



UNIVERSITI PUTRA MALAYSIA

***ASSOCIATION BETWEEN BODY COMPOSITION AND DIETARY
PATTERNS IN RELATION TO BLOOD PRESSURE LEVEL IN
UNDERGRADUATE UNIVERSITY STUDENTS OF UNIVERSITI PUTRA
MALAYSIA***

NORFATEN EMALIN BINTI RAZMI

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BY

NORFATEN EMALIN BINTI RAZMI

**A project submitted as a partial fulfillment of the requirement for the degree of
Bachelor of Science (Nutrition and Community Health) from the Faculty of
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LIST OF ABBREVIATION

BF %	Body fat percentage
BMI	Body Mass Index
BP	Blood pressure
HC	Hip circumference
DBP	Diastolic blood pressure
NHMS	National Health and Morbidity Survey
SBP	Systolic blood pressure
UPM	Universiti Putra Malaysia
WC	Waist circumference
WHR	Waist to hip ratio

ABSTRACT

Association Between Body Composition and Dietary Patterns In Relation To Blood Pressure Level In Undergraduate University Students of Universiti Putra Malaysia

NorFaten Emalin binti Razmi

There is an increase in hypertension prevalence among Malaysian adults and based on the National Health and Morbidity Survey 2015, it was estimated that 30.3% of the adult aged ≥ 18 years old was diagnosed with hypertension [systolic blood pressure (SBP) of $> 130\text{mmHg}$ and diastolic blood pressure (DBP) of $>80\text{mmHg}$]. Prevalence of prehypertension among undergraduate students in Universiti Malaysia Sarawak in 2010 were 42.9%. There are many factors that might affect blood pressure (BP) and Body composition and dietary patterns have been shown to be the factors that might affect blood pressure. Therefore, the study was aimed to investigate the association between body composition and caffeine intake with BP level in students in Serdang. A total of 195 female and 24 male participants with mean $\pm$ SD aged of 21.86 ± 1.34 years completed a questionnaire on socio-demographic and caffeine consumption habits. Height, body weight, body fat percentage (BF %), waist circumference (WC), hip circumference (HC) and BP level were measured. A Pearson coefficient correlation test was carried out to determine the association between the variables. SBP level was found to be associated with WC ($r=0.37, p<0.0001$), HC ($r=0.36, p<0.0001$), WH ratio ($r=0.21, p=0.002$), BF % ($r=0.16, p=0.162$) and body mass index (BMI) ($r=0.34, p<0.0001$). DBP level was found to be associated with WC ($r=0.42, p<0.0001$), HC ($r=0.45, p<0.0001$), WH ratio ($r=0.19, p=0.004$), BF% ($r=0.31, p<0.0001$) and BMI ($r=0.42, p<0.0001$). However, there was no significant association found between age and dietary intake with BP levels. Based on the findings, body composition could be one of the factors that leads to a higher BP level. These findings highlighted the importance of establishing intervention program at the early life stage to attempt and reduce the incidence of adulthood hypertension in later life.

ABSTRAK

Perkaitan Antara Komposisi Badan dan Corak Pemakanan Dengan Bacaan Tekanan Darah Dalam Kalangan Pelajar Ijazah Sarjana Muda di Universiti Putra Malaysia

NorFaten Emalin binti Razmi

Terdapat peningkatan kekerapan hipertensi di dalam kalangan dewasa muda di Malaysia. Berdasarkan Bancian Kesihatan dan Morbiditi Negara 2015, dianggarkan 30.3% peringkat umur dewasa di dalam lingkungan umur 18 tahun ke atas didiagnos menghidapi hipertensi (tekanan darah sistolik ≥ 130 mmHg dan tekanan darah diastolik ≥ 80 mmHg). Kekerapan prehipertensi dalam kalangan pelajar Universiti Malaysia Sarawak dilaporkan sebanyak 42.9% pada tahun 2010. Terdapat banyak faktor yang mungkin menjejaskan tekanan darah dan tabiat pemakanan dan komposisi tubuh adalah dua faktor utama yang dapat mempengaruhi tekanan darah. Oleh itu, matlamat kajian ini adalah untuk mengkaji perkaitan antara komposisi badan dan corak pemakanan dengan bacaan tekanan darah dalam kalangan pelajar ijazah sarjana muda di Universiti Putra Malaysia. Seramai 195 peserta perempuan dan 24 peserta lelaki dengan purata umur 21.86 ± 1.34 tahun telah melengkapkan boring soal selidik tentang ciri-ciri demografi dan pengambilan kafein. Ketinggian, berat badan, peratusan lemak badan, lilitan pinggang, lilitan pinggul dan bacaan tekanan darah turut diukur. Tekanan darah sistolik menunjukkan perkaitan yang signifikan dengan ukur lilit pinggang ($r=0.37$, $p<0.001$), ukur lilit pinggul ($r=0.36$, $p<0.001$), kadar pinggul pinggang ($r=0.21$, $p=0.002$), peratusan lemak ($r=0.16$, $p=0.16$) dan indeks jisim badan ($r=0.34$, $p<0.001$). Tekanan darah diastolic juga turut menunjukkan perkaitan dengan ukur lilit pinggang ($r=0.42$, $p<0.001$), ukur lilit pinggul ($r=0.45$, $p<0.001$), kadar pinggul pinggang ($r=0.19$, $p=0.004$), peratusan lemak ($r=0.31$, $p<0.001$) dan indeks jisim badan ($r=0.42$, $p<0.001$). Bagaimanapun, tiada perkaitan yang signifikan di Antara umur dan tabiat pemakanan dengan tekanan darah. Berdasarkan keputusan kajian, komposisi badan adalah salah satu factor yang menyumbang ke arah tekanan darah yang lebih tinggi. Hasil kajian ini menunjukkan kepetingan untuk menganjurkan lebih banyak program intervensi untuk mengurangkan penyakit tekanan darah tinggi di peringkat dewasa dan usia yang lebih lanjut.

CHAPTER 1

1.0 Introduction

Blood pressure (BP) is the force that blood exerts towards the walls of blood vessels when it is pumped by heart (World Health Organisation, 2017). There are two distinct categories of blood pressure, which are systolic blood pressure (SBP) and diastolic blood pressure (DBP) (Ministry Of Health Malaysia, 2008). SBP resembles the amount of pressure that the arterial walls receive for each heart beat whilst DBP resembles the total pressure that the arterial walls receive as the heart rests for a while in between beats (American Heart Association, 2017).

A blood pressure level is considered normal when the SBP is lower than 120 mmHg and DBP is lower than 80 mmHg (American Heart Association, 2017). A patient is diagnosed with high blood pressure if the SBP and DBP levels exceed 130 mmHg and 80 mmHg respectively. Approximately 22% of adults aged 18 and above across the globe experienced increased blood pressure levels in 2014 (World Health Organisation, 2016). It was previously shown in Malaysian National Health and Morbidity Survey (NHMS) 2015 that the overall prevalence of hypertension in Malaysian men and women adults aged 18 years and above was 30.3% (Institute for Public Health, 2015). It was reported in NHMS 2011 that the overall prevalence of

hypertension was 32.7% in Malaysian men and women aged 18 years and above (Institute for Public Health, 2011). Although the prevalence of hypertension decreased by 2.4%, but the prevalence of known hypertension increased by 0.3% whilst the prevalence of undiagnosed hypertension decreased by 2.6% (Institute for Public Health, 2015).

The prevalence of prehypertension in Malaysian undergraduate students was 30.1%, where the prevalence was reported to be higher in males (46.8%) compared to females (24.5%), and was higher in the 22 years old and above age group (36.8%) as compared to 18 to 21 years old group (24.6%) (Balami, Salmiah & Nor Afiah, 2014). It was reported in a study carried out by Lee, Ong, Muna, Syed Alwi and Kamarudin (2010) that the prevalence of prehypertension (SBP: 120 to 130 mmHg and DBP $\leq$ 80 mmHg) in Universiti Malaysia Sarawak undergraduate students was 42.9% and the prevalence for hypertension (SBP $\geq$ 130 mmHg and DBP $\geq$ 80 mmHg) was 12.7%. The overall mean $\pm$ SD of SBP and DBP of the 454 participants were 126.2 ± 13.39 mmHg and 80.17 ± 9.29 mmHg respectively, which indicated pre hypertension. The mean of systolic and diastolic blood pressure was 114.6 ± 12.4 mmHg and 74.3 ± 9.0 mmHg respectively.

The prevalence of prehypertension and hypertension in university students were also widely studied in many other countries including Indonesia, Laos, Malaysia, Myanmar, Philippines, Thailand and Vietnam. The prevalence of pre and hypertension reported in these studies ranged from 19% to 30.1% and 6.7% to 12.8% respectively which is higher to what reported in Malaysian undergraduate students (Lee et al., 2010; Thawornchaisit et al., 2013; Balami, Salmiah & Nor Afiah, 2014; Peltzer, Pengpid, Sychareun, Ferrer, & Low, 2017).

Understanding the risk factors that might increase SBP and DBP, especially in Malaysian population is crucial to possibly reduce the number of incidence of hypertension. In both men and women adults, hypertension incidence was reported to be associated with age, higher body mass index, family history of hypertensive disease, insufficient physical activity, high sodium intake, smoking, abusive alcohol consumption, self-medication, use of drugs that affect the blood pressure (BP), dyslipidaemia and diabetes mellitus, but not with socioeconomic status (Longo, Neves, Luciano, & Peres, 2009; Thawornchaisit et al., 2013; Access, Benite-ribeiro, Lauany, & Lima, 2016).

There were numbers of studies carried out to date to identify the factors that may lead to incidence of hypertension in university students (Tayem et al., 2012; Radzani, Razak, Maizi, & Muhamad, 2013; Aliyu, Ahmad, & Oyeyemi, 2014; Access et al., 2016; Peltzer, Pengpid, Sychareun, Ferrer, & Low, 2017). However, there are limited published studies available that investigate the association between dietary patterns and body composition with blood pressure, especially in Malaysia.

Diet pattern is one of modifiable factor that can be applied in the management of hypertension. A systematic review and meta-analysis of randomised control trials by Ndanuko, Tapsell, Charlton, Neale and Batterham (2016) to assess the effect of dietary patterns on blood pressure in adult suggested that diets rich in fruit, vegetables, whole grains, legumes, seeds, nuts, fish, and dairy products and low meat consumption significantly lowered SBP and DBP by 4.26 mm Hg and 2.38 mm Hg, respectively ($p < 0.05$).

The association between plant and animal protein intakes with changes in blood pressure was also studied in the The Zutphen Elderly Study (Tielemans, Kromhout, Kuil, & Geleijnse, 2014). A total of 1266 middle aged men performed physical and dietary examinations every 5 years from 1985 to 2000. It was found that there was no significant difference in changes of BP levels in relation with high protein intake ($P>0.05$). Plant protein intake showed a significant reduction of -2.64 mmHg (95% CI: 5.76, 0.47) for SBP and -1.75 mmHg (95% CI: 3.49, 0.02) for DBP ($p<0.05$). However, the association of low or high intake of diet with BP in the study is not conclusive as only healthy elderly males were included in the study whilst men with baseline CVD, diabetes mellitus, cancer and antihypertensive medication were excluded thus resulted in a relatively small study sample, which might reduced the power to detect associations.

To further understand the effects of dietary patterns on blood pressure, Yuan, Kakinami, Gray-donald, Czernichow, & Lambert (2013) carried out a study to examine the association between blood pressure and dairy product consumption in 610 healthy children aged 8 to 10 years old. The study reported that consumption of 2 servings of dairy products daily was associated with 1.74 mm Hg lower SBP ($p<0.05$) and 0.87 mm Hg lower DBP levels ($p=0.10$). Calcium was highlighted as the main component that served as antihypertensive effect. However, since calcium exists in other types of food such as fish, meats, cereals, eggs, and grains, it was unconcluded that calcium from dairy product consumption can reduce BP. Advanced research on whether other components within dairy products have antihypertensive effects should be further studied.

Coffee consumption was also been shown in various studies to associate with increased blood pressure, and caffeine was in particular been highlighted as the main component that may increase BP (Dusseldorp, Smits, Lenders, Thien, & Katan, 1991; Klag, MJ; Wang, NY; Meoni, LA; Brancati, FL; Cooper, LA; Liang, KY; Ford, 2002; Palatini et al., 2016). Farag et. al (2010) investigate the effect of caffeine consumption on blood pressure in a 2-week randomised control study in 165 healthy men and women. Farag et. al (2010) reported that 14 days of coffee consumption resulted in an acute rise of 4 ± 0.6 mmHg ($p < 0.01$) in SBP and 3 ± 0.4 mmHg in DBP levels ($p = 0.04$) in all the participants.

In another 2-week randomised pilot crossover study carried out in 20 healthy (7 men and 13 women) by Revuelta-Iniesta and Al-Dujaili (2014) to investigate the effect of green and black coffees (BC) on BP, it was found that green coffee (GC) consumption significantly reduced SBP by mean $\pm$ SEM of 2.65 ± 1.37 mmHg and DBP by 3.1 ± 0.81 mmHg ($p = 0.001$). Participants in the intervention group consumed 10 g of green coffee whilst the control group consumed black coffee four times daily for 2 weeks. It was reported that there was no significant change in SBP (2.23 ± 1.44 mmHg) and DBP levels (2.9 ± 1.05 mmHg) following the BC intervention ($p > 0.05$).

However, in a cross sectional study in 1352 participants carried out by Alkerwi et. al (2015) to investigate the association between caffeine consumption and BP, it was found that there was no association between coffee consumption and blood pressure ($p > 0.05$). No association was also observed between coffee consumption and hypertension incidence in a prospective cohort study in 55594 US women (Winkelmayer et. al, 2005). There is a need to further investigate the association between caffeine consumption and blood pressure due to the inconsistent findings.

Other than dietary patterns, body composition such as Body Mass Index (BMI), waist to hip ratio and waist circumference were also reported to be associated with BP levels in different populations (Siani et al., 2002; Xiu & Rong, 2013; Aliyu, Ahmad and Oyeyum, 2014; Benite-Ribeiro, Silva, Lima & Santos, 2016). In a cross sectional study carried out by Aliyu, Ahmad and Oyeyem (2014) to determine the association between BMI with SBP and DBP levels in 351 university students in Maiduguri, Nigeria, it was found that there was a significant association between BMI with SBP and DBP levels in the participants ($r = 0.214$ and 0.161 , $p < 0.01$). The finding was consistent with another previous studies carried out by Mungreiphy et al. (2011), Sanchez-Zamorano et al. (2009), Vlajinac et al. (2003) and Ejike et al. (2008).

Building on from BMI, waist circumference (WC) was also found to be associated with blood pressure. The association of WC and BP was investigated in the Olivetti Heart Study carried out by Siani et al. (2002) in 768 Italian men aged 25 to 75 years. Based on the findings, WC was positively associated with SBP and DBP levels (SBP, $r = 0.191$, $p < 0.001$; DBP, $r = 0.166$, $p < 0.001$). The findings suggested an independent role of waist circumference in the association between central adiposity and high BP. Moreover, the findings were consistent with a study carried out by Xiu & Rong (2013) that also found positive association between WC with SBP and DBP levels. It was reported that 1 cm increased in WC correlated with a 1.03 (1.02-1.04, 95% CI) and a 1.05 (1.04-1.06, 95% CI) increased risk of higher BP ($p < 0.01$).

There are many factors that might affect blood pressure and it was shown in previous studies that dietary patterns and body composition were two of the main factors that may affect blood pressure levels (Ndanuko, Tapsell, Charlton, Neale, & Batterham, 2016b). Therefore, the aim of this study is to investigate the association

between body composition and dietary pattern with blood pressure level to address the following research question:

1. Is there any association between weight status (weight, height, BMI) with blood pressure level in undergraduate students in UPM?
2. Is there any association between body fat with blood pressure level in undergraduate students in UPM?
3. Is there any association between risk of chronic diseases (waist and hip circumferences, waist hip ratio) with blood pressure level in undergraduate students in UPM?
- 4.
5. Is there any association between dietary patterns including caffeine consumption with blood pressure level in undergraduate students in UPM?

1.1 Objectives

1.1.1 General Objective

To investigate the association between body composition and dietary patterns with blood pressure level in undergraduate students of Universiti Putra Malaysia.

1.1.2 Specific Objectives

1. To determine the blood pressure level in undergraduate students in UPM.
2. To determine the body compositions (weight, height, BMI, waist circumference, hip circumference, waist to hip ratio) in undergraduate students in UPM.
3. To determine the dietary habits including coffee consumption in undergraduate students in UPM.
4. To compare body composition and blood pressure level between sexes in undergraduate students in UPM.
5. To determine the association between body composition and dietary intake including caffeine consumption from coffee with blood pressure level in undergraduate students in UPM.

1.2 Null Hypothesis

H1: There is an association between body composition and dietary patterns with blood pressure level in undergraduate students in UPM.

Ho: There is no association between body composition and dietary patterns with blood pressure level in undergraduate students in UPM.

1.3 Conceptual Framework

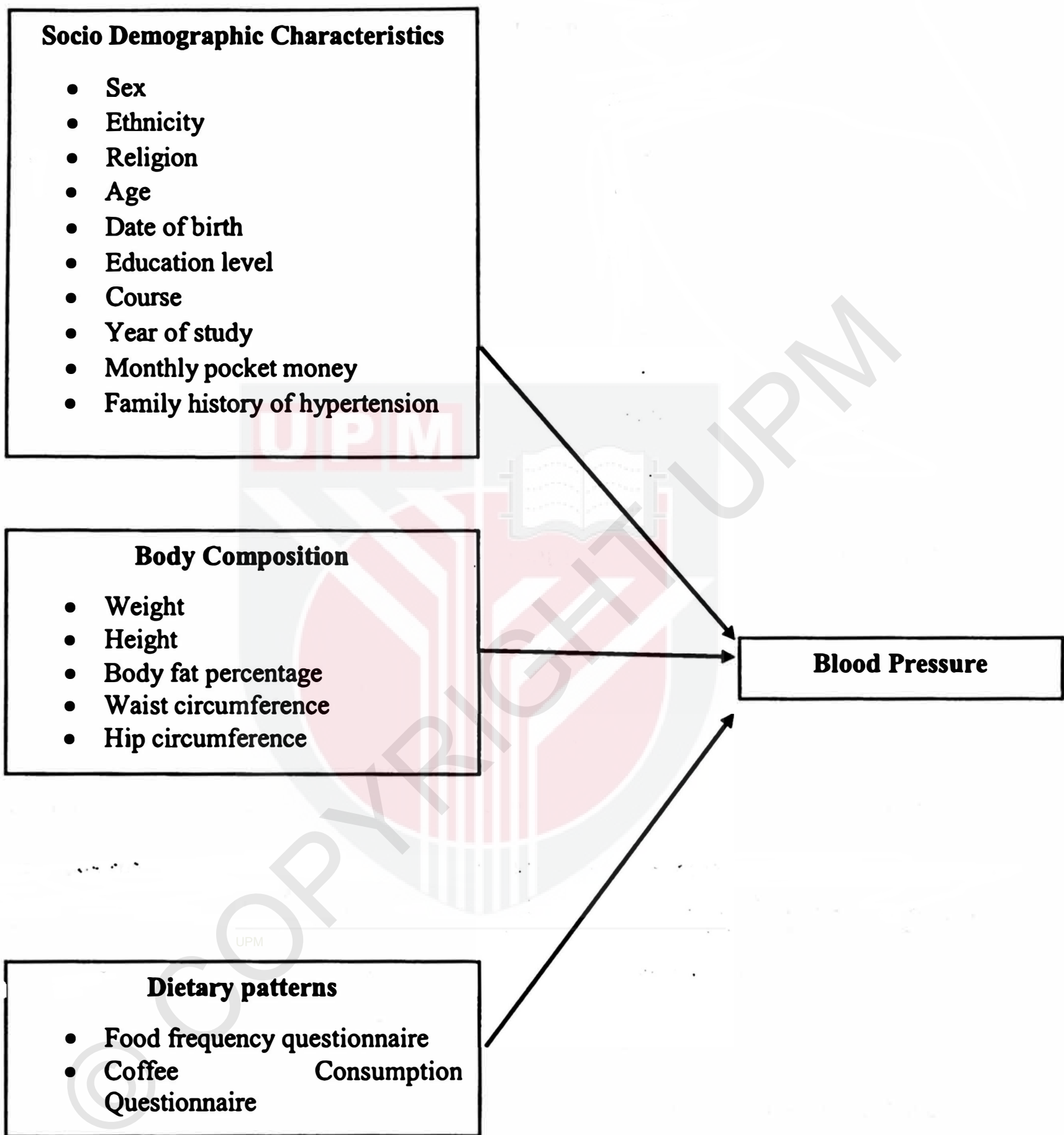


Figure 1.1: Conceptual framework

CHAPTER 2

2.0 Literature Review

2.1 Blood Pressure

2.1.1 Definition and classification

Blood pressure can be defined as a result from the force that blood exerted towards the walls of blood vessels when it is pumped by heart (World Health Organization, 2017). Systolic and diastolic blood pressure are the two main categories of blood pressure. Systolic blood pressure describes the amount of pressure that the arterial walls receive for each heartbeat. Diastolic blood pressure is the total pressure that the arterial walls receive as the heart rests for a while in between beats (American Heart Association, 2017).

Increased blood pressure has become one of the major concern in medical and public health field in recent years. Data from the National Health and Morbidity Survey (NHMS) 2015 found that the prevalence of hypertension in Malaysian adults aged 18 years and above was 30.3%. The highest prevalence of hypertension amongst ethnic groups was recorded in other Bumiputera (33.4%), followed by Indians (32.4%), Malay (31.1%) and Chinese (30.8%). However, there was no significant difference in the prevalence of hypertension found between male (30.8%) and female

(29.7%). In term of strata, rural areas (33.5%) had higher prevalence of hypertension than urban areas (29.3%). Across 14 states in Malaysia, Kedah recorded the highest prevalence of hypertension (37.5%), followed by Sarawak (37.3%) and Perak (36.4%). Wilayah Persekutuan Putrajaya recorded the lowest prevalence of hypertension (24.1%).

The American Heart Association (2017) had introduced the latest classification of blood pressure recently. There was a change in the new blood pressure classification compared with the previous classification. Normal blood pressure reading remain the same, which is 120 mmHg for systolic blood pressure (SBP) and 80mmHg for diastolic blood pressure (DBP). However, prehypertension, stage 1 and stage 2 hypertension classification are changed to the new range. The latest blood pressure classification is presented in Table 2.1.

Table 2.1: Classification of Blood Pressure

Blood Pressure Classification	Systolic Blood Pressure (mm Hg)	Diastolic Blood Pressure (mm Hg)
Normal	< 120	< 80
Pre-hypertension	120 – 129	< 80
Stage 1 hypertension	130 – 139	80 – 89
Stage 2 hypertension	≥ 140	≥ 90

Source: American Heart Association (2017)

2.1.2 The consequences of increased blood pressure

Uncontrolled increased blood pressure is recognised as one of the factor that might lead to significant vascular damage to the eyes, stroke, congestive heart failure, renal disease and myocardial infarction (Lee & Nieman, 2013). The use of pharmacological therapy for hypertension is helpful to reduce the number of mortality and morbidity. However, the therapy may give potent side effects to the patients, and the patients need to support high medical expenses. Hypertensive patients still have higher morbidity and mortality chances as compared with normotensive individuals (Lee & Nieman, 2013). There is a need to control and limit the prevalence of hypertension in order to reduce the epidemic of other chronic diseases.

2.1.3 Risk factors of increased blood pressure

Hypertension has been associated with several risk factors that were investigated in previous studies (Sadakane et al., 2008; Lee & Nieman, 2013; Mushengezi & Chillo, 2014; Steyn & Mchiza, 2014; Yuan et. al., 2015; Kalani, Salimi, & Rafiei, 2015; Ndanuko, Tapsell, Charlton, Neale, & Batterham, 2016; Penney et. al., 2017). The risk factors of hypertension are excess body fat, high body mass index (BMI), excessive energy consumption, smoking, physical inactivity, low intake of fruits and vegetables, whole grains, low-fat milk, fiber, nuts, and seeds, and high intake of red and processed meat, sugar, and sodium (Lee & Nieman, 2013; Mushengezi & Chillo, 2014; Steyn & Mchiza, 2014).

Excess body fat and high BMI are major risks of hypertension and cardiovascular diseases (Mushengezi & Chillo, 2014). Overweight and obese individuals are more likely to acquire high blood pressure as compared with individuals with normal weight status. Stevens et. al (2001) explained that blood pressure decreases in a dose response manner when weight is reduced. Hypertension and obesity start in early childhood till adolescence stage. Hence, it is crucial to control the blood pressure and body weight during childhood to reduce the prevalence of adulthood hypertension.

Dietary intake is always associated with the risk of hypertension. Diet high in sodium, low in potassium and excessive alcohol consumption increase the risk of developing hypertension (Lee and Nieman, 2013). A low intake of fruits and vegetables, whole grains, low-fat milk, fiber, nuts, and seeds, and high intake of red and processed meat, sugar, and sodium also increase the risk of developing hypertension (Penney et. al., 2017).

Dietary intake, weight status and physical activity level are amongst the risk factors of hypertension. There are several that can be used as the risk factors measurements for increased blood pressure. BMI, body fat percentage, waist circumference, hip circumference and waist to hip ratio are the measures that can be used to determine the risk of increased blood pressure (Lee & Nieman, 2013).

2.2 Body Composition

2.2.1 Body Mass Index

Body Mass Index (BMI) is an index to classify overweight and obesity in adults by calculating weight-for-height (kg/m^2) (World Health Organisation, 2018). BMI is a useful screening tool to assess overweight and obesity as it is the same for both sexes and for all ages of adults. However, BMI is not able to measure the degree of fatness in different individuals. Hence, other measurements are needed to further measure the percentage of fat in individuals.

Obesity remarks as one of health related issues worldwide. Over the years, the prevalence of obesity increased and the worldwide prevalence of obesity in 2016 was 3 times higher than in 1976 (World Health Organisation, 2017). It was reported that in 2016, 39% of adults in worldwide population aged 18 years and over were overweight and 13% of them were obese. It was estimated approximately 1.9 billion adults aged 18 years and older were overweight and out of the total number, 650 million of them were obese.

In Malaysia, the prevalence of overweight and obesity were also high. The reference used for the weight status classification was from World Health Organisation (1998). Based on the NHMS 2015, the prevalence of overweight in Malaysian adults aged 18 years and above was 30.0% (Institute for Public Health, 2015). Male had higher prevalence of overweight (31.6%) than female. The highest prevalence of hypertension amongst ethnic groups was recorded in Indians (35.0%). However, there

was no significant difference in the prevalence of hypertension found between rural areas (28.1%) and urban areas (30.7%). Across 14 states in Malaysia, Wilayah Persekutuan Putrajaya recorded the highest prevalence of hypertension (37.0%). Primary education attainers (31.3%) and government/ semi government employees (36.2%) had higher prevalence of overweight across all occupation.

The prevalence of obesity in Malaysian adults aged 18 years and older in 2015 was 17.7% (Institute for Public Health, 2015). Female had higher prevalence of overweight (20.6%) than male (15.0%). The highest prevalence of hypertension amongst ethnic groups was recorded in Indians (27.1%). However, there was no significant difference in the prevalence of hypertension found between rural areas (17.7%) and urban areas (17.5%). Across 14 states in Malaysia, Wilayah Persekutuan Putrajaya recorded the highest prevalence of hypertension (25.8%), followed by Negeri Sembilan (23.5%) and Perlis (22.3%). Wilayah Persekutuan Labuan and Sabah (13.4%) had the lowest prevalence of obesity. Unpaid workers/ home makers (23.7%) and secondary education attainers (19.9%) had higher prevalence of overweight across all occupation.

BMI is obtained by dividing weight in kilograms by height in meters squared (Lee & Nieman, 2013). BMI is the best single indicator of total fat in adults (Barlow, Dietz, Barlow, & Dietz, 1998). Table 2.2 shows classification of BMI based on the World Health Organisation (1997) classification guidelines.

Table 2.2: BMI classification

Classification	Cut off Point (kg/m²)
Underweight	18.5
Normal weight	18.5 - 24.9
Overweight	25.0–29.9
Obese class I	30.0–34.9
Obese class II	35.0–39.9
Obese class III	≥ 40

Source: WHO (1997)

As BMI increases above 25.0 kg/m², there is a gradual increase in risk of acquiring other non-communicable diseases such as type 2 diabetes, hypertension, coronary heart disease, stroke, gallbladder diseases, osteoarthritis, sleep apnea and other respiratory problems (Lee & Nieman, 2013). In fact, the risk of several types of cancer such as prostate cancer, colon cancer, endometrial cancer and breast cancer increase with higher BMI. Nonetheless, the risk of morbidity and mortality of chronic diseases increases even more when BMI is greater than 30 kg/m².

The risk of type 2 diabetes increases in women who have higher BMI (Weinstein et al., 2004). Risk of type 2 diabetes rise threefold in women with a BMI between 25.0 kg/m² to 29.9 kg/m². The risk rise to the extent of ninefold in women with BMI greater than 30.0 kg/m². The increased risk of acquiring type 2 diabetes with

increased BMI is the same in all population groups, regardless of gender, ethnicity, physical activity and even family history of chronic diseases (Weinstein et al., 2004).

Individuals with high BMI usually have a vast amount of total body fat (Lee & Nieman, 2013). However, BMI tends to overestimate total body fat in individuals who are very muscular and underestimate body fat in individuals who lost muscle mass such as the elderly. Special measures are needed for certain groups as their body composition may differ from normal individuals. BMI is the most frequent measure used as it is easy to be used and a practical approach in assessing body fat in a research or clinical setting. Besides BMI, there are a few available assessment tools that can be used to measure total body fat and the risk of acquiring chronic diseases, namely body fat percentage, waist circumference, hip circumference and waist to hip ratio.

2.2.2 Body Fat Distribution

Body fat distribution describes the region and distribution of fat within the body and is marked as an important factor in determining the consequence of overweight and obesity (Lee & Nieman, 2013). There are two types of body classification, upper and lower body or gynoid. Android obesity is characterised by obese individuals having a greater proportion of fat within the upper body, primarily within the abdomen compared with the proportion of fat within the hips and thighs (Lee & Nieman, 2013). Gynoid obesity is characterised by obese individuals having the most fat distribution within hips and thighs region. In general population, android obesity are more likely to be seen in obese men, whilst women are more likely to be seen with gynoid obesity. **Figure 2.1** portrays the difference between android and gynoid obesity.

Android obesity

Gynoid obesity



Figure 2.1: The android and gynoid physical appearance

Source: Centre for Chronic Diseases (CDC), United States of America

Android obesity increases the risk of acquiring insulin resistance, hyperinsulinemia (elevated blood insulin), prediabetes (impaired glucose tolerance), type 2 diabetes mellitus, hypertension, hyperlipidemia (elevated blood cholesterol and triglyceride levels) and stroke (Lee & Nieman, 2013). Fat distribution, primarily in upper body region, is a more important risk factor for morbidity and mortality than obesity. Android obesity is associated with elevated triglyceride, serum cholesterol and low density lipoprotein (LDL) levels in obese adolescent females (Zwiauer K, Widhalm K, 1990). In adolescent males, android obesity is associated with lower high density lipoprotein (HDL) levels, higher LDL levels and a higher ratio of total cholesterol to HDL.

Total abdominal fat is defined as the sum of fat in subcutaneous, visceral and retroperitoneal of the abdominal region (Gallagher et al., 2000; Lee & Nieman, 2013). Increased total abdominal fat is an independent risk predictor of morbidity and mortality. The most accurate instrument to measure total abdominal fat is by using magnetic resonance imaging (Lee & Nieman, 2013). However, the method is expensive and not practical for the use in research and clinical settings.

Another inexpensive and practical approaches available to measure total abdominal fat are waist circumference, hip circumference, waist to hip ratio and body fat percentage by using the Omron body fat analyser. The cut off points and classifications for waist circumference, hip circumference, waist to hip ratio and body fat percentage are shown in Table 2.3 and Table 2.4.

Table 2.3: The classification of waist circumference, hip circumference and waist to hip ratio.

Category	Waist circumference	Hip circumference	Waist to hip ratio	Classification
Men	< 89 cm	≤ 102 cm	< 0.90	Normal
	≥ 90 cm	> 102 cm	≥ 0.90	At risk of chronic diseases
Women	< 80 cm	≤ 88 cm	< 0.85	Normal
	≥ 80 cm	> 88 cm	≥ 0.85	At risk of chronic diseases

Source: WHO (2008)

Table 2.4: The classification of body fat percentage

Category	Body Fat Percentage (%)	Classification
Men	< 25	Normal
	≥25	At risk of obesity
Women	<35	Normal
	≥35	At risk of obesity

Source: Gallagher et al. (2000)

2.2.4 Previous studies on the association between body composition and blood pressure

Several studies had been carried out to investigate the association between body composition, primarily body fat percentage, waist circumference, hip circumference and waist to hip ratio with SBP and DBP. Table 2.5 summaries the studies that had been carried out over the years to study the association.

Table 2.5: The summary of previous studies on the association of body composition and blood pressure

Reference	Country of origin	Population size	Age (years)	Study Design	Outcome	Findings	Remarks
Al-sendi, Shetty, Musaiger, & Myatt (2003)	Bahrain	504	12-17	CS	BP, BMI, BF%, WC, HC, WHR	BF% was associated with SBP (Male: $r=0.28$, $p < 0.001$, female: $r=0.47$, $p < 0.001$) and DBP (Male: $r=0.18$, $p < 0.01$, female: $r=0.38$, $p < 0.001$). WC was associated with SBP (Male: $r = 0.38$, $p < 0.001$; female: $r = 0.51$, $p < 0.001$) and DBP (Male: $r = 0.27$, $p < 0.001$; female: $r = 0.37$, $p < 0.001$). WHR was associated with SBP (Male: $r = 0.21$, $p < 0.01$; female: $r = 0.31$, $p < 0.001$) and DBP (Male: $r = 0.14$, $p < 0.05$; female: $r = 0.14$, $p < 0.05$). SBP was associated with BMI ($r=0.21$, $p=0.02$) and WC ($r=0.20$, $p=0.03$) were associated with SBP in female, not male.	Results suggest that obesity influences BP. WHR and WC are useful in identifying children at risk of developing high BP
Arruda et al. (2009)	Brazil	300	20-59	CS	BP, BMI, WC, WHR		SBP was associated with BMI and WC in female but not in male.

Jan et al. (2011)	Malaysia	296	18-59	CS	BP, BMI, WC, HC, BF%	BMI was associated with SBP ($r=0.11$, $p<0.05$) and DBP ($r=0.25$, $p<0.01$). WC was associated with SBP ($r=0.11$, $p<0.05$) and DBP ($r=0.27$, $p<0.01$). HC was only associated with SBP ($r=0.20$, $p<0.01$). There was a significant correlation between BMI with SBP ($r = 0.21$) and DBP ($r =0.16$) ($p<0.01$). BP, BMI, BMI was correlated with SBP PA, BF%, (Male: $r=0.47$, female: $r=0.39$, $p<0.001$) and DBP (Male: $r=0.35$, female: $r=0.38$, $p<0.001$). BF% was correlated with SBP (Male: $r=0.38$, female: $r=0.36$, $p<0.001$) and DBP (Male: $r=0.32$, female: $r=0.36$, $p<0.001$). BP, BMI, BMI was associated with SBP ($p = 0.03$) but not DBP ($p = 0.06$). PHT (26.8 ± 7.5 kg/m ²) students had higher BMI than NMT (21.2 ± 4.0 kg/m ²) ($p<0.001$).	BMI, WC and HC were associated with BP, but not WHR and BF%.
Aliyu, Ahmad, & Oyeyemi (2014)	Nigeria	351	20-30	CS	BP, BMI	Results from this study indicate a significant relationship between BMI and BP.	
Pramanik, Koley, & Bisas (2015)	India	1361	10-17	CS	BP, BMI, PA, BF%, FH	There was significant correlation between BMI and BF% with BP. There was significant association between PA and FH with BP.	
Benite-ribeiro, Lauany, Lima & Santos (2016)	Brazil	2812	11-19	CS	BP, BMI, PA, EB.	SBP was positively associated with BMI. When BMI was high and EB was low, DBP was recorded high. No relationship was observed between BP and PA	

Abbreviations: BF%, body fat percentage; BP, blood pressure; BMI, Body Mass Index; DBP, diastolic blood pressure; DI, dietary intake; CS, cross sectional; EB, eating behavior; FH, food habit; HC, hip circumference; K, potassium; Na, sodium; PA, physical activity; SBP, systolic blood pressure; WC, waist circumference; WHR, waist to hip ratio.

2.3 Dietary Intake

Diet is one of the risk factor that can influence SBP and DBP (Sinatra & Houston, 2015). Diet rich in fresh fruits, vegetables, nuts, seeds, olive oil, coconut oil, lean meats, fish, non-gluten grains and legumes provide protective effects towards blood pressure. Limiting fast food consumption may benefits the blood pressure as this type of food contain high amount of sugar, salt, fat, preservatives and food colourings.

A few dietary pattern have been identifies to provide inverse relationship between food intake and blood pressure. Vegetarian, Mediterranean and Paleolithic diets provide cardio protective effect on blood pressure (Sinatra & Houston, 2015). These type of diets promote consumption of meat, fish, legumes, dairy products and eggs at various amount of consumption. Consumption of gluten from grains is reduced in the diets as gluten may lead to inflammation in the arteries and intestines (Sinatra & Houston, 2015).

Vegetarian diet is defined diet that consume most foods except meat products (Sinatra & Houston, 2015). However, the practice of vegetarian diet may vary from one person to another. Pesco-vegetarians are vegetarians who chose to eat only fish, while vegetarians who consume dairy products and eggs are classified as lacto-ovo vegetarians. Vegetarian diet contributes to lowered risk of hypertension due to high intake of fruits, vegetables and fiber with a moderate intake of fish, eggs, nuts, oils and gluten free grains (Sinatra & Houston, 2015).

Paleolithic diet practices high consumption of fruits, vegetables, meat, fish and shellfish with a low consumption of fat and grains (Sinatra & Houston, 2015). This results in a lower serum cholesterol and blood pressure and increase insulin sensitivity. Paleolithic diet is considered the best type of diet for weight reduction as carbohydrate and fat are consumed in a minimal amount.

Mediterranean diet is the most popular diet to reduce and control blood pressure globally (Lee & Nieman, 2013). Dietary Approach to Stop Hypertension (DASH) diet is a diet that emphasise high consumption of fruits, vegetables and low dairy fat products while reducing the intake of saturated and total fat in overall diet. The practice of DASH diet is able to reduce SBP by approximately 8 to 14 mmHg (Lee & Nieman, 2013). The reduction of sodium intake to lower than 2300 mg/day may even assist in the reduction of blood pressure.

2.3.1 Previous studies on the association between dietary intake and blood pressure

Several studies had been carried out to investigate the association between dietary intake with SBP and DBP. Table 2.6 summaries the studies that had been carried out over the years to study the association.

Table 2.6: The summary of previous studies on the association of dietary intake and blood pressure

Reference	Country of origin	Population size	Age (years)	Study Design	Outcome	Findings	Remarks
Pitsavos et al. (2006)	Greece	5003	18-74	CS	BP, DI	Hypertensive participants consumed more fish, fruits and juices, cereals, and low fat milk and yogurt than normotensive participants ($p<0.01$).	Association between DI and BP should be considered to further investigate the relationship between diet and BP.
Nguyen,Choi, & Lustig (2009)	USA	4867	12-18	CS	BP, sugar sweetened beverage consumption	Results indicate that higher sugar sweetened beverage consumption was associated with higher SBP.	The increased in SBP could not be compare with adult population as BP in adolescents are measured in z-scores.
Abdel Megeid, Abdel karem, & El-fetouh (2011)	Saudi Arabia	312	21.1 ±2.8	CS	BP, food consumption	Fat was positively associated with SBP (Male: $r=0.28$, $p=0.05$, female: $r=0.29$, $p=0.05$) and DBP (Male: $r=0.29$, $p=0.05$, female: $r=0.30$, $p=0.05$).	Fat and Na consumption were positively associated with BP in both gender. Consumption of fiber, grains, vegetables, fruits, beans were negatively associated with BP in both gender.
						Na was positively associated with SBP (Male: $r=0.39$, $p=0.01$, female: $r=0.34$, $p=0.01$) and DBP (Male: $r=0.39$, $p=0.05$, female: $r=0.35$, $p=0.05$).	

Noh et al. (2015)	South Korea	24,096	≥19	CS	BP, K and Na intake	Findings show that high Na intake was associated with increased DBP. High K intake was associated with lowered SBP.	An increase of 1mg of Na was associated with an increase of 0.21 mmHg in DBP ($p<0.001$). An increase of 1mg of K was associated with a decrease of 1.01 mmHg in SBP ($p<0.001$)
Julian-Almarcegui, et. al. (2016)	Austria, Belgium, France, Germany, Greece, Hungary, Italy, Spain, Sweden and United Kingdom	2283	12.5- 17.5	CS	BP, DI	Dairy products were negatively associated with SBP (Boys: $r=-0.13$, $p<0.05$, girls: $r=-0.13$, $p<0.05$) and DBP (Boys: $r=-0.14$, $p<0.05$, girls: $r=-0.16$, $p<0.05$). Fish intake was negatively associated with SBP (Boys: $r=-0.13$, $p<0.05$, girls: $r=-0.12$, $p<0.05$) and DBP (Girls: $r=-0.06$, $p<0.05$).	The results found that dairy products and fish intake were negatively associated with BP.

Radwanur, Talukder, Rutherford & Phung (2016)	Bangladesh	253	19-25	CS	BP, water salinity	Consumption of water high in salinity increase BP in young coastal population of Bangladesh.	Consumption of high water salinity (>600 mg/L) was associated with higher SBP (120±10mmHg, <i>p</i> =0.03) and DBP (67 ± 9 mmHg, <i>p</i> = 0.03).
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Abbreviations: BP, blood pressure; BMI, Body Mass Index; DBP, diastolic blood pressure; DI, dietary intake; CS, cross sectional; K, potassium; Na, sodium; SBP, systolic blood pressure

CHAPTER 3

3.0 Methodology

3.1 Participants

Recruitment was carried out in the University Putra Malaysia. The university consists of 16 faculties, 16 centers, nine institutes, one school, and one academy. Undergraduate students were recruited for this study. Potential participants were provided a participant information sheet (PIS) that contains the details of the study protocol. If participants met the eligibility criteria and agreed to participate, a written informed consent was provided for them to complete before they enrolled into the study. Each participant was screened based on inclusion and exclusion criteria as follows (Table 3.1):

Table 3.1: Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
• Malaysian • Undergraduate students • Age between 19-29 years old	• Pregnant and lactation women • Undergraduate students who had one or more chronic health conditions (e.g., type 2 diabetes mellitus, heart disease, cancer, stroke, etc.)

3.2 Sample size

A correlation formula developed by (Hulley, Cummings, Browner, Grady, & Newman, 2013) was used to determine the number of subjects in this study. The formula that was used in the calculation was as below (Table 3.2):

Correlation formula:

$$n = [(Z_{\alpha}+Z_{\beta})/C]^2 + 3$$

$$C = 0.5*\ln[(1+r)/(1-r)]$$

Where:

N = sample size,

The standard normal deviate for $\alpha = Z_{\alpha} = 1.96$

The standard normal deviate for $\beta = Z_{\beta} = 0.84$

r = the expected correlation coefficient

Table 3.2: Correlation calculation and formula

Variable	Value	Calculation	Sources
BMI with SBP	r = 0.214	$C = 0.5*\ln[(1+0.214)/(1-0.214)]$ $= 0.74$ $N = [(1.96+0.84)/0.74]^2 + 3$ $= 169$	Aliyu, Ahmed and Oyeyemi (2014)
WC with SBP	r = 0.693	$C = 0.5*\ln[(1+0.693)/(1-0.693)]$ $= 0.85$ $N = [(1.96+0.84)/0.85]^2 + 3$ $= 14$	Phing, Hoa & Hua (2017)
HC with DBP	r = 0.20	$C = 0.5*\ln[(1+0.20)/(1-0.20)]$ $= 0.20$ $N = [(1.96+0.84)/0.20]^2 + 3$ $= 199$	Hamid et al (2011)
WHR with SBP	r = 0.590	$C = 0.5*\ln[(1+0.590)/(1-0.590)]$ $= 0.68$ $N = [(1.96+0.84)/0.68]^2 + 3$ $= 20$	Phing, Hoa & Hua (2017)
BF% with DBP	r = 0.197	$C = 0.5*\ln[(1+0.197)/(1-0.197)]$ $= 0.20$ $N = [(1.96+0.84)/0.20]^2 + 3$ $= 199$	Hamid et al (2011)

Dietary sodium restriction with SBP	$r = 0.66$	$C = 0.5 \cdot \ln[(1+0.66)/(1-0.66)] = 0.79$ $N = [(1.96+0.84)/0.79]^2 + 3 = 16$	Parijs, Joossens, Lindén, Verstreken & Amery (1973)
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Abbreviations: BMI, body mass index; WC, waist circumference; HC, hip circumference; WHR, waist to hip ratio; BF%, body fat percentage

Based from the calculations based on all objectives, the highest value of calculated sample size ($n = 199$) was used. Previous studies showed that the dropout rates were approximately 17 to 20 % (Alperet et al., 2016). To account for 20% of dropout rate, 40 more participants were added. The total number of participants that should be recruited was 239. During data collection, 219 students were recruited in the study. The response rate was 60.8%.

3.3 Sampling Design

All 15 faculties in Universiti Putra Malaysia (UPM) were included in the sampling. Simple random sampling was used to select which faculty to be included in the study. Two faculties were randomly selected, which were Faculty of Science and Faculty of Engineering. All students from Year 1 to Year 4 from the Bachelor of Science (Mathematics) and Bachelor of Engineering (Process and Food) programme were approached. A simple online random sampling software (www.random.org) that was built by Dr Mads Haahr in 1998 was used to randomly select the faculties. The sampling method was shown in Figure 3.1. Based on the random sampling, Faculty of Science and Faculty of Engineering were included to recruit participants. All students from all courses listed in the faculties were selected to potentially participate in this study.

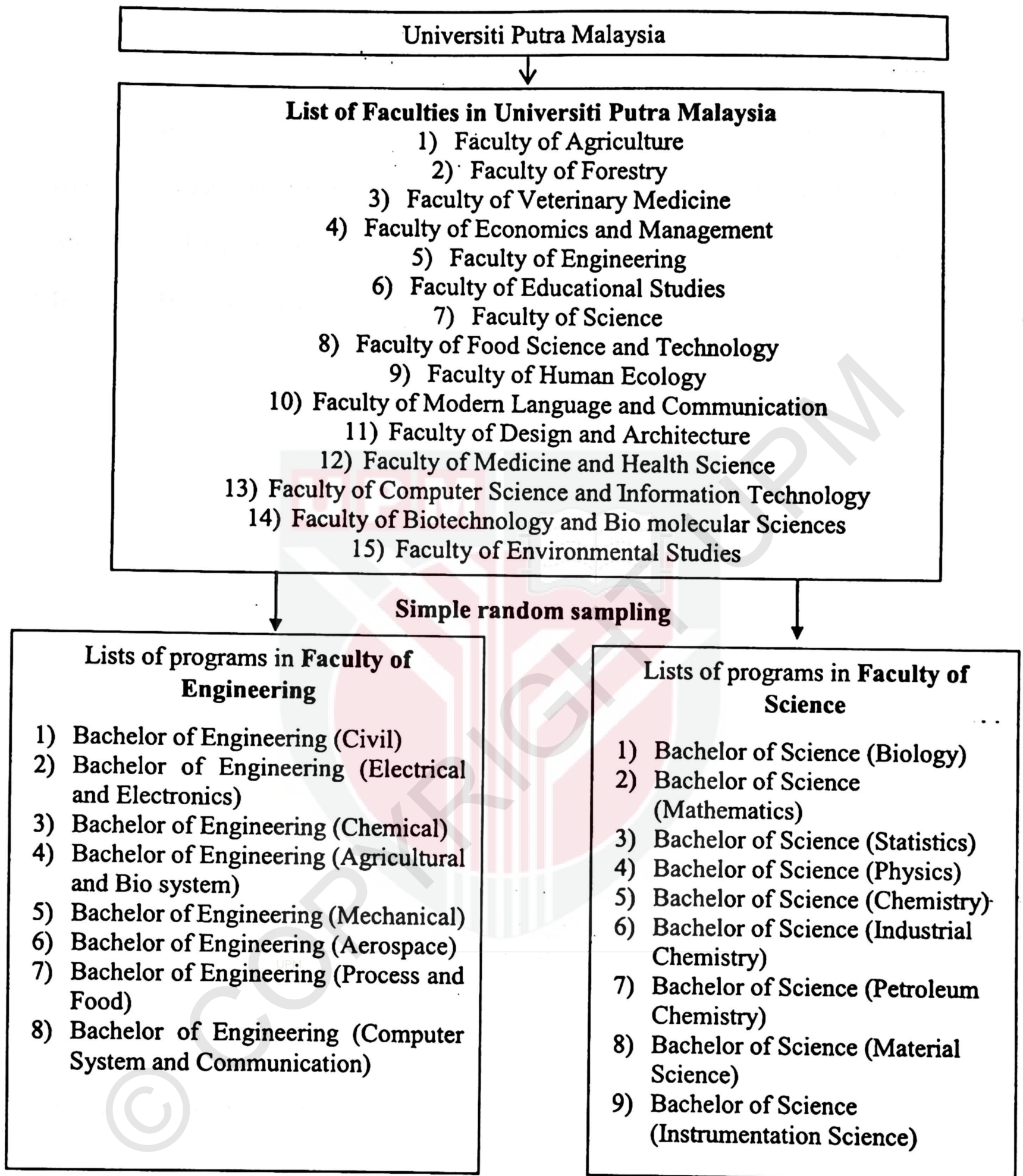


Figure 3.1: Sampling Design

3.4 Study Design

This was a cross-sectional study to investigate the association between body composition and dietary patterns with blood pressure level student of Universiti Putra Malaysia. Ethical approval was obtained from UPM Ethic Committee for Research Involving Human Subject (JKEUPM).

3.4.1 Study Protocol

A written consent was obtained from each of the participant after explaining the purpose of the research and study protocol. A set of questionnaire was used to obtain and record information on sex, ethnicity, religion, age, date of birth, education level, course of study, year of study, monthly income, family history of hypertension, height, weight, body fat percentage, waist circumference, hip circumference, blood pressure, dietary and caffeine consumption.

Blood pressure measurement was performed with a digital BP monitor OMRON HEM-7120 which was wrapped around the distal part of the left forearm in sitting position. Participants' weights was measured with the participant standing on a TANITA digital weighing scale without shoes and any external materials that might increase weight. Height was measured using tape wall SECA body meter with the participants in standing position without shoes. Body mass index (BMI) was calculated by dividing the participants' weight in kilogram by the square of their height in meter (kg/m^2). Measuring tape was used to measure waist and hip circumference whilst

OMRON Body Fat Analyser (HBF-306CN, United State) was used to measure body fat percentage of the participants.

A self-administered of Food Frequency Questionnaire (FFQ) was used to obtain detail information about all foods and beverages consumption which includes foods which might contain caffeine. In addition, Caffeine Consumption Questionnaire (CCQ) was used to assess the amount of coffee consumed by the participants. The study protocol is described in Figure 3.2.

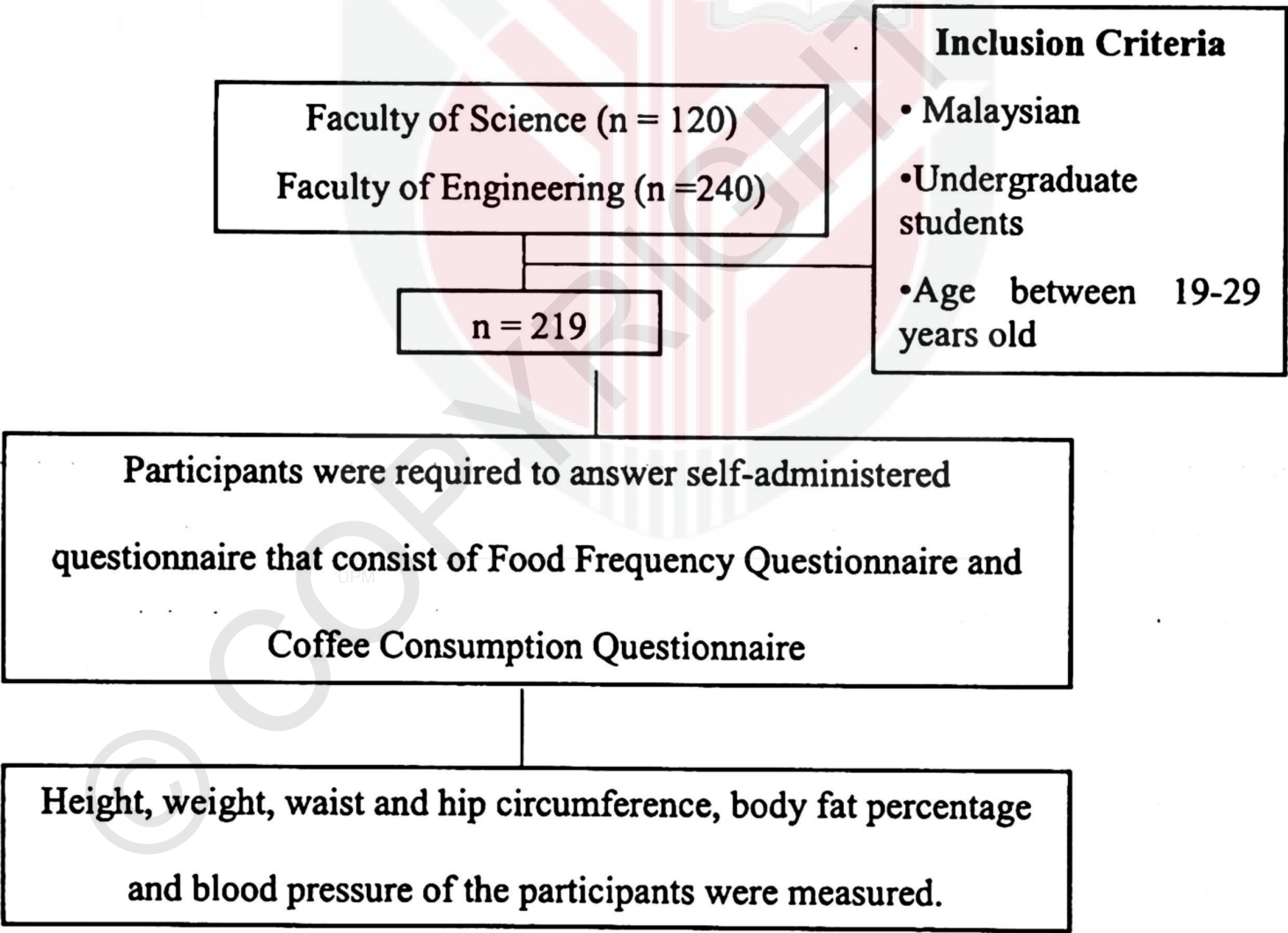


Figure 3.2: Study Protocol

3.5 Anthropometric Measurement

The measurements that were recorded were height, weight, hip circumference, and waist circumference and body fat percentage.

3.5.1 Weight, Height and BMI

Height and weight were measured by using TANITA digital weighing scale (Tanita Corporation, USA). The participants were instructed to wear light weight clothing with no shoes and stand in the center of the scale. The participants were instructed to look straight and stay still on the scale until settle recording measurement (European Health Risk Monitoring, 2002). The measurement was performed twice and average value then was calculated (Karuppiah et. al, 2011).

Height was measured using a tape wall SECA body meter (SECA,Japan). To measure height, the head was positioned in the Frankfurt horizontal plane, feet together and knees straight. For the heels, buttock and shoulder blade should be in contact with the wall. For both measurement, the value was recorded to the nearest 0.1 cm and the measurement was performed twice and average value then was calculated (Karuppiah et. al, 2011). BMI was calculated as weight divided by height squared (kg/m^2). The BMI classification of the participants were based on the WHO classification as shown in the following Table 3.3:

Table 3.3: BMI classification

Classification	Cut off Point (kg/m²)
Underweight	18.5
Normal weight	18.5 - 24.9
Overweight	25.0–29.9
Obese class I	30.0–34.9
Obese class II	35.0–39.9
Obese class III	≥ 40

Source: WHO (2008)

3.5.2 Waist and Hip Circumference

Measuring tape was used to measure waist and hip circumference. The waist circumference was measured at the end of several consecutive natural breaths, at a level parallel to the floor, midpoint between the top of the iliac crest and the lower margin of the last palpable rib in the mid axillary line whilst the hip circumference was measured at a level parallel to the floor, at the largest circumference of the buttocks. For both measurements, the measuring tape was wrapped snugly around the participants, but not to the point that the tape was constricting. The participants were instructed to stand upright during the measurement, with arms relaxed at the side, feet evenly spread apart and body weight evenly distributed (WHO, 2008). The measurement was performed twice and average value then was calculated. The waist hip ratio (WHR) was calculated and assessment the risk of abdominal obesity was based on the WHO classification as shown in the following Table 3.4:

Table 3.4: Waist, Hip and Waist to Hip ratio classification

Category	Waist circumference	Hip circumference	Waist to hip ratio
Men	≥90 cm	>102 cm	≥0.90 cm
Women	≥80 cm	>88 cm	≥0.85 cm

Source: WHO (2008)

3.5.3 Body Fat Percentage

OMRON Body Fat Analyser (HBF-306CN, United States) was used to measure body fat percentage of the participants. The measurement was performed with participants stood with both feet slightly apart while holding the grip electrode by wrapping middle finger around the groove of the hand and placed the palm of his/her hand on the top and the bottom electrodes as well as his/her thumbs up, resting on top. The arms were straighten at a 90 degree angle to the body. Cut off points to define obesity was based on the WHO classification as shown in the following Table 3.5:

Table 3.5: Body Fat Percentage classification

Category	Body Fat Percentage (%)
Men	≥25
Women	≥35

Source: WHO (2008)

3.6 Dietary patterns

A self-administered food frequency questionnaire (FFQ) was used to obtain detailed information about all the foods and beverages consumption by using a validated FFQ from Malaysian Adult Nutrition Survey (MANS) (2014). The FFQ was modified, with medium reference size and weight for medium size included for each food items to make the participants easy to complete the FFQ. Participants were instructed to tick either their food consumption in small, medium or large portion size. For each food item, participants were required to choose the frequency of consumption of each food item in the list (how many times per day, per week, per month, or do eat/very seldom).

3.7 Coffee Consumption Questionnaire (CCQ)

The Coffee Consumption Questionnaire was used to assess the amount of coffee consumed by the participants. This questionnaire was developed by Irons (2016) to record average weekly consumption of several caffeinated beverages, caffeinated foods and over-the-counter caffeinated drugs. The questionnaire was validated in United States of America, but there is no recent study in Asia region that have used this questionnaire. The questionnaire was modified based on the relevancy and additional questions was adapted from tea consumption questionnaire by Iman et. al (2001).

3.8 Measurement of Blood Pressure Levels

Blood pressure level was assessed by using a digital BP monitor OMRON HEM-7120 (Kyoto, Japan). The blood pressure reading was performed based on the methods derived from the Malaysian Clinical Practice Guideline on Hypertension Management (2008). Participants were required to sit for at least 5 minutes before the measurement. Smoking, eating, caffeine intake or any physical activities were not allowed for at least 30 minutes before the measurement. Participants had to sit with legs uncrossed in a quiet room with both back and arm supported and the cuff bladder must be placed at heart level during measurement. Two measurements were taken for each participant and the average values was calculated to be used in this study. The blood pressure level of the participants were classified based on the American Heart Association (2017) as shown in the following Table 3.6:

Table 3.6: Blood Pressure classification

Classification	Systolic BP (mmHg)	Diastolic BP (mmHg)
Normal	<120	And <80
Elevated	120-129	<80
Stage 1 hypertension	130-139	80-89
Stage 2 hypertension	≥140	≥90
Hypertensive crisis	>180	>120

Source: American Heart Association (2017)

3.9 Socio-Demographic Questionnaire

For socio-demographic factors, the participants were required to answer 10 questions which included information such as sex, ethnicity, religious, age, date of birth, education level, courses, year of study, monthly income and family history of hypertension.

3.10 Data Analysis

Statistical analyses was performed using SPSS 22.0 software (SPSS, Chicago, Ill., USA). All data were reported as frequencies, mean $\pm$ SD and the level of statistical significance was set at $p < 0.05$. The descriptive characteristics of the participants in this study were analysed by using descriptive analysis. Independent T test was performed to investigate the differenced of variables between gender. Pearson correlation test or Chi Square test was used to determine the association between body composition and dietary patterns in relation with blood pressure levels.

CHAPTER 4

4.0 RESULTS AND DISCUSSION

4.1 Socio Demographic Characteristics

A total of 219 participants from Faculty of Science and Faculty of Engineering Universiti Putra Malaysia with mean $\pm$ SD age of 21.86 ± 1.34 years with range between 19 to 26 years old were included in this study. The sex distribution was uneven as the proportion of female participants (89.0%) were higher than male participants (11.0%). Malay participants represented the largest proportion among the other ethnicity (79.9%), followed by Chinese (15.1%), Indian (2.7%) and others (2.3%). Most of the participants (41.6%) had monthly pocket money ranged from RM 100 to RM300. Only 5.0% of the participants had both mother and father history of hypertension, whilst 74.9% of the participants had no family history of hypertension. **Table 4.1** illustrates the distribution of socio demographic characteristics of the participants.

Table 4.1: Socio-demographic characteristics (n = 219)

Variables	n (%)	Mean ± SD
Age (Years)		21.86 ± 1.34
Sex		
Male	24 (11)	
Female	195 (89)	
Ethnicity		
Malay	175 (79.9)	
Chinese	33 (15.1)	
Indian	6 (2.7)	
Others	5 (2.3)	
Religion		
Islam	178 (81.3)	
Christian	5 (2.3)	
Buddha	28 (12.8)	
Hindu	7 (3.2)	
Others	1 (0.5)	
Faculty		
Faculty of Science	104 (47.5)	
Faculty of Engineering	115 (52.5)	
Current Year of study		
1 st year	55 (25.1)	
2 nd year	61 (27.9)	
3 rd year	32 (14.6)	
4 th year	71 (32.4)	
Monthly Pocket Money		
≤RM 100.00	19 (8.7)	
RM 100.01-RM 300.00	91 (41.6)	
RM 300.01-RM 500.00	70 (32)	
RM 500.01-RM 700.00	26 (11.9)	
RM 700.01-RM 900.00	5 (2.3)	
>RM 900.00	8 (3.7)	
Family History of Hypertension		
Mother	26 (11.9)	
Father	18 (8.2)	
Mother and Father	11 (5.0)	
No	164 (74.9)	

4.2 Blood pressure profiles of the participants

The mean $\pm$ SD of systolic blood pressure (SBP) and diastolic blood pressure (DBP) are summarised in **Table 4.2**. The mean $\pm$ SD of SBP and DBP were 118.15 ± 13.40 mmHg and 76.10 ± 9.51 mmHg respectively. Male participants had a significantly higher mean $\pm$ SD of SBP (134.54 ± 17.80 mmHg, $p < 0.001$) and DBP level (80.25 ± 9.85 mmHg, $p = 0.02$) compared to female participants.

Blood pressure profiles were classified into several classifications in **Table 4.3**. Overall, 56.6% of the undergraduate university students were normotensive, 10.5% had elevated blood pressure and 33.0% were hypertensive. Only one male participant was categorised as hypertensive crisis. In total, elevated blood pressure (12.5%) and hypertension (70.8%) prevalence in male were higher than female participants.

Table 4.2: Mean ± SD of blood pressure profiles in all participants (n=219)

Variables	Mean ± SD				
	Total (n=219)	Male (n=24)	Female (n=195)	p- value	t- value
Blood Pressure					
Systolic (mmHg)	118.15 ± 13.40	134.54 ± 17.80	116.13 ± 11.27	<0.001	4.95
Diastolic (mmHg)	76.10 ± 9.51	80.25 ± 9.85	75.59 ± 9.37	0.02	2.29

p-value is for independent t-test on blood pressure profiles between sexes

Table 4.3: Blood Pressure Profiles Classification (n=219)

Variables	n (%)		
	Total (n=219)	Male (n=24)	Female (n=195)
*Blood Pressure			
Normal	124 (56.6)	4 (16.7)	120 (65.0)
Elevated	23 (10.5)	3 (12.5)	20 (10.3)
Stage 1 Hypertension	47 (21.5)	8 (33.3)	39 (20.0)
Stage 2 Hypertension	24 (11.0)	8 (33.3)	16 (8.2)
Hypertensive Crisis	1 (0.5)	1 (4.2)	0 (0.0)

*Classification is based on American Heart Association (2017)

This study observed that 70.8% of male participants had hypertension, whilst only 28.2% of female participants were hypertensive. The high prevalence of hypertension in men might be due to their unhealthy nutritional habits (Abdel-megeid et al., 2011). Prasanna et. al. (2015) suggested a lifestyle modification and adoption of the Dietary Approaches to Stop Hypertension (DASH) diet as the SBP and DBP were decreased significantly with the effect of lifestyle changes and implementation of DASH diet in 186 hypertensive patients (SBP: -7.00 ± -3.82 mmHg, $p = 0.012$, DBP: -6.55 ± -4.74 mmHg, $p = 0.034$).

A number of cross sectional studies have studied the prevalence of hypertension and the association between hypertension and its risk factors in university students (Lee et al., 2010; Aliyu, Ahmad, & Oyeyemi, 2014; Balami, Salmiah & Nor Afiah, 2014; Baig et. al., 2015; Peltzer et. al., 2017). Aliyu, Ahmad and Oyeyemi (2014) found that male had higher prevalence of hypertension (18.0%) in comparison with female (7.1%) in their study population. Lee et al. (2010) also found that male had higher prevalence of hypertension compared with female, as 21.4% of male participants were hypertensive whilst only 9.0% female participants were hypertensive. Peltzer et al. (2017) found similar trend of hypertension in university students, where 9.4% of male participants were hypertensive compared with female participants (5.3%).

4.3 Factors associated with blood pressure level

4.3.1 Body Composition

Table 4.4 summarises the mean ± SD of body weight, height, body mass index (BMI), waist circumference (WC), hip circumference (HR), waist to hip ratio (WHR) and body fat percentage (BF%). Male participants were found to have a significantly higher body weight (68.28 ± 21.64 kg, $p=0.001$), height (167.00 ± 7.00 cm, $p=0.001$), BMI (24.30 ± 6.26 kg/m², $p=0.21$), waist circumference (80.44 ± 17.96 cm, $p=0.001$), hip circumference (98.14 ± 12.99 cm, $p=0.11$) and waist to hip ratio (0.81 ± 0.07 , $p=0.001$) compared to female participants. However, female participants had a higher BF % (30.70 ± 6.96 %, $p=0.001$) compared to male participants.

Body composition classifications are summarises in Table 4.5. Overall, 24.6% of the participants were categorised as overweight and obese. Only 3 participants were classified as obese class III. In general, female had a higher risk of abdominal obesity compared with male participants.

Table 4.4: Body composition measures (n=219)

Variables	Mean ± SD			p-value	t-value
	Total (N=219)	Male (n=24)	Female (n=195)		
Body Weight (kg)	57.24 ± 14.28	68.28 ± 21.64	55.88 ± 12.52	0.001	4.16
Height (cm)	158.00 ± 6.00	167.00 ± 7.00	156.00 ± 5.00	0.001	6.77
BMI (kg/m ²)	23.02 ± 5.25	24.30 ± 6.26	22.87 ± 5.10	0.21	1.27
WC (cm)	72.59 ± 12.19	80.44 ± 17.96	71.62 ± 10.96	0.001	3.43
HC (cm)	94.81 ± 10.75	98.14 ± 12.99	94.41 ± 10.41	0.11	1.61
WHR	0.76 ± 0.07	0.81 ± 0.07	0.76 ± 0.06	0.001	4.05
BF% (%)	29.95 ± 7.20	23.91 ± 6.38	30.70 ± 6.96	0.001	-4.55

p-value is for independent t-test on blood pressure profiles between sexes

Abbreviations: BMI, body mass index; WC, waist circumference; HC, hip circumference; WHR, waist to hip ratio; BF%, body fat percentage

Table 4.5: Body composition classification of all participants (n=219)

Variables	n (%)		
	Total (n=219)	Male (n=24)	Female (n=195)
Body mass index (kg/m²)			
Underweight	35 (16.0)	3 (12.5)	32 (16.4)
Normal	127 (58.0)	13 (54.2)	114 (58.5)
Overweight	34 (15.5)	5 (20.8)	29 (14.9)
Obese Class I	13 (5.9)	2 (8.3)	11 (5.6)
Obese Class II	4 (1.8)	0 (0.0)	4 (2.1)
Obese Class III	3 (1.4)	1 (4.2)	2 (1.0)
Waist circumference (cm)			
Normal	173 (79.0)	20 (83.3)	153 (78.5)
At risk of chronic diseases	46 (21.0)	4 (16.7)	42 (21.5)
Hip circumference (cm)			
Normal	69 (31.5)	18 (75.0)	51 (26.2)
At risk of chronic diseases	150 (68.5)	6 (25.0)	144 (73.8)
Waist to Hip Ratio			
Normal	199 (90.9)	21 (87.5)	178 (91.3)
At risk of chronic diseases	20 (9.1)	3 (12.5)	17 (8.7)
Body fat percentage (%)			
Normal	159 (72.6)	16 (66.7)	143 (73.3)
At risk of obesity	60 (27.4)	8 (33.3)	52 (26.7)

Classification is based on World Health Organisation (2008)

The results from this study found that there was a significant difference in waist circumference (WC), waist to hip ratio (WHR) and body fat percentage (BF%) between male and female participants ($p < 0.0001$). However, there is no significant difference in Body Mass Index (BMI) and hip circumference (HC) between male and female participants ($p < 0.0001$).

The participants' mean $\pm$ SD of BMI in this study was $23.02 \pm 5.25 \text{ kg/m}^2$. Overall, 15.5% of the participants were overweight and 9.1% of the participants were classified as obese. The percentage of overweight and obese in this study is still lower than the National Health and Morbidity Survey (NHMS) 2015 (Institute for Public Health, 2015).

4.3.2 Dietary Intake

The mean $\pm$ SD of amount of food intake per day are shown in Table 4.6. There were 14 food groups analysed in total. The most food group consumed was beverages ($2036.94 \pm 1171.84 \text{ g}$), followed by cereal and cereal products ($688.72 \pm 476.01 \text{ g}$) and vegetables ($271.44 \pm 347.73 \text{ g}$). Between sexes, male participants consumed more cereal and cereal products ($858.52 \pm 869.42 \text{ g}$), meat and meat products ($139.68 \pm 86.73 \text{ g}$), egg ($53.85 \pm 87.26 \text{ g}$), alcoholic beverages ($2.90 \pm 9.63 \text{ g}$) and bread spread ($11.08 \pm 20.62 \text{ g}$) compared to female participants.

Table 4.7 illustrates the frequency of food intake per day in all 14 food groups. The frequently food group consumed was beverages (6.43 ± 3.20), followed by cereal and cereal products (3.76 ± 2.29) and vegetables (3.65 ± 4.36). Male participants had a higher frequency of cereal and cereal products (4.35 ± 3.07), meat and meat products (1.69 ± 0.10), egg (0.77 ± 0.91), milk and milk products (0.78 ± 0.85), vegetables (3.98 ± 3.66), beverages (7.11 ± 2.44) and seasonings (2.38 ± 1.97) intake compared to female participants.



Table 4.6: Mean $\pm$ SD of daily dietary intake of participants (n=219)

Food (g)	Group	Mean $\pm$ SD			p- value	t- value
		Total	Male	Female		
Cereals and cereal products		688.72 $\pm$ 476.01	858.52 $\pm$ 869.42	667.82 $\pm$ 401.25	0.299	1.06
Fast foods		178.12 $\pm$ 209.18	126.10 $\pm$ 106.61	184.34 $\pm$ 217.59	0.218	-1.24
Meat and meat products		131.72 $\pm$ 145.72	152.38 $\pm$ 78.81	129.28 $\pm$ 151.65	0.483	0.70
Fish and seafood		64.75 $\pm$ 82.68	48.61 $\pm$ 45.19	66.80 $\pm$ 86.15	0.321	-0.99
Egg		41.42 $\pm$ 49.53	53.85 $\pm$ 87.26	39.80 $\pm$ 42.37	0.445	0.78
Nuts and nut products		48.01 $\pm$ 77.41	38.09 $\pm$ 38.53	49.21 $\pm$ 80.86	0.556	-0.59
Milk and milk products		103.83 $\pm$ 179.02	75.61 $\pm$ 72.04	107.58 $\pm$ 188.54	0.422	-0.80
Vegetables		281.73 $\pm$ 350.15	268.97 $\pm$ 260.20	283.36 $\pm$ 360.60	0.850	-0.19
Fruits		275.76 $\pm$ 384.56	192.63 $\pm$ 220.28	286.15 $\pm$ 399.58	0.273	-1.10
Beverages		2046.28 $\pm$ 1166.33	1955.97 $\pm$ 703.85	2057.46 $\pm$ 1212.15	0.689	-0.40
Alcoholic beverages		29.28 $\pm$ 29.73	23.23 $\pm$ 18.89	31.54 $\pm$ 33.75	0.702	-0.40
Confectionery		147.17 $\pm$ 192.91	94.26 $\pm$ 69.68	153.57 $\pm$ 201.98	0.005	-2.87
Bread spread		12.27 $\pm$ 18.50	15.65 $\pm$ 23.14	11.86 $\pm$ 17.92	0.427	0.80
Seasonings		19.72 $\pm$ 22.14	18.40 $\pm$ 16.18	19.89 $\pm$ 22.79	0.767	-0.30

p-value is for independent t-test on dietary intake between sexes

Table 4.7: Mean ± SD of frequency of food intake per day (n=219)

Food (times)	Group	Mean ± SD			p- value	t- value
		Total	Male	Female		
Cereals and cereal products		3.76 ± 2.29	4.35 ± 3.07	3.69 ± 2.17	0.182	1.34
Fast foods		1.30 ± 1.47	1.02 ± 0.86	1.33 ± 1.52	0.336	-0.96
Meat and meat products		1.54 ± 1.26	1.85 ± 0.89	1.50 ± 1.29	0.219	1.23
Fish and seafood		1.20 ± 1.33	0.92 ± 0.85	1.24 ± 1.38	0.281	-1.08
Egg		0.63 ± 0.65	0.77 ± 0.91	0.61 ± 0.61	0.256	1.14
Nuts and nut products		0.57 ± 0.66	0.54 ± 0.64	0.56 ± 0.67	0.911	-0.11
Milk and milk products		0.81 ± 1.47	0.81 ± 0.86	0.81 ± 1.54	1.000	0.00
Vegetables		3.77 ± 4.38	3.98 ± 3.66	3.74 ± 4.47	0.802	0.25
Fruits		2.14 ± 3.22	1.80 ± 2.49	2.19 ± 3.31	0.589	-0.54
Beverages		6.43 ± 3.20	7.11 ± 2.44	6.35 ± 3.27	0.176	1.38
Alcoholic beverages		0.14 ± 0.13	0.09 ± 0.06	0.16 ± 0.14	0.423	-0.84
Confectionery		2.03 ± 2.38	1.45 ± 1.53	2.10 ± 2.45	0.215	-1.24
Bread spread		0.56 ± 0.82	0.51 ± 0.61	0.56 ± 0.85	0.820	-0.23
Seasonings		2.29 ± 2.16	2.59 ± 1.92	2.26 ± 2.19	0.490	0.69

p-value is for independent t-test on dietary intake between sexes

In this present study, the findings found that amongst the food groups that were highly consumed by the participants were cereals and cereal products (688.72 ± 476.01 g/day), vegetables (281.73 ± 350.15 g/day), fruits (275.76 ± 384.56 g/day), fast foods (178.12 ± 209.18 g/day), confectionery (147.17 ± 192.91 g/day) and meat (131.72 ± 145.72 g/day). The least food groups consumed by the participants were egg (41.42 ± 49.53 g/day) as well as nuts and nut products (41.42 ± 49.53 g/day).

The findings showed that the participants had low frequency of milk and milk products consumption (0.81 ± 1.47 times/day). However, fast foods (1.30 ± 1.47 times/day), confectionery (2.03 ± 2.38 times/day) and seasonings (2.29 ± 2.16 times/day) frequency intake were high. The high consumption of fast foods, sugar rich product such as confectionery and high salt food in the participants might be due to the availability of the foods since UPM is located in an urbanised location. Bishwajit (2016) reported that people who resided in urban area were most likely to consume fast foods and diet high in fats and sugars. This explains the possible reason of high consumption of fast foods, confectionery and high salt food observed in the participants.

The mean $\pm$ SD frequency of intake for confectionery, fruits and vegetables from this study are comparable with the mean $\pm$ SD frequency of intake for confectionery, fruits and vegetables from the Malaysian Adult Nutrition Survey (MANS) 2014. For confectionery, the frequency of intake in this study was 2.03 ± 2.38 times/day. Data from MANS 2014 reported that the mean frequency of intake for confectionery in the survey was 2.91 days/week (95% CI: 2.80 – 3.02).

The mean $\pm$ SD frequency of fruits intake in this study was 2.14 ± 3.22 times/day, whilst MANS 2014 reported that Malaysian adults aged 18 years old and above consumed fruits approximately 3.70 days/week (95% CI: 3.58 – 3.81). The findings indicated that participants in this present study had a higher frequency of fruits consumption than the average Malaysian population.

In this present study, the frequency of vegetables intake was 3.77 ± 4.38 times/day. Meanwhile, data from the MANS 2014 observed that the mean frequency of intake for vegetables among Malaysian adults of 18 years and above in the survey was 5.90 days/week (95% CI: 5.82– 5.99). The findings indicated that participants in this present study had higher frequency of vegetables consumption than the average Malaysian population. The frequency of intake of vegetables in this study is aligned with the Malaysian Dietary Guideline (MDG) 2010, as MDG 2010 suggested 7.0 days/week of vegetables consumption.

Norimah et al. (2008) reported the food consumption pattern based on the findings from the previous MANS 2003. The top 10 daily food consumed by Malaysians were rice, marine fish, green leafy vegetables, sweetened condensed milk, powdered milk, bread, biscuit, *local kuih*, chicken egg and anchovies. Within cereals and cereal products group, rice was the most consumed food as 97.15% of the participants consumed rice daily with mean frequency intake per day of 2.00. Marine fish was the most consumed food from fish and seafood group. It was reported that 40.78% of participants consumed marine fish with the mean frequency intake of 1.61 times per day. The study reported that 39.89 of the participants consumed 1.47 times

of green leafy vegetables daily. Sweetened condensed and powdered milk were consumed 1.57 and 1.41 times daily respectively. The mean frequency intake per day for bread and anchovies were 1.24 times per day. As for biscuit and *local kuih*, both were consumed 1.25 times daily. The mean frequency intake per day for egg was 1.15 times per day. The findings were in coherent with the results from this study in term of food consumption pattern.

In a cross sectional study carried out by Al-naggar, Bobryshev and Noor (2013) in 1100 undergraduate students in a public university in Malaysia, it was found that 25.2% of the participants consumed meat daily. As for fruits, 28.8% of the participants consumed fruits twice daily. It was noted that almost 80% of students consumed vegetables twice per day. The findings on the frequency of fruits and vegetables in this present study is in agreement with Al-naggar et al. (2013) findings in their study. Results from both studies indicated that Malaysian university students consumed fruits and vegetables adequately and fulfilled the MDG 2010 recommendation and the findings from this present study is in coherent with previous studies.

4.3.3 Coffee consumption

The amount of coffee consumed are summarised in Table 4.8. The mean $\pm$ SD of weekly coffee intake was 301.72 ± 110.42 ml. Caffeinated coffee (93.1%) was the most consumed coffee by the participants. Instant coffee (71.8%) was the most popular pick amongst other types of coffee. Although instant coffee was the most consumed but 53.4% of the participants chose to prepare their own coffee. The participants reported to have used coffee bag (mean $\pm$ SD: 0.99 ± 0.07) or teaspoons of coffee

(mean $\pm$ SD: 1.36 ± 0.61) during the preparation. More than half of the participants (56.0%) added sugar into their prepared coffee.

The findings from this study observed that participants consumed 66.43 ± 135.53 ml of coffee daily with mean $\pm$ SD frequency of intake per day was 0.32 ± 1.06 times. The amount consumed by the participants was low compared to the data of coffee consumption from MANS 2004 and MANS 2014. In MANS 2004, 64.5% Malaysian adult consumed coffee daily with mean intake 170.51 ml/day. Whilst in MANS 2014, 53.2% Malaysian adult consumed coffee daily with mean intake of 211.75 ml/day. It was found that 61.6% of the participants consumed coffee at least once in a week and caffeinated coffee was the preferred type of coffee (93.1%). Instant coffee (71.8%) was the most popular type of coffee preparation which is in contrast with the findings from Lee, You and Chang (2013).

Lee, You and Chang (2013) carried out a cross sectional study to investigate the food habits score, nutrients intake and dietary quality with regard to coffee consumption in 190 college students in Incheon, South Korea. The average daily coffee intake of male and female college students were 156.8 ml and 157.4 ml, respectively. Male participants consumed caramel macchiato, cafe latte, americano, cafe mocha, and cappuccino whilst female participants preferred caramel macchiato, Americano, cafe mocha, cafe latte, and cappuccino. Korean college students consumed more coffee in term of volume (156.8 ml and 157.4 ml) as compared with findings from this present study (66.43 ml).

Table 4.8: Coffee consumption pattern of participants (n=219)

Variables	n (%)	Mean $\pm$ SD
Please indicate how many servings of coffee you consume, on average, each week (ml).		301.72 $\pm$ 110.42
Amount of coffee intake per day (g)		66.43 $\pm$ 135.53
Frequency of coffee intake per day (times)		0.32 $\pm$ 1.06
Do you drink coffee at least once a week?		
Yes	135 (61.6)	
No	84 (38.4)	
What type of coffee that you usually consume?		
Caffeinated coffee	162 (93.1)	
Decaffeinated coffee	12 (5.5)	
How do you prepare your coffee?		
Recipe	93 (53.4)	
Restaurant	30 (17.2)	
Bottle only	17 (9.8)	
Instant coffee	125 (71.8)	
If recipe,		
When you making coffee how much do you use bags per cup?		0.99 $\pm$ 0.07
When you making coffee how much do you use teaspoons per cup?		1.36 $\pm$ 0.61
Do you usually add anything to you tea?		
Yes	75 (78.9)	
No	20 (21.1)	
If yes, what do you add to your coffee?		
Sugar	42 (56.0)	
Fresh milk	10 (13.3)	
Condensed milk	31 (41.3)	
Skimmed milk	1 (0.5)	
Creamer	19 (25.3)	

4.4 Association between body composition with blood pressure level

4.4.1 Association between weight status (BMI), body fat percentage, waist circumference, hip circumference and waist to hip ratio with systolic blood pressure (SBP)

The Pearson's correlation coefficients (r) between weight status (BMI), body fat percentage (BF%), waist circumference (WC), hip circumference (HC) and waist to hip ratio (WHR) with SBP are presented in Figure 4.1, Figure 4.2, Figure 4.3, Figure 4.4 and Figure 4.5. It was found that BMI ($r=0.34, p<0.001$), BF% ($r=0.16, p=0.016$), WC ($r=0.37, p<0.001$), HC ($r=0.36, p<0.001$) and WHR ($r=0.21, p=0.002$) were significantly associated with SBP levels. These associations indicate that increase in BMI, BF%, WC, HC and WHR will result in increase of SBP.

4.4.2 Association between weight status (BMI), body fat percentage, waist circumference, hip circumference and waist to hip ratio with diastolic blood pressure (DBP)

The association between weight status (BMI), body fat percentage (BF%), waist circumference (WC), hip circumference (HC) and waist to hip ratio (WHR) with DBP are presented in Figure 4.6, Figure 4.7, Figure 4.8, Figure 4.9 and Figure 4.10. It was also found out in the study that there were associations between BMI, BF% ($r=0.31, p<0.001$), WC ($r=0.42, p<0.001$), HC ($r=0.45, p<0.001$) and WHR ($r=0.19, p=0.004$) with DBP levels. The findings demonstrate that DBP can be influenced by BMI, BF%, WC, HC and WHR.

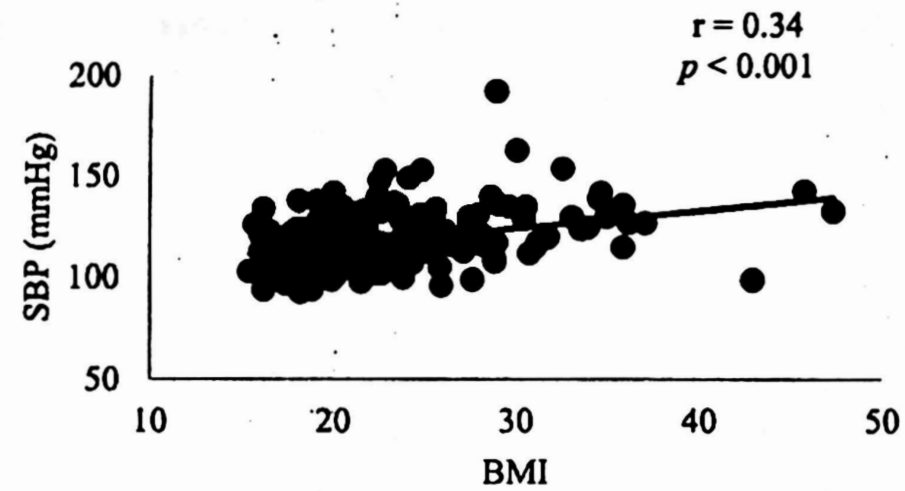


Figure 4.1: Association between BMI and SBP

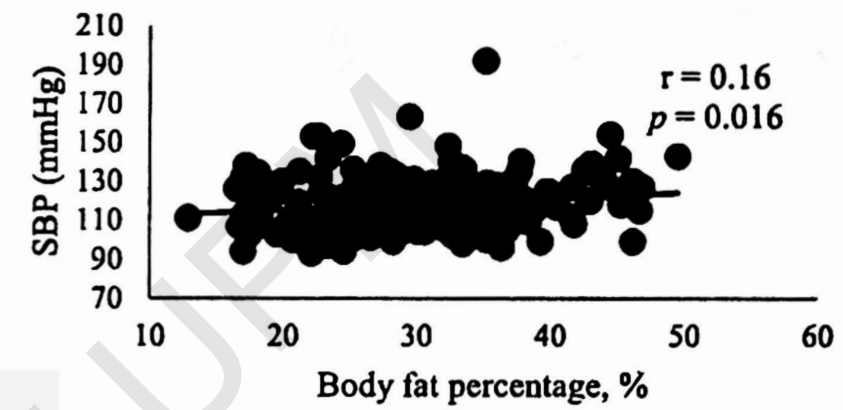


Figure 4.2: Association between BF% and SBP

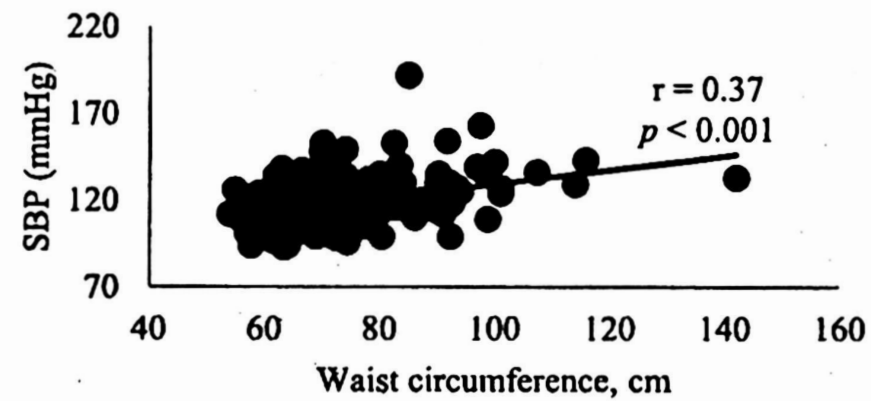


Figure 4.3: Association between WC and SBP

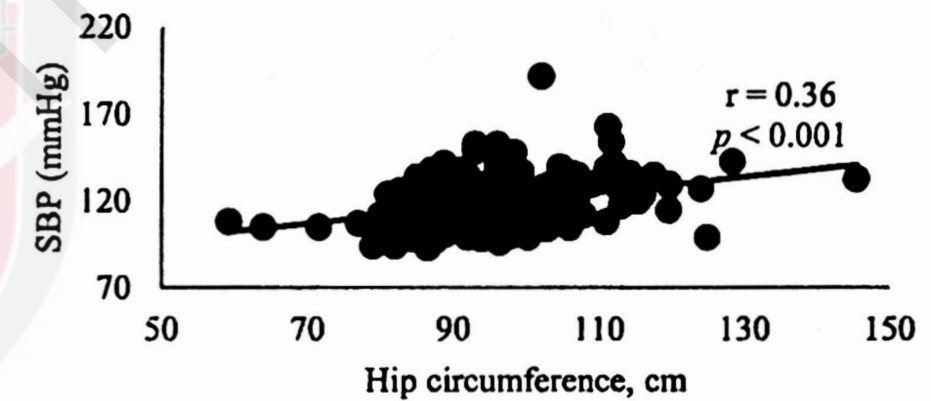


Figure 4.4: Association between HC and SBP

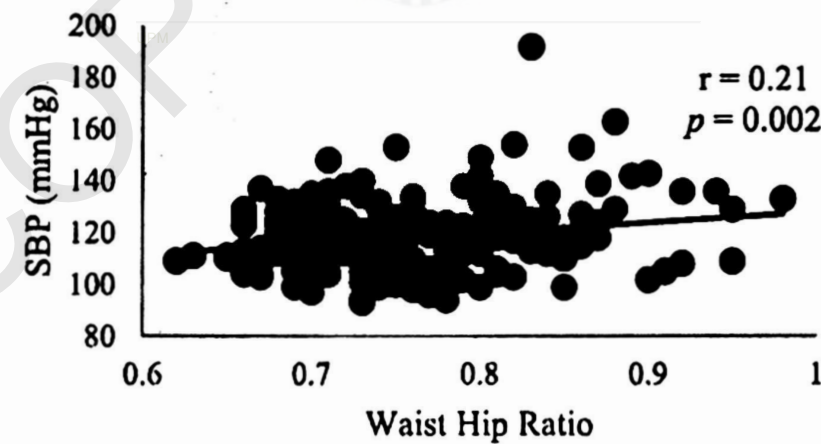


Figure 4.5: Association between WHR and SBP

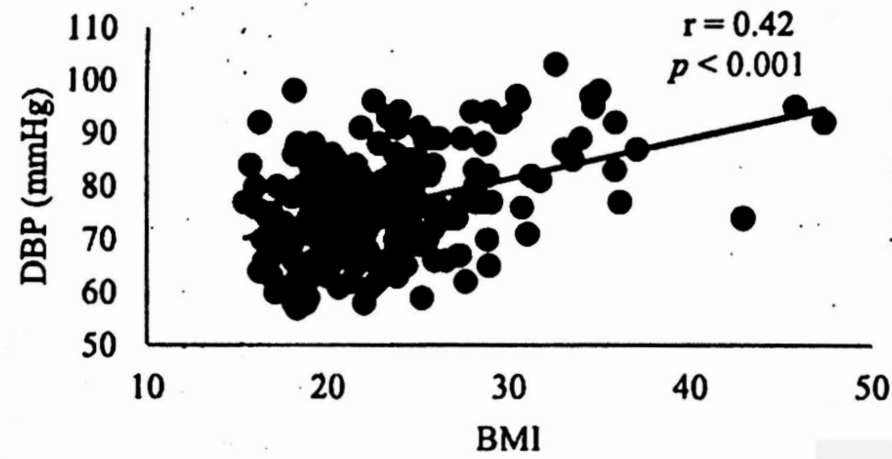


Figure 4.6: Association between BMI and DBP

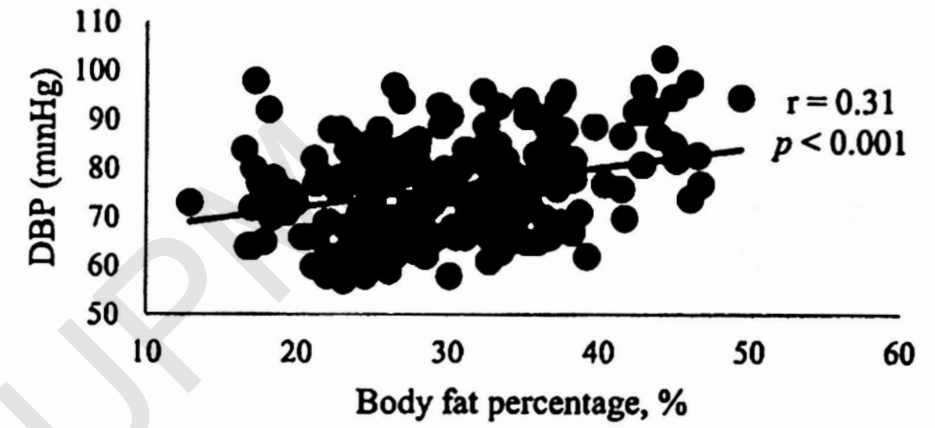


Figure 4.7: Association between BF% and DBP

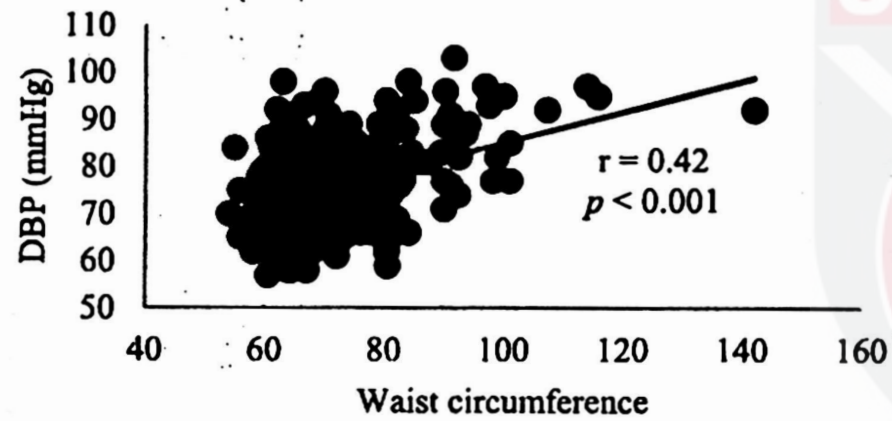


Figure 4.8: Association between WC and DBP

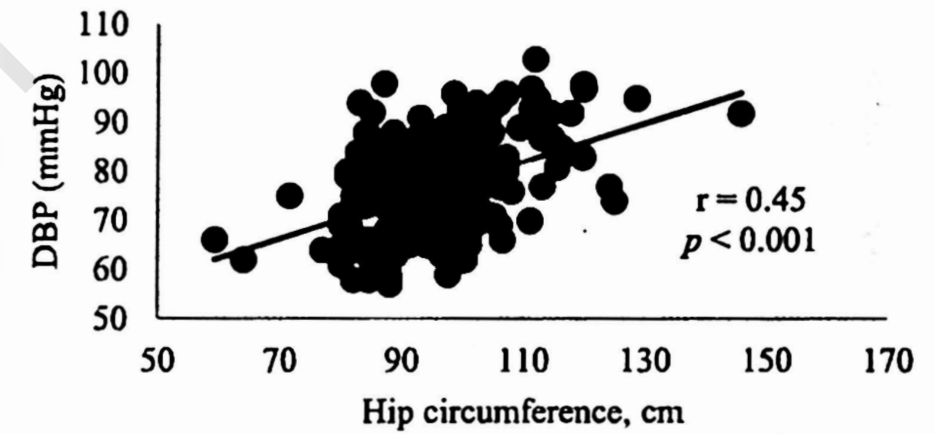


Figure 4.9: Association between HC and DBP

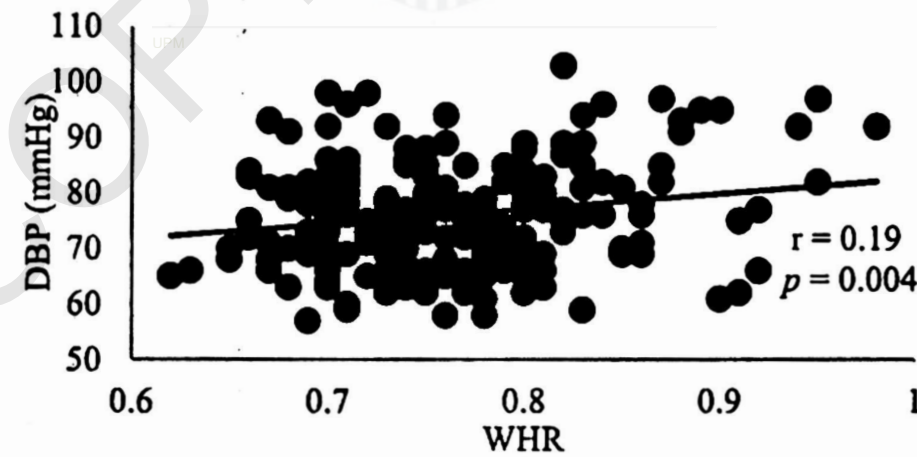


Figure 4.10: Association between WHR and DBP

The positive associations observed between BMI, BF%, WC, HC and WHR with SBP and DBP levels indicate that these parameters will potentially result in increment in SBP and DBP levels. The finding from this study is consistent with other previous studies (Siani et al., 2002; Al-sendi, Shetty, Musaiger, & Myatt, 2003; Liu, Ikeda, & Yin, 2004; Drøyvold, Midthjell, Nilsen, & Holmen, 2005; Arruda et al., 2009; Jan et al., 2011; Cohen et al., 2012; Sharaye, Olorunshola, Ayo, & Dikki, 2013; Aliyu et al., 2014; Mushengezi & Chillo, 2014; Pramanik, Koley, & Biswas, 2015; Lelong et al., 2015; Kalani, Salimi, & Rafiei, 2015; Patil, Rajaram, BS, & Seeri, 2015; Phing, Hoa, & Hua, 2017; Yajun et al., 2017).

Siani et al. (2002) carried out 1-year follow up study in 768 Italian men to investigate the association between overweight, high BP with insulin resistance. It was found that BMI was significantly associated with SBP ($r = 0.14, p < 0.01$) and DBP levels ($r = 0.21, p < 0.01$). Liu et al. (2004) carried out a cross sectional study in 1901 middle-aged Chinese men and women from five ethnic groups, the Han people (Beijing, Guangzhou, Shijiazhuang, Shanghai and Chongqing), the Uygur people (Hetian, Tulufan and Urumqi), the Kazakh people (Altai), the Tibetan people (Lhasa) and the Bouyei people (Guiyang). It was also found that there was a significant association between BMI with SBP (Hans: $r = 0.21, p < 0.01$; Uygurs: $r = 0.46, p < 0.01$; Kazakhs: $r = 0.47, p < 0.01$; Tibetans: $r = 0.11, p > 0.05$; Bouyei: $r = 0.26, p < 0.01$) and DBP (Hans: $r = 0.28, p < 0.01$; Uygurs: $r = 0.50, p < 0.01$; Kazakhs: $r = 0.54, p < 0.01$; Tibetans: $r = 0.13, p > 0.05$; Bouyei: $r = 0.32, p < 0.01$). The different association between ethnics may be affected by different dietary habits that each ethnic group practice. The Bouyei ethnic group had the lowest mean $\pm$ SD of SBP (112.30 ± 1.50

mmHg) and DBP (64.80 ± 0.90 mmHg) respectively due to low salt intake and consumption of homemade oil-tea camellia.

In a cross sectional studies carried out by Jan et al. (2011) in 296 healthy, Malaysian adults aged between 18 to 59 years, the associationS between waist and hip circumference, body fat with SBP and DBP levels were investigated. It was found that BMI was significantly associated with SBP ($r = 0.11, p < 0.05$) and DBP levels ($r = 0.20, p < 0.01$). The result indicate that BMI is one of predictor of hypertension. The possible mechanism of the association between BMI with SBP and DBP were explained by an inadequate vasodilatation in the presence of increased blood volume and cardiac output, which are natural consequences of an increased mass (Dua, Bhuker, Sharma, Dhall, & Kapoor, 2014).

The association between BF %, WC and WHR with BP level were investigated in a cross sectional study carried out by Al-Sendi et al. (2003) in 504 Bahraini schoolchildren aged 12 to 17 years old. It was found that BF % was significantly associated with SBP (Male: $r = 0.28, p < 0.001$, female: $r = 0.47, p < 0.001$) and DBP levels (Male: $r = 0.18, p < 0.01$, female: $r = 0.38, p < 0.001$). There was significant associations between WC with SBP (Male: $r = 0.38, p < 0.001$; Female: $r = 0.51, p < 0.001$) and DBP levels (Male: $r = 0.27, p < 0.001$; Female: $r = 0.37, p < 0.001$). WHR was significantly associated with SBP (Male: $r = 0.21, p < 0.01$; Female: $r = 0.31, p < 0.001$) and DBP levels (Male: $r = 0.14, p < 0.05$; Female: $r = 0.14, p < 0.05$). These associations indicate that BF % which is one of the obesity indicators that can be a vital factor that associated with increased risk of developing increased BP. In the study,

WC and WHR were used to measure excess accumulation of fat in the abdominal region. The findings might be helpful to explain the mechanism of fat distribution related to elevated blood pressure. Alteration in insulin sensitivity was suggested as part of the mechanism contributed to how central fat deposition may affect blood pressure level (Tamborlane et al., 2004). Excessive insulin secretion might cause water retention and stimulation of sympathetic activity, which might increase blood pressure level.

In another cross sectional study carried out by Jan et al. (2011) in 296 healthy Malaysian adults aged 18 to 59 years old, it was found that there was no significant association between SBP and BF% ($p > 0.05$). However, there was a significant association found between BF % and DBP ($r = 0.20, p < 0.01$). It was also found that there was a significant association between WC with SBP ($r = 0.11, p < 0.05$) and DBP ($r = 0.27, p < 0.01$). HC was significantly associated with SBP ($r = 0.04, p < 0.05$) and DBP ($r = 0.20, p < 0.01$). WHR was significantly associated with SBP ($r = 0.15, p < 0.01$) and DBP ($r = 0.19, p < 0.01$). It was explained in the study that visceral fat had better association with SBP and DBP levels compared with BF %. Individuals with a higher fat mass have a higher tendency to experience increase in BP level especially women as long term increase in body fat is associated with increase in BP level (Siervogel et al., 1998). Al-sendi et al. (2003) explained that WC is a better predictor of abdominal fat accumulation compared to WHR as hip might reflect changes in bones and muscles more than changes in fat.

Siani et al. (2002) found the association between WC and WHR with SBP and DBP levels in a cross sectional study carried out in 1079 Italian men aged ranged from 25 to 75 years old. There was significant associations observed between WC with SBP ($r = 0.23, p < 0.01$) and DBP levels ($r = 0.27, p < 0.01$). It was also found that there was significant associations between WHR with SBP ($r = 0.22, p < 0.01$) and DBP levels ($r = 0.20, p < 0.01$). WC was described as an index of central adiposity that indicates metabolic syndrome.

Phing et al. (2017) carried out a pilot study in 35 Malaysian university students to investigate the association between obesity indices and cardiovascular risk factors. It was found that there was significant associations between WC with SBP ($r = 0.69, p < 0.001$) and DBP levels ($r = 0.47, p = 0.004$). WHR was significantly associated with SBP ($r = 0.59, p < 0.001$) and DBP levels ($r = 0.34, p = 0.047$). The findings in this study indicate that WC is the best predictor of the cardiovascular risk factors as compared with other measures such as HC and WHR.

4.4.3 Association between age and dietary intake including coffee consumption with blood pressure level

The findings shows that there was no association found between dietary intake and coffee consumption with BP levels. The results are tabulated in **Table 4.9**. Previous studies investigated the association between dietary intake with blood pressure and dietary intake was associated with BP levels (Lee et al., 2010; Lelong et al., 2015; Ndanuko, Tapsell, Charlton, Neale, & Batterham, 2016).

Lelong et al. (2015) investigated the association between dietary intake with blood pressure in 8,670 healthy French adults with mean $\pm$ SD age of 50.3 ± 13.8 years. A 3-day 24-hour dietary recall was used to record dietary intake of the participants. Total energy, macronutrients and minerals (sodium, potassium, calcium, magnesium, and phosphorus) were calculated. It was found that there was no association between dairy products consumption with BP levels. However, there was a significant, negative association between fiber intake with SBP in both sexes (Men: $\beta = -0.08$, $p = 0.02$ in men; Women: $\beta = -0.12$, $p < 0.0001$). Intake of fruits and vegetables which were high in fiber might decrease BP levels due to the high content of potassium and fiber (Whelton et al., 2004).

The association between dietary pattern and BP level was also investigated in a cross sectional study carried out by Ndanuko et al. (2016) in 328 Australian adults. To assess the dietary intake, a 4-day food record was collected, consisted of 3 weekdays and 1 weekend days. Food intake was categorised into several dietary patterns. Seeds, nuts, fruits and seafood dietary pattern was significantly and inversely associated with SBP ($F[7320]=15.248$, $p<0.0005$, adjusted $R^2=0.234$) and DBP levels ($F[7320]=17.351$, $p<0.0005$, adjusted $R^2=0.259$). A possible explanation for the negative association was the combination nutrients, primarily potassium, magnesium, polyphenols and long-chain n-3 fatty acids which were highly available in seeds, nuts, fruits and seafood (Ndanuko et al., 2016). Under reporting might be one of the

The association between dietary pattern with blood pressure was studied in a cross sectional study carried out by Lee et al. (2010) in healthy Chinese 39 252 men age ranged from 40 to 74 years old. Food frequency questionnaire (FFQ) was used to evaluate the dietary intake of the participants. Food intake was categorised into several dietary patterns. Amongst all dietary patterns, the findings found that 'fruit and milk' dietary pattern was inversely associated with SBP ($x^2 = -1.6$, $p < 0.001$) and DBP ($x^2 = -0.8$, $p < 0.001$). Participants who had high consumption of fruits and milks had a lower mean SBP and DBP levels by 2.9mmHg (95% CI: 23.4 – 22.4) and 1.7mmHg (95% CI: 22.0-21.4). The protective effects of high fruits and milks consumption was contributed by the high bioavailability of antioxidants in fruit and calcium in milk (Lee et al., 2010)

In this present study, there was no association observed between coffee consumption with blood pressure ($p > 0.05$). The finding is inconsistent with a cross sectional study carried out to investigate the association between daily consumption of coffee with metabolic syndromes, including increased blood pressure by Grosso et al. (2015) in 8821 healthy Polish adults. Grosso et al. (2015) found association between daily coffee consumption with SBP (OR: 0.78, CI: 0.80-1.01, $p < 0.001$) and DBP (OR: 0.88, CI: 0.77-1.02, $p < 0.001$). High content of polyphenols such as hydroxycinnamic acids (caffeic and ferulic acids), vitamins (vitamin C, riboflavin, niacin, folic acid, pantothenic acid) and minerals (magnesium, potassium, manganese, and fluoride) were suggested to be the bioactive components in coffee that contribute to the protective effects (Grosso et al., 2015).

Table 4.9: Association between age, amount of food intake per day (g), coffee consumption and frequency of food intake per day (times) with blood pressure (n=219)

Variables	Amount of food intake per day (g)				Frequency of food intake per day (times)			
	SBP		DBP		SBP		DBP	
	<i>r</i>	<i>p</i> -value	<i>r</i>	<i>p</i> -value	<i>r</i>	<i>p</i> -value	<i>r</i>	<i>p</i> -value
Age	0.05	0.444	0.02	0.761				
Frequency of coffee intake per day					0.01	0.944	0.02	0.780
Amount of coffee intake per day (g)					0.03	0.689	0.04	0.516
Food Groups								
Cereals and cereal products	0.04	0.519	0.09	0.193	0.04	0.555	0.001	0.989
Fast foods	0.02	0.747	0.09	0.189	0.04	0.562	0.11	0.100
Meat and meat products	0.11	0.101	0.10	0.149	0.12	0.076	0.12	0.067
Fish and seafood	-0.05	0.466	-0.01	0.863	-0.07	0.290	0.002	0.974
Egg	0.08	0.245	0.05	0.449	0.001	0.961	0.02	0.797
Nuts and nut products	0.06	0.390	0.04	0.575	0.08	0.255	0.08	0.218
Milk and milk products	0.00	0.999	0.04	0.549	0.01	0.880	0.07	0.317
Vegetables	0.09	0.174	0.05	0.456	0.13	0.054	0.12	0.082
Fruits	0.06	0.422	0.08	0.233	0.05	0.451	0.06	0.363
Beverages	0.12	0.083	0.10	0.145	0.07	0.338	0.04	0.585
Alcoholic beverages	0.11	0.113	0.03	0.637	0.11	0.113	0.03	0.636
Confectionery	-0.03	0.612	-0.02	0.797	0.009	0.890	0.04	0.604
Bread spread	0.05	0.488	0.08	0.252	0.03	0.666	0.07	0.295
Seasonings	0.07	0.307	0.04	0.571	0.07	0.304	0.06	0.354

CHAPTER 5

5.0 CONCLUSION & RECOMMENDATION

5.1 Conclusion

This cross sectional study investigated the association between weight status (weight, height, BMI), body composition (body fat percentage, waist and hip circumferences, waist hip ratio) and dietary intakes which include caffeine consumption from coffee with BP level in undergraduate students in Universiti Putra Malaysia. A total of 195 female and 24 male participants with mean $\pm$ SD aged of 21.86 ± 1.34 years completed a questionnaire on socio-demographic and caffeine consumption habits. Participants were randomly selected from Faculty of Engineering (52.5%) and Faculty of Science (47.5%).

Nearly 25.1% (n=55) of the participants had family history of hypertension. The findings showed that 10.5% of the participants were found to have elevated blood pressure whilst 33.0% were hypertension. The mean $\pm$ SD of SBP and DBP were 118.15 ± 13.40 mmHg and 76.10 ± 9.51 mmHg respectively. Male participants had higher mean SBP (134.54 ± 17.80 mmHg, $p < 0.001$) and DBP levels (80.25 ± 9.85 mmHg, $p = 0.02$) as compared to female participants. BMI was significantly associated

with SBP ($r = 0.34, p < 0.001$) and DBP levels ($r = 0.42, p < 0.001$). It was found that there was association between body fat percentage with SBP ($r = 0.16, p = 0.016$) and DBP levels ($r = 0.31, p < 0.001$). Waist circumference was significantly associated with SBP ($r = 0.37, p < 0.001$) and DBP levels ($r = 0.42, p < 0.001$). Hip circumference was significantly associated with SBP ($r = 0.36, p < 0.001$) and DBP levels ($r = 0.45, p < 0.001$). Waist to hip ratio was significantly associated with SBP ($r = 0.21, p = 0.002$) and DBP levels ($r = 0.19, p = 0.004$). However, there was no significant association found between mean $\pm$ SD of caffeine intake ($301.72 \pm 110.41\text{ml}$) and dietary intake with SBP and DBP levels.

In conclusion, the prevalence of hypertension in undergraduate students of Universiti Putra Malaysia was high and almost similar with the data from the NHMS 2015 which was 30.0%. Several body compositions, including BMI, body fat percentage, waist circumference, hip circumference and waist to hip ratio, but not dietary intake including caffeine intake, were found to be associated with SBP and DBP levels. Based on the findings, body composition could be one of the factors that leads to a higher BP level, but not dietary intake, including coffee consumption. These findings highlighted the importance of establishing intervention program at the early life stage to attempt and reduce the incidence of adulthood hypertension in later life. Appropriate intervention should be taken to control the occurrence of more hypertension cases.

The findings from this study could provide a new insight on the association between dietary patterns and body composition with blood pressure. There is a lack of

information on the risk factors of blood pressure among university students, especially in Malaysia. Hence, the findings from this study will provide baseline data to be used by future researchers to further investigate the risk factors of blood pressure among students in tertiary education level. Plus, the results can be used to plan suitable intervention programs for students in order to prevent and control hypertension by managing the risk factors properly. In fact, this study will raise the awareness on the risk factors that might lead to high blood pressure among university students.

5.2 Limitations

This study had some limitations that should be highlighted for future research.. This was a cross sectional study that can only investigate prevalence and association but not a causal-effect relationship which the data was collected at one point of time. Collected data could not indicate the changes of SBP and DBP over the years and causality of the changes in blood pressure profiles.

Participants recruited in this study did not represent the whole university students in Malaysia as only students from two faculties in Universiti Putra Malaysia were randomly selected to participate. The results could not be generalized to all university students due to unrepresentative sample. The number of male participants in this study was very low (11%) from the total participants which might contribute to a potential bias. Macro and micro nutrients of the dietary intake were not analysed in this study and only amount of food consume per day (g/day) was calculated. Hence, the association between macro and micro nutrients with blood pressure could not be determined.

5.3 Recommendations

There are a few recommendations that can be applied for future research. The study design should be a prospective cohort study or randomised control trial. These type of study design are able to determine the cause and effect of the risk factors of a disease. The study should include participants from other universities as well in order to obtain a larger sample size and to enable results to be generalised.

The number of male participants should be increased as the proportion of male and female participants should be evenly distributed in order to minimise bias in results due to gender difference. Future study should consider to include 24-hour dietary recall to obtain the macro and micro nutrient intake of the participants in order to determine the potential associations between nutrients and blood pressure.

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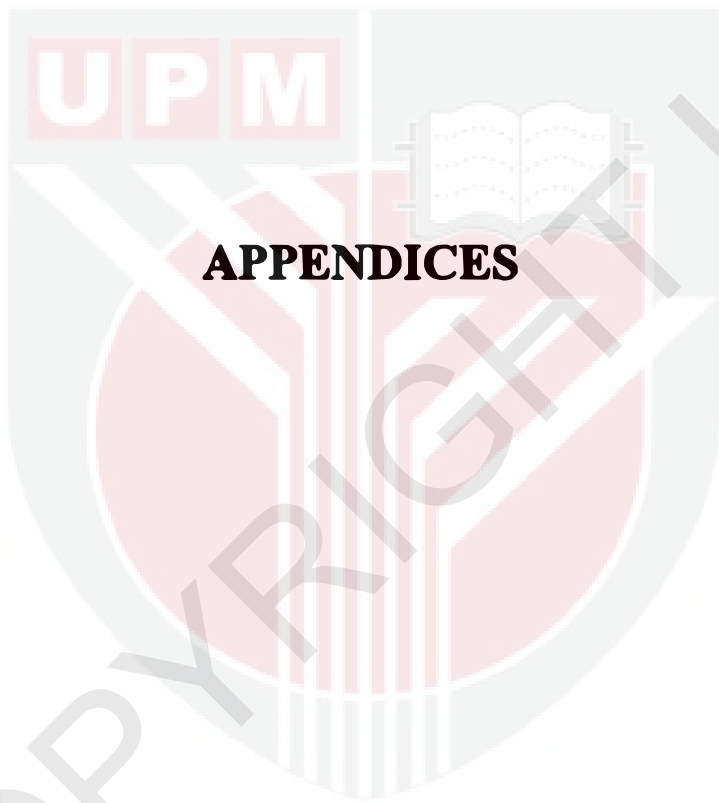
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APPENDICES

UPM



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

RESPONDENT'S INFORMATION SHEET AND INFORMED CONSENT FORM

You are being invited to take part in a research study. Before you decide, it is important for you to understand why the research is being carried out and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part. This study has been approved by the JKEUPM Ethics Review Panel.

1. STUDY TITLE :

Association between body composition and dietary patterns in relation to blood pressure level in undergraduate university students of Universiti Putra Malaysia.

2. INTRODUCTION:

There is an increase in prevalence of hypertension among adults in Malaysia and based on the National Health and Morbidity Survey 2015, it was estimated that 30.3% of the adult age is 18 years old and above was diagnosed with hypertension (systolic blood pressure of ≥ 130 mmHg and diastolic blood pressure of ≥ 80 mmHg. Additionally, prevalence of prehypertension in undergraduate students of Universiti Malaysia Sarawak was reported to be 42.9% in 2010. Consumption of caffeinated coffee was shown to increase blood pressure level in non-habitual drinkers and based on the Malaysian Adult Nutrition Survey 2014, coffee was the third most widely consumed drink in Malaysia. There are many factors that might affect blood pressure and among all, dietary habit and body composition have been shown to be two of the main factors that may affect blood pressure. Therefore, the aim of this study is to investigate the association between body composition and dietary patterns with blood pressure level in undergraduate university students of Universiti Putra Malaysia.

3. WHAT WILL YOU HAVE TO DO?

You will first be screened to assess your eligibility to take part in the study. Inclusion criteria will include undergraduate students who are Malaysians, aged between 19 to 29 years old with no history of cardiovascular diseases, including stroke, hypertension, coronary heart disease, diabetes mellitus, renal dysfunction and gastro esophageal reflux diseases. You will then be required to complete a set of questionnaire to obtain socio-demographic information as well as dietary and caffeine consumption habits. Height, weight, body fat percentage, waist circumference, hip circumference and blood pressure measurements will also be measured.

4. DO I HAVE TO TAKE PART?

It is up to you to decide whether or not to take part. If you decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part you are still free to withdraw at any time and without giving a reason. A decision to withdraw at any time, or a decision not to take part, will not affect you in any way.

5. WHO SHOULD NOT PARTICIPATE IN THE STUDY?

Pregnant and lactating women and those who with cardiovascular diseases, including stroke, hypertension, coronary heart disease, diabetes mellitus, renal dysfunction and gastro esophageal reflux diseases will be excluded from this study. You have been chosen because you satisfy the inclusion criteria of the study.

6. WHAT WILL BE THE BENEFITS OF THE STUDY:

(a) TO YOU AS THE SUBJECT?

You will be provided with a dietary analysis, blood pressure levels, body weight status (body mass index and body fat percentage) and waist hip ratio data. Dietary analysis will be performed by the researcher on completion of the study using dietary analysis software. The analysis will be based on the information you will have already provided us in the Food Frequency Questionnaire during the course of the study and will thus require no further time input. We will provide you information on your nutrient intake as well as information on your total energy, fat, carbohydrate and protein intake with a comparison to recommended values. You will also be contributing to the development of knowledge on the association between body composition and dietary patterns in relation to blood pressure level.

(b) TO THE INVESTIGATOR?

This study will help the researchers to understand how body composition and dietary patterns may effect the systolic and diastolic blood pressure of undergraduate university students in Universiti Putra Malaysia. This will also serves as a baseline data in reference to the association between body composition and dietary habits in relation to blood pressure level in undergraduate university students of Universiti Putra Malaysia.

7. WHAT ARE THE POSSIBLE RISKS?

There are no disadvantages foreseen in taking part in the study as there are no activities involving biological sampling such as blood, urine samples or others. You only have to answer the provided questionnaire and height, weight, waist and hip circumferences as well as blood pressure level will be measured. The study is not funded by any bodies or grants. Therefore, unfortunately, it will not be possible to reimburse any travel or other expenses incurred in taking part in the study.

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

All information which is collected about you during the course of the research will be kept strictly confidential and anonymised so that only the researcher carrying out the research will have access to such information. The researcher will also not provide any participant information to any party without the consent of participants.

9. WHAT WILL HAPPEN TO THE RESULTS OF THE RESEARCH STUDY?

The results will be written up into a dissertation for a Final Year Project thesis and potential publications. Individuals who participate will not be identified in any subsequent report or publication. After the completion of the study, a sheet summarising the findings of the study will be sent to the participants via post or email.

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

If you would like more information about the research before you decide whether or not you would be willing to take part, please contact:

Researcher : NORFATEN EMALIN BT RAZMI (019-3127620 / norfatenemalin@gmail.com)
Supervisor : DR SALMA FAEZA BT AHMAD FUZI (03-8609297 / salmafaeza@upm.edu.my)

Thank you for your interest in this research.



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

11. CONSENT

I Identity Card No.
address.....

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

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

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

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

* delete where necessary

Signature
(Respondent)

Signature
(Witness)

Date :.....

Name :.....

IC No. :.....

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

Date

Signature
(Researcher)



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

BORANG PENERANGAN DAN PERSETUJUAN RESPONDEN

Anda dijemput untuk mengambil bahagian dalam kajian penyelidikan ini. Sebelum anda membuat keputusan, adalah penting bagi anda untuk memahami tujuan dan proses penyelidikan. Sila luangkan masa untuk membaca maklumat berikut dengan teliti. Sila bertanya kepada kami jika ada apa-apa yang tidak jelas atau jika anda ingin maklumat lanjut. Luangkan masa untuk membuat keputusan sama ada anda mahu mengambil bahagian atau tidak. Kajian ini telah mendapat kelulusan daripada Jawatankuasa Etika Penyelidikan Universiti Melibatkan Manusia, Universiti Putra Malaysia.

1. TAJUK KAJIAN

Perkaitan antara komposisi badan dan corak pemakanan dengan bacaan tekanan darah dalam kalangan pelajar ijazah sarjana muda di Universiti Putra Malaysia.

2. PENGENALAN

Terdapat peningkatan kekerapan hipertensi di dalam kalangan dewasa muda di Malaysia. Berdasarkan Bancian Kesihatan dan Morbiditi Negara 2015, dianggarkan 30.3% peringkat umur dewasa di dalam lingkungan umur 18 tahun ke atas didiagnos menghidapi hipertensi (tekanan darah sistolik ≥ 130 mmHg dan tekanan darah diastolik ≥ 80 mmHg). Kekerapan prehipertensi dalam kalangan pelajar Universiti Malaysia Sarawak dilaporkan sebanyak 42.9% pada tahun 2010. Kopi berkafein memberi kesan terhadap peningkatan tekanan darah dan di dalam Bancian Pemakanan Dewasa Malaysia 2014, kopi adalah minuman ketiga yang paling banyak diminum di Malaysia. Terdapat banyak faktor yang mungkin menjejaskan tekanan darah. Tabiat pemakanan dan komposisi tubuh adalah dua faktor utama yang dapat mempengaruhi tekanan darah. Oleh itu, matlamat kajian ini adalah untuk mengkaji perkaitan antara komposisi badan dan corak pemakanan dengan bacaan tekanan darah dalam kalangan pelajar ijazah sarjana muda di Universiti Putra Malaysia.

3. APAKAH YANG PERLU ANDA LAKUKAN?

Anda akan menjalani pemeriksaan untuk menilai kelayakan anda untuk mengambil bahagian dalam kajian ini. Kriteria inklusi akan termasuk pelajar siswazah yang berumur antara 19 hingga 29 tahun tanpa sejarah penyakit kardiovaskular, termasuk strok, hipertensi, penyakit jantung koronari, kencing manis, gangguan fungsi buah pinggang dan penyakit refluks gastro esofagus. Anda akan perlu mengisi satu set soal selidik terdiri daripada soalan ciri-ciri sosio demografi, rekod pengambilan kafein dan corak pemakanan. Ketinggian, berat badan, peratusan lemak badan, lilitan pinggang, lilitan pinggul dan bacaan tekanan darah akan turut diukur.

4. ADAKAH SAYA PERLU MENGAMBIL BAHAGIAN?

Terpujang kepada anda untuk membuat keputusan sama ada untuk mengambil bahagian atau tidak. Sekiranya anda membuat keputusan untuk mengambil bahagian, anda akan diberikan borang penerangan dan persetujuan dan diminta untuk menandatangani borang tersebut. Sekiranya anda membuat keputusan untuk mengambil bahagian, anda berhak untuk menarik diri pada bila-bila masa. Keputusan untuk menarik diri pada bila-bila masa, atau keputusan untuk tidak mengambil bahagian, tidak akan menjejaskan anda.

5. SIAPA YANG TIDAK BOLEH MENYERTAI KAJIAN INI?

Wanita hamil dan menyusukan anak serta mereka yang mempunyai penyakit kardiovaskular, termasuk strok, hipertensi, penyakit jantung koronari, penyakit diabetes kencing manis, disfungsi buah pinggang dan penyakit refluks gastro esofagus akan dikecualikan daripada kajian ini. Anda telah dipilih kerana anda memenuhi kriteria inklusi kajian ini.

6. APAKAH FAEDAH MENYERTAI KAJIAN INI?

a) KEPADA ANDA SEBAGAI PESERTA?

Anda akan diberikan analisis diet, tekanan darah, status berat badan (Indeks Jisim Badan) dan nisbah pinggul pinggang. Analisis diet akan dilakukan oleh penyelidik setelah menggunakan perisian analisis diet. Analisis ini akan berdasarkan kepada maklumat yang anda telah berikan kepada kami dalam soalan kekerapan pengambilan makanan (FFQ). Kami akan memberikan anda maklumat tentang pengambilan nutrien anda maklumat mengenai jumlah tenaga, lemak, karbohidrat dan pengambilan protein anda dengan perbandingan dengan nilai yang diperuntukkan. Anda juga akan menyumbang maklumat kepada perkembangan pengetahuan mengenai Perkaitan antara komposisi badan dan pengambilan kafein di dalam diet dengan bacaan tekanan darah.

b) KEPADA PENYELIDIK?

Kajian ini akan membantu para penyelidik memahami bagaimana komposisi badan dan pengambilan kafein di dalam diet memberi kesan terhadap tekanan darah sistolik dan diastolik dalam kalangan pelajar ijazah sarjana muda di Universiti Putra Malaysia. Ini juga akan berfungsi sebagai rujukan tentang perkaitan antara komposisi badan dan pengambilan kafein di dalam diet dengan bacaan tekanan darah dalam kalangan pelajar ijazah sarjana muda di Universiti Putra Malaysia.

7. ADAKAH IA BERISIKO?

Kajian ini tidak mendatangkan apa-apa kesan berbahaya kepada peserta kerana tiada prosedur invasif yang digunakan. Tiada aktiviti yang melibatkan pensampelan biologi seperti darah, sampel air kencing dan lain-lain. Anda hanya perlu menjawab soal selidik yang disediakan dan ketinggian, berat badan, pinggang dan pinggul pinggul serta paras tekanan darah akan diukur oleh penyelidik. Tiada sebarang bentuk bayaran terhadap tuntutan perjalanan atau kos pengangkutan yang anda belanjakan untuk ke pusat penyelidikan.

8. ADAKAH MAKLUMAT DAN IDENTITI SAYA KEKAL RAHSIA?

Semua maklumat yang diberikan akan disimpan dan digunakan secara sulit dan hanya penyelidik yang menjalankan penyelidikan akan mendapat akses kepada maklumat tersebut. Penyelidik juga tidak akan memberikan sebarang maklumat peserta kepada mana-mana pihak tanpa persetujuan peserta.

9. APAKAH YANG AKAN DILAKUKAN TERHADAP KEPUTUSAN KAJIAN PENYELIDIKAN?

Hasil kajian akan dilaporkan di dalam tesis Projek Tahun Akhir dan berpotensi untuk diterbitkan. Identiti peserta akan dirahsiakan dalam mana-mana laporan atau penerbitan. Setelah selesai kajian, ringkasan penemuan kajian akan dihantar kepada peserta melalui pos atau e-mel.

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

Sekiranya anda ingin mendapatkan maklumat lebih lanjut tentang penyelidikan, sila hubungi

Penyelidik : NORFATEN EMALIN BT RAZMI (019-3127620 / norfatenemalin@gmail.com)

Penyelia : DR SALMA FAEZA BT AHMAD FUZI (03-8609297 / salmafaeza@upm.edu.my)

TERIMA KASIH ATAS KERJASAMA ANDA



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

11. PERSETUJUAN

Saya..... No Kad Pengenalan.
beralamat.....
.....dengan ini bersetuju untuk mengambil bahagian secara sukarela dalam
penyelidikan yang tersebut di atas *(kajian klinikal/percubaan ubat-ubatan/rakaman video/kumpulan
sasaran/temuduga/ soal selidik).

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

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

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

*potong yang tidak berkenaan

Tandatangan Tandatangan
(Responden) (Saksi)
Tarikh : Nama :
No. K/P:

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

Tarikh Tandatangan
(Penyelidik)

Reference No.

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FACULTY OF MEDICINE & HEALTH SCIENCES

DEPARTMENT OF NUTRITION & DIETETICS

QUESTIONNAIRE

SOAL SELIDIK

TITLE:

TAJUK:

**ASSOCIATION BETWEEN BODY COMPOSITION AND DIETARY PATTERNS IN
RELATION TO BLOOD PRESSURE LEVEL IN UNDERGRADUATE UNIVERSITY
STUDENTS OF UNIVERSITI PUTRA MALAYSIA**

**PERKAITAN ANTARA KOMPOSISI BADAN DAN CORAK PEMAKANAN DENGAN
BACAAN TEKANAN DARAH DALAM KALANGAN PELAJAR IJAZAH SARJANA MUDA DI
UNIVERSITI PUTRA MALAYSIA**

RESEARCHER:

PENYELIDIK:

NORFATEN EMALIN BT RAZMI (179561)

SUPERVISOR:

PENYELIA:

DR SALMA FAEZA BT AHMAD FUZI

**The information given is for the study purpose only and will be kept confidentially and
will not be revealed to other parties. Your cooperation in answering this questionnaire
is fully appreciated.**

**Maklumat peribadi yang diberikan di dalam soal selidik ini adalah bertujuan untuk kajian
sahaja dan akan disimpan secara sulit serta tidak akan didedahkan kepada mana-mana
pihak. Oleh itu, kerjasama anda amat diperlukan bagi menyiapkan soal selidik ini.
Penghargaan daripada pihak saya di atas kesudian anda dalam menjawab soal selidik ini.**

Date of data collection: / /

Tarikh pengumpulan data:

ARAHAN AM-

- SECTION A: Socio-demographic characteristics**
BAHAGIAN A: Ciri-ciri sosio-demografi

ARAHAN: Soalan-soalan berikut mengenai maklumat peribadi anda. Sila jawab semua soalan dengan menulis di ruangan yang disediakan dan tandakan (/) dalam petak untuk setiap kenyataan.

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	Tahap pengajian tertinggi (Sila pilih hanya satu)	☐ STPM / Diploma / A-Level ☐ SPM / O-Level ☐ PMR ☐ UPSR ☐ No Formal Education
7	Course of study <i>Kas Pengajian</i>	
8	Current year of study <i>Tahun pengajian semasa</i>	☐ First Year / Tahun Satu ☐ Second Year / Tahun Dua ☐ Third Year / Tahun Tiga ☐ Fourth Year / Tahun Empat
9	Monthly pocket money <i>Kewangan bulanan</i>	☐ ≤ RM 100.00 ☐ RM 100.01 – RM 300.00 ☐ RM 300.01 – RM 500.00 ☐ RM 500.01 – RM 700.00 ☐ RM 700.01 – RM 900.00 ☐ > RM 900.00
10	Do you have any family history of hypertension? <i>Sejarah keluarga yang pernah menghadapi hipertensi?</i>	☐ Yes / Ya If yes, / Jika ya ☐ Mother / Ibu ☐ Father / Bapa ☐ No / Tidak

SECTION B: Coffee Consumption
BAHAGIAN B: Pengambilan Kopi

No	Question <i>Soalan</i>	Options <i>Pilihan</i>
1	Do you drink coffee at least once a week? <i>Adakah anda meminum kopi sekurang-kurangnya seminggu sekali?</i>	☐ Yes / Ya ☐ No / Tidak

2	Please indicate how many servings of coffee you consume, on average, each week. <i>Sila nyatakan jumlah hidangan kopi yang anda ambil, secara purata, setiap minggu.</i>	☐  250 ml (1 cup) ☐  350 ml (1 ½ cups) ☐  500 ml (2 cups) ☐  600 ml (2.5 cups)
3	What type of coffee that you usually consume? <i>Apakah jenis kopi yang kebiasaannya anda minum?</i>	☐ Caffeinated coffee / <i>kopi berkafein</i> ☐ Decaffeinated coffee / <i>kopi tidak berkafein</i> ☐ Others / <i>lain-lain</i> : _____
4	How do you prepare your coffee? <i>Bagaimana cara penyediaan kopi?</i>	☐ Recipe / <i>Resepi</i> ☐ Restaurant / <i>Restoran</i> ☐ Bottle only / <i>Botol sahaja</i> ☐ Instant coffee / <i>Kopi segera</i>

If recipe, <i>Jika resepi,</i>	When you making coffee how much do you use? <i>Semasa penyediaan kopi, berapa banyak kopi yang digunakan?</i> ☐ Bags per cup / <i>uncang per cawan</i> OR ☐ Teaspoons per cup / <i>sudu the per cawan</i> Do you usually add anything to you tea? <i>Kebiasaannya, adakah anda menambah sesuatu ke dalam kopi?</i> ☐ Yes / <i>Ya</i> ☐ No / <i>Tidak</i> If yes, what do you add to your coffee? <i>Jika ya, apakah yang ditambah ke dalam kopi?</i> ☐ Sugar / <i>Gula</i> ☐ Fresh milk / <i>Susu segar</i> ☐ Condensed milk / <i>Susu pekat</i> ☐ Creamer / <i>krimer</i> ☐ Others / <i>lain-lain</i> : _____
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SECTION C: FOOD FREQUENCY QUESTIONNAIRE (FFQ)
BAGIAN C: SOAL SELIDIK KEKERAPAN PENGAMBILAN PEMAKANAN

INSTRUCTION: Please answer the following questions by tick (✓) on your portion size to every type of foods and fill in the frequency of consumption of each type of foods whether on how many times a day, how many times a week, how many times a month or tick (✓) if you do not eat or rarely eat the type of food by only fill in one of the boxes out of four boxes provided.

ARAHAN: Sila jawab soalan-soalan berikut dengan tanda (✓) pada saiz rujukan anda untuk setiap jenis makanan dan menulis kekerapan pengambilan setiap makanan sama ada berapa kali sehari, berapa kali seminggu, berapa kali sebulan atau tanda (✓) jika tidak makan atau jarang dengan hanya mengisi satu kotak daripada empat pilihan kotak yang disediakan.

A) CEREALS AND GRAIN PRODUCTS (BIJIRAN DAN HASIL BIJIRAN)										
Code / Kod	Type Of Food (Jenis Makanan)	Reference Size (Medium) (M) / Saiz Rujukan (Medium) (M)	Weight (g) / Berat (g)	Your Portion Size / Saiz rujukan anda			Frequency Of Consumption (Kekerapan Pengambilan)			
				S	M	L	How many times a day / berapa kali sehari	How many times a week / berapa kali seminggu	How many times a month / berapa kali sebulan	Do not eat/very seldom / tidak makan atau jarang
A1	White rice/Nasi putih	1 chinese bowl/ mangkuk cina	250							
A2	Brown rice/Nasi beras perang	1 chinese bowl/ mangkuk cina	250							
A3	Flavoured rice/Nasi berperisa seperti nasi beriyani	1 plate/pinggan	245							
A4	Rice porridge/Bubur nasi	1 cup/cawan	250							
A5	Glutinous rice/Pulut	1 cup/cawan	188.7							
A6	Noodles/Mee kuning, mee siput, mee segera	1 plate/pinggan	250							
A7	Mihun/kueh teow/loh shi fun/laksa/laksam	1 cup/cawan	250							
A8	Pasta/Pasta	1 cup/cawan	92							
A9	Sagu/ambuyat/linut	¼ cup/cawan	43							
A10	Bread/Roti putih	2 pieces/ keping	60							

Code / Kod	Type Of Food (Jenis Makanan)	Reference Size (Medium) (M) / Saiz Rujukan (Medium) (M)	Weight (g) / Berat (g)	Your Portion Size / Saiz rujukan anda			Frequency Of Consumption (Kekerapan Pengambilan)			
				S	M	L	How many times a day / berapa kali sehari	How many times a week / berapa kali seminggu	How many times a month / berapa kali sebulan	Do not eat/very seldom / tidak makan atau jarang
A11	Wholemeal bread/Roti bijiran mil penuh	2 pieces/keping	50							
A12	Bread bun/Roti bun	1 pieces/keping	45							
A13	Roti canai (termasuk roti telur, roti sardine, roti bawang, roti pisang, murtabak)	1 piece/keping	95							
A14	Capati	1 piece/keping	100							
A15	Tosai	1 piece/keping	80							
A16	Breakfast cereals/Bijiran sarapan pagi (cornflakes, koko crunch, honeystar dish)	1 cup/cawan	20							
A17	Cereals grain prepared with water/Bijiran tersedia perlu dibancuh (Nestum, quaker oats)	1/3 cup/cawan	30							
A18	Corn/Jagung	1 cup/cawan	222							
B) FAST FOOD (MAKANAN SEGERA)										
B1	Burger/Burger	1 piece/keping	114							
B2	Fried chicken/Ayam goreng	1 piece/keping	120							
B3	Pizza/Pizza	1 slice/keping	79							
B4	French fries/Kentang goreng	1 packet/paket	194							
B5	Mashed potatoes/Kentang leryek	1 small container/bekas kecil	110							
B6	Coleslaw/Coleslaw	1 cup/cawan	191							

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				S	M	L	How many times a day / berapa kali sehari	How many times a week / berapa kali seminggu	How many times a month / berapa kali sebulan	Do not eat/very seldom / tidak makan atau jarang
B7	Sosaj/hotdog/frankfurter	1 piece/keping	76							
B8	Nugget/Nugget	3 pieces/keping	54							
C). MEAT AND MEAT PRODUCTS (DAGING DAN HASIL DAGING)										
C1	Chicken/Ayam	1 medium size/ saiz sederhana	65							
C2	Meat/Lembu	1 matchbox/ kotak manis	31							
C3	Mutton/Kambing	1 matchbox/ kotak manis	28.3							
C4	Internal organs (liver, spleen, lungs) / organ dalaman (hati, limpa, paru)	1 matchbox/ kotak manis	28.3							
C5	Chicken or meat balls/Babola ayam atau daging	1 piece/keping	28.3							
C6	Quail/Burung puyuh	1 whole/biji	85							
C7	Duck/Itik	1 piece/keping	28.3							
For non-islam participants										
C8	Ham/Ham	1 piece/keping	28.4							
C9	Bacon/Bacon	1 slice/keping	6.3							
C10	Luncheon meat	1 slice/keping	56.7							
C11	Pork/Babi	1 matchbox/ kotak manis	28.4							

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				S	M	L	How many times a day / berapa kali sehari	How many times a week / berapa kali seminggu	How many times a month / berapa kali sebulan	Do not eat/very seldom / tidak makan atau jarang
D) FISH AND SEAFOOD (IKAN DAN MAKANAN LAUT)										
D1	Marine fish/Ikan laut, (Tenggiri, kembong, etc)	1 whole/skor	137							
D2	Fresh water fish/Ikan air tawar	1 whole/skor	77							
D3	Prawn/Udang basah	5 whole/skor	49							
D4	Squid/Sotong basah	1 whole/skor	113							
D5	Canned fish/Ikan dalam tin	1 whole/skor	57							
D6	Crab/Kestam	1 whole/skor	85							
D7	Anchovy/Ikan bilis	½ cup/cawan	28							
D8	Shellfish/Kekarang	10 pieces/biji	99							
D9	Snail/Siput sedut	10 pieces/biji	105							
D10	Pickled fish/Ikan jeruk pekasam	1 piece/ keping	15							
D11	Dried squid/Sotong kering	3 piece/ keping	84.9							
D12	Fish,prawn,squid,crab crackers/Keropok ikan,udang,sotong,ke- stam	1 large packet / paket besar	80							
D13	Keropok Iskor	3 slice/keping	70							
D14	Fish, prawn, squid, crab ball/ Babola ikan,udang,sotong, kestam	1 stick/cucuk	45							
E) EGGS (TELUR)										
E1	Hen eggs (bills eye,omelette,boiled, with chillies or herbs) / Telur ayam (mata kerbau,telur dadar, telur rebux, telur masak sambal,telur pindang)	1 piece/ keping	48							

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				S	M	L	How many times a day / berapa kali sehari	How many times a week / berapa kali seminggu	How many times a month / berapa kali sebulan	Do not eat/very seldom / tidak makan atau jarang
E2	Duck eggs(cooked with coconut milk gravy, omelette) / Telur itik (masak lemak, gulai, telur dadar	1 whole/biji	56.7							
E3	Quail eggs (boiled, with chillies) / Telur puyuh (rebus, masak sambal)	1 whole/biji	56.7							
E4	Salted eggs/Telur masin	1 whole/biji	56.7							
F) LEGUMES AND LEGUME PRODUCTS (KACANG DAN HASILNYA)										
F1	Legumes/ Kacang (kacang hijau, kacang parang, kacang kuda, kacang merah, dsb)	½ cup/ cawan	96							
F2	Groundnuts/ Kacang tanah	½ cup/ cawan	77							
F3	Soya bean curd, unsweetened/ Tauhu, tampa gula	1 container/ bekas	368							
F4	Soya bean curd/Tauhu	1 cup/ cawan	201							
F5	Fermented soy beans/ Tempe	1 piece/ keping	71							
G) MILK AND MILK PRODUCTS (SUSU DAN TENUSU)										
G1	Fresh milk/Susu segar yang tidak diproses	1 cup/cawan	226.4 ml							
G2	Commercial milk/Susu komersial	1 cup/cawan	250 ml							
G3	Yogurt/lassi/tairu	1 cup/cawan	135 ml							
G4	Powdered milk/ Susu tepung	1 tablespoon/ sudu besar	7.5							
G5	Evaporated milk/Susu cair, susu sejat	1 tablespoon/ sudu besar	14.2							
G6	Cheese/Kaju	1 slice/keping	21							

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				S	M	L	How many times a day / berapa kali sehari	How many times a week / berapa kali seminggu	How many times a month / berapa kali sebulan	Do not eat/very seldom / tidak makan atau jarang
H) VEGETABLES (SAYUR-SAYURAN)										
H1	Leaf green vegetables/ Sayuran berdaun hijau (bayam, kangkung, kalia n, dsb)	2 tablespoon/ sudu besar	30							
H2	Ladies finger/Bendi	5 whole/biji	66							
H3	Other types of legumes/ Sayuran kekacang lain (kacang panjang, kacang buncis, kacang botol, dsb)	1 cup/cawan	116							
H4	Bean sprout/Taugeh	1 cup/cawan	87							
H5	Tubers (potatoes, sweet potatoes, yam) / Sayuran berubi (kentang, keledek, keladi)	1 tablespoon/ sudu besar	8.6							
H6	Cabbages/Sayuran kobis (kobis bulat, brokoli, kobis cina, bunga kobis)	1 cup/cawan	88							
H7	Chillies/Cili	1/4 cup/ cawan	26							
H8	Tomatoes/Tomato	1 whole medium/biji	55							
H9	Brinjal	1 cup/cawan	86							
H10	Fruit vegetables (luffa, pumpkin, cucum ber, baby corn) / Sayuran berbuah lain (petola, labu, timun, pui k jagung)	1 cup/cawan	136							
H11	Salted or dried vegetables/Sayuran asin, kering(pucuk soo hon, db)	1 cup/cawan	21							

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				S	M	L	How many times a day / berapa kali sehari	How many times a week / berapa kali seminggu	How many times a month / berapa kali sebulan	Do not eat/very seldom / tidak makan atau jarang
H12	Fresh salads/Ulam- ulaman	½ cup/cawan	17							
H13	Mushrooms/Cendawan basah	1 cup/cawan	79							
H14	Dried mushrooms/Cendawan kering	5 pieces/keping	11							
D) FRUITS (BUAH-BUAHAN)										
I1	Papaya/Betik	1 slice/ potong	180							
I2	Mango/Mangga	1 whole/ biji	232							
I3	Pineapple/Nenas	1 slice/ potong	130							
I4	Watermelon /Tembikai	1 slice/ potong	238							
I5	Dragon fruit/Buah naga	3 slice/ potong	94							
I6	Honey dew/Tembikai susu	1 slice/ potong	175							
I7	Rock melon	2 slice/ potong	89							
I8	Guava/Jambu batu	1 slice/ potong	59							
I9	Water apple/Jambu air	2 whole/ biji	105							
I10	Lime/Limau	1 whole/ biji	90							
I11	Banana/Pisang (pisang segar, pisang goreng, pengat pisang, pisang salai, dsb)	1 small piece/biji kecil	60							
I12	Starfruit/Belimbing	1 whole/ biji	113							
I13	Apple/Epal	1 whole/ biji	128							
I14	Orange/Oren, mandari n	1 whole/ biji	134							
I15	Pear/Pir, lai	1 whole/ biji	207							
I16	Grape/Anggur	8 pieces/ keping	93							
I17	Rambutan/Rambutan	5 whole/biji	176							

Code/ Kod	Type Of Food (Jenis Makanan)	Reference Size (Medium) (M) / Saiz Rujukan (Medium) (M)	Weight (g) / Berat (g)	Your Portion Size / Saiz rujukan anda			Frequency Of Consumption (Kekerapan Pengambilan)			
				S	M	L	How many times a day / berapa kali sehari	How many times a week / berapa kali seminggu	How many times a month / berapa kali sebulan	Do not eat/very seldom / tidak makan atau jarang
I18	Longan/Mata kucing segar	8 pieces/biji	110							
I19	Lychee/Laici segar	5 piece/biji	118							
I20	Mangosteen/Manggis	5 whole, small/biji kecil	346							
I21	Durian/Durian	5 piece/biji	189							
I22	Jackfruit/Nangka, camp edak	5 piece/biji	117							
I23	Canned fruits/Buahan dalam tin (laici, longan, dsb)	1 cup/cawan	263							
I24	Dried fruits/Buahan kering (kurma, prun, kismis, dsb)	¼ cup /cawan	39							
I25	Pickled fruits/Buahan jeruk, acar	½ cup/cawan	80							
I26	Young coconut/Kelapa muda	1 cup/cawan	80							
J) DRINKS (MINUMAN)										
J1	Plain water/Air kosong	1 cup/cawan	250ml							
J2	Tea/Tea	1 cup/cawan	250ml							
J3	Coffee/Kopi	1 cup/cawan	250ml							
J4	Chocolate drink/ Minuman bercoklat (van houtsen, Cadbury, dsb)	1 cup/cawan	250ml							

Code / Kod	Type Of Food (Jenis Makanan)	Reference Size (Medium) (M) / Saiz Rujukan (Medium) (M)	Weight (g) / Berat (g)	Your Portion Size / Saiz rujukan anda			Frequency Of Consumption (Kekerapan Pengambilan)			
				S	M	L	How many times a day / berapa kali sehari	How many times a week / berapa kali seminggu	How many times a month / berapa kali sebulan	Do not eat/very seldom / tidak makan atau jarang
J5	Malted drink / Minuman bermalt (milo, Horlick, dsb)	1 cup/cawan	250ml							
J6	Pre-mixed drinks / Minuman pra- campuran 2 in 1, 3 in 1, dsb)	1 cup/cawan	250ml							
J7	Minuman ready-to- drink seperti air tin, air kotak, (kecuali botani/herba)	1 cup/cawan	250ml							
J8	Cordial syrup / Sirap kordial	1 cup/cawan	250ml							
J9	Fruit juice / Jus buah- buahan	1 cup/cawan	250ml							
J10	Carbonated drinks includes isotonic / Minuman bergas termasuk isotomik	1 cup/cawan	240ml							
J11	Soy milk / Kacang soya	1 cup/cawan	250ml							
J12	Herbal or botanical drinks (pre-mixed) / Minuman botani atau herba 2 in 1 atau 3 in 1, dsb (pra-campuran)	1 cup/cawan	250ml							
J13	Herbal or botanical drinks (ready-to-drink) / Minuman botani atau herba seperti dalam tin, kotak (ready-to- drink)	1 cup/cawan	250ml							
J14	Herbal or botanical brewed drinks / Minuman air rebusan botani atau herbal	1 cup/cawan	200ml							

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J15	Energy drink/Minuman bertenaga (red bull, livita)	1 cup/cawan	250ml							
J16	Yogurt drinks/Minuman yogurt	1 cup/cawan	250ml							
K) ALCOHOLIC DRINKS (MINUMAN BERALKOHOL) – Bagi peserta bukan islam-										
K1	Shandy/Syandi	1 glass/ gelas	250ml							
K2	Beer/bir (lager, ale, stout)	1 glass/ gelas	250ml							
K3	Todi/Tuak kelapa atau bahar	1 glass/ gelas	250ml							
K4	Wine, cider, champagne / Wain, cider, champagne , peri	1 glass/ gelas	250ml							
K5	Rice wine/Wain beras, tuak beras, li hing	1 glass/ gelas	250ml							
K6	Whiskey, Vodka / Brandi, rum, wiski, vodka, gin, samsu, sam chang, montoku, langka u	1 glass/ gelas	250ml							
L) CONFECTIONARIES (KONFEKSSI)										
L1	Local kuih/Kuih-muih	1 piece/biji	50							
L2	Sweets/Gula-gula	1 piece/biji	14							
L3	Chocolate bar/Coklat bar	1 small size/saiz kecil	40							
L4	Cake/Kek	1 slice/ potong	23							
L5	Jelly, custard /Agar- agar, kastard	1 slice/ potong	56.7							
L6	Lolly ice/Aiskrim (tanpa susu)	1 slice/ batang	86							
L7	Ice cream/Aiskrim (tanpa susu)	1 slice/ batang	69							

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L8	Ice blended (ABC) / Air batu campur, ais	1 cup/ cawan	500							
L9	Cream crackers/Biskut tawar, krim cracker	3 pieces/ keping	30							
L10	Flavoured, cream, filled cookies/ Biskut berperisa, berkrim, beri nti	3 pieces/ keping	33							
L11	Pastry (pie, croissant) / Pastri (pai, croissant)	1 whole/ biji	53							
L12	Snacks, crackers /Snek, kerepek	3 slice/ keping	33							
M) BREAD SPREAD (SAPUAN ROTI)										
M1	Jam/Jem	1 tablespoon/ sudu besar	21							
M2	Coconut jam/Seri kaya	1 tablespoon/ sudu besar	15							
M3	Butter/Mentega	1 tablespoon/ sudu besar	13							
M4	Margarine/Marjerin	1 tablespoon/ sudu besar	13							
M5	Peanut butter/Mentega kacang	1 tablespoon/ sudu besar	5							
M6	Cream cheese/Krim keju	1 tablespoon/ sudu besar	15							
M7	Chocolate spread/Sapuan coklat	1 tablespoon/ sudu besar	15							
M8	Garlic spread	1 tablespoon/ sudu besar	15							
N) FLAVORS (PERENCAH/PERASA)										
N1	Sugar (white, brown, Melaka) / Gula (putih, perang, Melaka)	1 tablespoon/ sudu besar	15							
N2	Honey/Madu	1 tablespoon/ sudu besar	21							

Code/ Kod	Type Of Food (Jenis Makanan)	Reference Size (Medium) (M) / Saiz Rujukan (Medium) (M)	Weight (g) / Berat (g)	Your Portion Size / Saiz rujukan anda			Frequency Of Consumption (Kekerapan Pengambilan)			
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N3	Condensed milk (creamer) / Susu pekat manis (susu isian pekat manis, krimer pekat manis)	2 tablespoon/ sudu besar	30							
N4	Pickles/ Jeruk (jeruk berwang, niah)	1 tablespoon/ sudu besar	18							
N5	Shrimp paste/Belacan	1 tablespoon/ sudu besar	14							
N6	Budu/Budu	1 tablespoon/ sudu besar	15							
N7	Cencalok/Cencalok	1 tablespoon/ sudu besar	15							
N8	Soy sauce/Kicap	1 tablespoon/ sudu besar	15							
N9	Chilli sauce/Sos cili	1 tablespoon/ sudu besar	15							
N10	Tomato sauce/Sos tomato	1 tablespoon/ sudu besar	15							
N11	Oyster sauce/Sos tiram	1 tablespoon/ sudu besar	15							
N12	Fish sauce/Sos ikan	1 tablespoon/ sudu besar	15							
N13	Petis, beko/Otak udang	1 tablespoon/ sudu besar	18							
N14	Chilli flakes/Cili kering	1 tablespoon/ sudu besar	15							
N15	Salad dressing	1 tablespoon/ sudu besar	18							

SECTION D: Anthropometric Measures
BAHAGIAN D: Ukuran Antropometri

INSTRUCTIONS: This section will be filled out by the assessor
ARAHAN: Bahagian ini akan diisi oleh penilai

		Reading 1 <i>Bacaan 1</i>	Reading 2 <i>Bacaan 2</i>	Average <i>Purata</i>
1.	Hip circumference (cm) <i>Ukur lilit pinggul (cm)</i>			
2.	Waist Circumference (cm) <i>Ukur lilit pinggang (cm)</i>			
3.	Waist to Hip ratio <i>Ratio pinggul dan pinggang</i>			
4.	Height (cm) <i>Tinggi (cm)</i>			
5.	Weight (kg) <i>Berat (kg)</i>			
6.	Body Mass Index <i>Indeks Jisim Badan</i>	 kg/m ²		
7.	Body Fat Percentange <i>Peratus Lemak Badan</i>	 %		

SECTION E: Blood Pressure Measurement
BAHAGIAN E: Ukuran Tekanan Darah

INSTRUCTIONS: This section will be filled out by the assessor
ARAHAN: Bahagian ini akan diisi oleh penilai

		Reading 1 <i>Bacaan 1</i>	Reading 2 <i>Bacaan 2</i>	Average <i>Purata</i>
1.	Systolic Blood Pressure (mm Hg) <i>Tekanan Darah Tinggi Sistolik (mm Hg)</i>			
2.	Diastolic Blood Pressure (mm Hg) <i>Tekanan Darah Tinggi Diastolik (mm Hg)</i>			

END OF THE QUESTIONNAIRE
TAMAT SOAL SELIDIK

THANK YOU FOR YOUR PARTICIPATION AND COOPERATION
TERIMA KASIH ATAS KERJASAMA ANDA