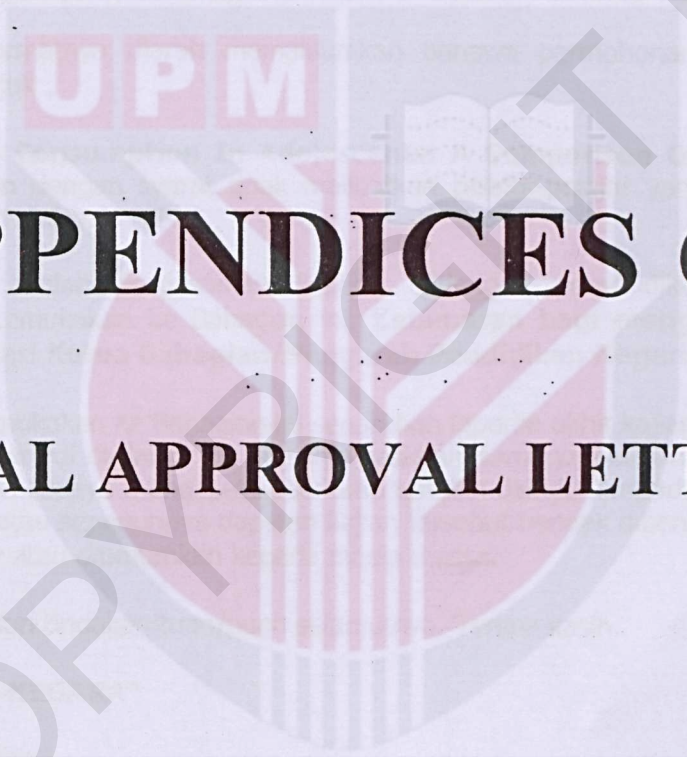
Ref. Kani
Tarikh

KP/PP/PP/103/5/2019
1 Disember 2019

APPENDICES C

ETHICAL APPROVAL LETTERS

UPM



JKEUPM Ref No. : FPSK_November(13)06

- a) Members of the JKEUPM who reviewed the documents:
 - Prof. Dato' Dr. Lye Munn Sann
- b) Date of approval: 9/1/2014

Endorsed at JKEUPM Meeting on 7/2/2014, attended by:

NAME	DESIGNATION	GENDER	TICK IF PRESENT
Prof. Dr. Norlijah Othman	Paediatrics & Dean, Faculty of Medicine and Health Sciences	Female	√
Prof. Dr. Zamberi Sekawi	Medical Microbiologist & Deputy Dean of Research and Internationalization, Faculty of Medicine and Health Sciences	Male	√
Prof. Dato' Dr. Lye Munn Sann	Medical Statistician, Dept of Community Health, Faculty of Medicine and Health Sciences	Male	√
Prof. Dr. Tengku Aizan Abd Hamid	Gerontologist & Director, Institute of Gerontology	Female	
Prof. Dr. Lekhraj Rampal	Medical Statistician, Dept of Community Health, Faculty of Medicine and Health Sciences	Male	√
Prof. Dr. Elizabeth George	Pathologist, Dept of Pathology, Faculty of Medicine and Health Sciences	Female	
Prof. Dr. Lim Thiam Aun	Anesthesiologist, Dept of Surgery, Faculty of Medicine and Health Sciences	Male	√
Prof. Dr. Wan Omar Abdullah	Medical Parasitologist, Dept of Medical Microbiology and Parasitology, Faculty of Medicine and Health Sciences	Male	√
Prof. Dr. Patimah Ismail	Professor of Biomedicine, Dept of Biomedical Sciences, Faculty of Medicine and Health Sciences	Female	√
Prof. Dr. Johnson Stanslas	Pharmacologist, Dept of Medicine, Faculty of Medicine and Health Sciences	Male	√
Assoc. Prof. Dr. Mansor Abu Talib	Assoc. Professor of Guidance and Counselling, Dept of Human Development and Family Studies, Faculty of Human Ecology	Male	√
Assoc. Prof. Dr. Azmawani Abd. Rahman	Operations and Technology Management / Deputy Dean of Research and Graduate Studies	Female	
Assoc. Prof. Dr. Noritah Omar (Lay Person)	Assoc. Professor of English Language, Dept of English Language, Faculty of Communication and Modern Languages	Female	
Dr. Rojanah Kahar (Lay Person)	Senior Lecturer of Dept of Human Development and Family Studies, Faculty of Human Ecology	Female	√
Tan Sri Dato' Napsiah Omar (Independent Member)	Chairman, National Population and Family Development Board	Female	