PREVALENCE OF PREHYPERTENSION AND ITS ASSOCIATED FACTORS AMONG ADULTS ATTENDING OUTPATIENT CLINIC IN UNIVERSITI SAINS MALAYSIA HOSPITAL

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LIST OF ABBREVIATIONS

BMI   Body Mass Index

BP   Blood Pressure

CVD   Cardiovascular disease

DBP   Diastolic Blood Pressure

I-PAQ International Physical Activity Questionnaire

JNC   Joint National Committee

MET   Metabolic Equivalent

NCD   Non-communicable disease

NHMS National Health and Morbidity Survey

SBP   Systolic Blood Pressure

SD   Standard Deviation

USM   Universiti Sains Malaysia

WHO World Health Organization

ABSTRAK

PREVALENS PRA-HIPERTENSI DAN FAKTOR-FAKTOR YANG BERKAITANNYA DI KALANGAN DEWASA YANG HADIR DI KLINIK PESAKIT LUAR HOSPITAL USM

Latar belakang: Pra-hipertensi adalah satu istilah yang baru diperkenalkan oleh laporan ketujuh bersama Jawatankuasa Kebangsaan Pencegahan, Pengesanan, Penilaian dan Rawatan untuk tekanan darah tinggi (JNC-7) . Pra-hipertensi ditakrifkan sebagai tekanan darah daripada 120 hingga 139 mmHg sistolik atau 80 hingga 89 diastolik. Anggaran kelaziman populasi pra-hipertensi dan mengenalpasti faktor-faktor berkaitan kardiovaskular adalah penting untuk mengurangkan risiko untuk mendapatkan hipertensi.

Objektif: Untuk menentukan prevalens pra-hipertensi dan faktor-faktor berkaitannya dikalangan dewasa yang menghadiri klinik pesakit luar Hospital USM.

Kaedah: Kajian berbentuk hirisan lintang telah dilakukan pada tahun 2015 kepada golongan dewasa yang menghadiri klinik pesakit luar Hospital USM. Sejumlah 151 orang dewasa yang berusia 18 tahun dan ke atas terlibat di dalam kajian ini. Temuduga muka ke muka telah dilakukan dengan menggunakan borang Soal Selidik Surveilans NCD (penyakit tidak berjangkit) di Malaysia versi Bahasa Melayu dan Bahasa Inggeris yang terdiri daripada sosiodemografi, status gaya hidup dan pengukuran data antropometri. Tekanan darah ini diukur sebanyak tiga kali dengan menggunakan sphygmomanometer dan bacaan kali pertama telah dihapuskan dan purata daripada dua bacaan lagi direkod dalam analisis data. Regresi logistik telah dilakukan untuk melihat faktor-faktor yang berkaitan pra-hipertensi.

Keputusan: Prevalens pra-hipertensi adalah 37.1% (95% CI: 29.29, 44.69). Faktor-faktor yang berkaitan dengan pra-hipertensi dalam kajian ini adalah usia (OR:1.06; 95% CI: 1.02,1.11; p=0.007), lelaki (OR:4.44 ;95% CI: 1.58, 12.44; p=0.005) dan ukuran lilit pinggang (OR:31.65; 95% CI: 11.25,89.02; p<0.001) daripada analisis regresi logistik berganda.

Kesimpulan: Prevalens pra-hipertensi dikalangan dewasa yang menghadiri klinik pesakit luar adalah 37.1% dan ia adalah setanding dengan kajian-kajian lain di Malaysia. Pertambahan umur, lelaki dan ukuran lilit pinggang yang tidak normal menyumbang kepada faktor risiko pra-hipertensi. Kesedaran tentang pra-hipertensi antara penyedia penjagaan kesihatan dan pendidikan pra-hipertensi kalangan masyarakat perlu dilaksanakan untuk meningkatkan kesedaran terhadap risiko untuk mendapat tekanan darah tinggi dan penyakit kardiovaskular.

Kata kunci: prevalens, pra-hipertensi, penyakit kardiovascular.

ABSTRACT

PREVALENCE OF PREHYPERTENSION AND ITS ASSOCIATED FACTORS AMONG ADULT ATTENDING OUTPATIENT CLINIC IN UNIVERSITI SAINS MALAYSIA HOSPITAL

Background: Prehypertension is a new term introduced by The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (JNC-7). Prehypertension is defined as blood pressure from 120 to 139 mmHg systolic or 80 to 89 mmHg diastolic. Estimation of prevalence of prehypertension in population and identify cardiovascular associated factors is important to reduce the progression to hypertension.

Objectives: To determine the prevalence of prehypertension and associated factors among adult attending outpatient clinic in USM Hospital.

Methodology: A cross sectional study was conducted in 2015 among adults attending outpatient clinic in USM Hospital. A total 151 adults age 18-year-old and above participated in this study. Face to face interview was done by using Malay and English version of Malaysia NCD (Non-communicable Disease) surveillance questionnaire, which consist of sociodemographic, lifestyle status and measurement of anthropometric data. Blood pressure was measured three times using sphygmomanometer and the first reading was removed and average from two reading was recorded for further data analysis. Logistic regression was done to look at the associated factors of prehypertension.

Result: The prevalence of prehypertension was 37.1% (95% CI: 29.29, 44.69). Factors associated with prehypertension in this study were age (OR:1.06; 95% CI: 1.02,1.11; p=0.007), male (OR:4.44 ;95% CI: 1.58, 12.44; p=0.005) and abnormal waist circumference (OR:31.65; 95% CI: 11.25,89.02; p<0.001) from multiple logistic regression analysis.

Conclusion: The prevalence of prehypertension among adult attending outpatient clinic was 37.1% and it was comparable with other studies in Malaysia. Increasing age, male gender and abnormal waist circumference were associated with prehypertension. An awareness of prehypertension among healthcare providers and education of prehypertension among community need to be implemented to increase awareness regarding the risk of getting hypertension and cardiovascular diseases.

Keywords: prevalence, prehypertension, cardiovascular diseases.

CHAPTER 1: INTRODUCTION

1.1 Overview

Prehypertension is a new terminology that was first introduced when The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (JNC-7, 2003) was launched at the American Society of Hypertension annual scientific conference in 2003 (Chobanian *et al.*, 2003). This term is being introduced because it has been approved that blood pressure readings in between the optimum and established hypertension is associated with cardiovascular risk. Besides, the prevalence of prehypertension has been increasing and progression from prehypertension to hypertension is high.

1.2 Impact of Non-communicable diseases

Epidemiologically, the burden of chronic diseases has been increasing in worldwide especially at the developing countries. Malaysia is one of a fast-developing country in the South East Asian region. According to Department of Statistics Malaysia, in 2016, total population in Malaysia is estimated at 31.7 million persons.

Based on World Health Organization (WHO), non-communicable diseases (NCDs) or chronic disease is defined as a disease of long duration and generally slow in progression. According to data, it causes almost 38 million deaths each year. Cardiovascular diseases contributed as the most NCD deaths, or 17.5 million people yearly. These diseases are mainly due to ageing, rapid unplanned urbanization, and unhealthy lifestyles such as unhealthy diets that may show up in individuals as hypertension, diabetes mellitus,

hyperlipidemia, and obesity. These are all risk factors which can lead to cardiovascular disease.

Among the most common chronic non-communicable diseases worldwide, hypertension is increasingly becoming a matter of medical and public health importance. It has been gradually emerging as a major cause of death in developing countries. Based on WHO, hypertension is estimated to cause 18% of the global disease burden, followed by overweight and obesity. High blood pressure or hypertension in adult is defined as systolic blood pressure (SBP) of 140mmHg or higher, or diastolic blood pressure (DBP) of 90 mmHg or higher after 2 or more readings on at least 2 clinics visit.

National Health and Morbidity Survey (NHMS) were conducted in 2015 on a nationally representative sample of population in Malaysia to obtain community-based data and information on the prevalence of chronic diseases. From the survey, overall prevalence of the most common chronic illness was hypercholesterolemia (47.7%), and then followed by hypertension (30.3%). It showed that 6.1 million of adults aged 18 years and above has hypertension. Among them, 13.1% are known to be hypertensive, and remaining 17.2% falls into category undiagnosed hypertension. As for Kelantan state, the prevalence of the known hypertension was almost similar to the national prevalence which was 10.6%. However, in Kelantan, it was found out that there was higher prevalence of undiagnosed hypertension which reported about 23.2% compared to the national prevalence with 17.2%.

1.3 Prehypertension and associated factors

The Seventh Report of the Joint National Committee (JNC-7) on Prevention, Detection, Evaluation and Treatment of High Blood pressure in 2003 has proposed a new

classification for individuals between normal blood pressure (BP) and established hypertension (Chobanian *et al.*, 2003). This new term "prehypertension" is defined as patients with systolic BP (SBP) of 120 to 139 mmHg and/or diastolic BP (DBP) of 80 to 89 mmHg. Based on Seventh Report of the Joint National Committee (JNC-7) in 2003, this term prehypertension is to replace the previous borderline hypertension classifications (Chobanian *et al.*, 2003).

From the National Health and Nutrition Examination Survey (NHANES) 1999-2000, it was reported that overall prevalence of prehypertension is 31% all around the world. According to National Heart, Lung, and Blood Institute in 2008, it was noted that the prevalence of prehypertension was highest among the younger adult group in between age 18 to 29 years old and often undiagnosed (National Heart, 2012).

From the survey, the overall prevalence of prehypertension in Malaysia is 37% (Chia, 2008) and the prevalence is higher than prevalence of hypertension itself. For the prevalence study for prehypertension in young adult, it is limited number of study about this new term in classification of hypertension. According to the prevalence of prehypertension among local government university undergraduate students in Malaysia, it was reported as 42.9% had prehypertension (Lee Y, 2010). In another study based on the local undergraduate university students, it was found that the prevalence of prehypertension among university students was 30.1% (Balami *et al.*, 2014).

The important consequences of patients with prehypertension is a risk of developing hypertension and subsequently become cardiovascular risk. Trial of Preventing Hypertension Study (TROPHY) showed that rate of conversion of getting hypertension was

37% in 4 years for those who have higher than normal blood pressure. In addition, it was found that in period of 4 years, almost two third of patients diagnosed with prehypertension develop stage 1 hypertension (Julius *et al.*, 2006).

There are many associated factors for prehypertension. It can be classified as modifiable and non-modifiable risk factors. Examples of non-modifiable risk factors are age, gender, ethnicity or family history of hypertension. There are various modifiable risk factors which can cause prehypertension. Physical activity, dietary intake, smoking, alcohol intake and body weight are the risk factors that can lead to prehypertension.

Prehypertension and hypertension have major impact in person especially in the quality of life. Early health intervention and recognition of the disease, then identifying the important risk factors can play important roles in preventing the complications.

1.4 Rationale of study

Prehypertension is a new term designed to identify individuals at high risk of developing hypertension. As a result of this, both patients and clinicians are alerted to this risk and encouraged to intervene and prevent or delay the disease from developing.

A lot of studies done to look at the prevalence of hypertension and associated factors in Malaysia and also in other countries worldwide. However, there are very limited studies done to evaluate the prevalence of prehypertension. The data of prevalence of prehypertension especially in young adults are still lacking. Besides, the associated risk factors for prehypertension were not well studied and this resulted in lack of data for the association with other cardiovascular risk factors. The identification of modifiable or non-

modifiable risks factors is important to reduce the risk of developing further complication that associated with cardiovascular disease. If the risk is identified at an earlier age, then preventative behaviors can be established to prevent the onset of hypertension and reduce the prevalence of cardiovascular disease.

1.5 Scope of study

Literatures have shown the prevalence of prehypertension in Malaysia, South East Asian countries and worldwide with its associated factors (Chia, 2008) (Balami *et al.*, 2014) (Widjaja, 2013) (Yu *et al.*, 2008) (Wang and Wang, 2004) (Zhang *et al.*, 2006) . This study is to look at the prevalence of patients with prehypertension attending outpatient clinic in Universiti Sains Malaysia Hospital that is also a tertiary hospital in North East Malaysia. From this study, we also want to look at the significant association in between prehypertension with modifiable and non-modifiable risk factors by using Malaysia Non-Communicable Disease(NCD) surveillance questionnaire.

CHAPTER 2: LITERATURE REVIEW

2.1 Definition of Prehypertension

Prehypertension is a new term introduced by The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (JNC-7, 2003) for those with blood pressure from 120–139 mmHg systolic and/or 80–89 mmHg diastolic. This new classification is based on the average of two or more properly measured, seated, blood pressure readings on each of two or more office visits. This new category in blood pressure classification is the change in contrast of the classification that had stated in JNC-6. Based on the study, person with prehypertension had increased risk of progressing to hypertension. The person with Blood Pressure of 130/90 to 139/89 are two times higher risk to develop hypertension compared to those at lower reading (Chobanian *et al.*, 2003). The low-end threshold of blood pressure for prehypertension in this new report is lower than the previous category for high normal blood pressure (BP) in JNC-6 which was 130/85mmHg. This also emphasize that even slight increase in blood pressure will increase the cardiovascular risk. Reported that the risk of cardiovascular disease doubles when increment of systolic blood pressure 20mmHg and diastolic blood pressure 10mmHg (Vasan *et al.*, 2001).

According to Malaysian Clinical Practice Guideline for Management of Hypertension, prehypertension is defined as Systolic Blood pressure (SBP) of 120 to 139 mmHg or diastolic blood pressure (DBP) of 80 to 89mmHg based on two or more seated readings on each of two or more clinic visits. This term replaces the old term of high normal and above optimal blood pressure readings and discard the term borderline hypertension as it was

define as imprecise and inconsistent (Ministry of Health, 2013). The rationale of this new category is to emphasize the cardiovascular risk that associated with this blood pressure reading. It was estimated nearly one third of blood pressure related death from coronary heart disease occur in individual with blood pressure in between 110 and 139mmHg (Prospective Studies Collaboration, 2002).

The data from National Health and Morbidity Survey (NHMS III) at 2006, it showed that 37% of our population had prehypertension. The prehypertension can later progressed to hypertension with conversion rate of 37% in 4 years based on the Framingham Study (Vasan *et al.*, 2001). The predictors or risk factors of conversion of prehypertension to hypertension including baseline blood pressure, increasing age, obesity and weight gain.

Based on the European Society of Hypertension (ESH) and European Society of Cardiology (ESC), the term high normal of blood pressure categories for systolic blood pressure (SBP) 130 to 139 and/ or diastolic blood pressure (DBP) 85 to 89 mmHg still maintain (Committee, 2003). However, the definition is individualized for each patient based on the individual risk. The value may be considered as high for patients with high risk or acceptable in individuals with lower risk.

Individuals with high normal blood pressure has higher risk of developing hypertension. In view of this, Canadian Hypertension Education Program for diagnosis of hypertension recommended for those with high normal blood pressure with systolic blood pressure (SBP) 130 to 139 mmHg and/or diastolic blood pressure (DBP) 85 to 89 mmHg to be follow up annually and advice for healthy lifestyle changes and for the early detection of development for hypertension. There was evidence from clinical trial showed that subjects with high

normal blood pressure will develop hypertension 40% over 2 years and 63% over 4 years (Bolli *et al.*, 2007).

Regardless of the terminology of blood pressure, this condition is a precursor of the hypertension and it is associated with morbidity and mortality from cardiovascular causes. In addition, an association of prehypertension with other cardiovascular risk factors has been established.

2.2 Classification of Blood Pressure

Hypertension is defined as persistent elevation of systolic blood pressure (SBP) of 140mmHg or greater and/or diastolic blood pressure (DBP) of 90mmHg or greater. This definition is based on the average of two or more properly measured, seated, blood pressure reading on each of two or more clinic visit (Ministry of Health, 2013).

The National Health and Morbidity Survey (NHMS) were conducted in 2015 to obtain community-based data and information on the prevalence of chronic diseases. From the survey that been done for adult age 18 years old and above, the overall prevalence of hypertension was 30.3%. The percentage was almost similar to NHMS in 2011 which was 32.7%. Unfortunately, from these numbers, 17.2% of them were undiagnosed hypertension.

Based on Malaysian Clinical Practice Guideline for Management of Hypertension, the classification of hypertension divided into 3 classes (Table 2.1). Normal blood pressure is when systolic blood pressure (SBP) less than 120 mmHg and diastolic blood pressure (DBP) less than 80mmHg. Category of prehypertension is when blood pressure from 120–139 mmHg systolic or 80–89 mmHg diastolic. Then, hypertension is categorized when the

systolic blood pressure (SBP) of 140mmHg or greater and/or diastolic blood pressure (DBP) of 90mmHg or greater.

The measurement of blood pressure need to be done correctly before diagnosing hypertension or prehypertension. The mercury sphygmomanometer remains the gold standard of measurement for blood pressure. Currently, most of the health center has been using the electronic or ambulatory blood pressure measurement devices due to environmental and health concern. However, only professionally validated and calibrated devices should be used in taking the measurement of blood pressure. The best is from those validated by reputable body eg. British Hypertension Society or American Association for the Advancement of Medical Instrumentation (Ministry of Health, 2013).

Management of prehypertension is depending on the individual's patient global cardiovascular risk. All patients detected in the criteria of prehypertension should have assessment of cardiovascular risk factors. Based on the recent study in Malaysia, it was nearly 54% patients with essential hypertension did not have their cardiovascular risk adequately assessed (Cheong *et al.*, 2015). All patients with prehypertension and hypertension need to be risk stratified for determination of management and preventing the complications. Those with low cardiovascular risk need to be advised on non-pharmacological and lifestyle modifications for lowering the blood pressure. There are still lack of evidence of pharmacological intervention for pre-hypertensive patients with moderate or low global cardiovascular (CVD) risk. There are two trials in pharmacological treatment, first is Trial of Preventing Hypertension (TROPHY) and the second one is Prevention of Hypertension with Angiotensin Converting Enzyme inhibitor Ramipril in

Patients with High normal pressure (PHARAO) have shown significant reduction of risk of developing hypertension by treatment monotherapy of Angiotensin Converting Enzyme (ACE) inhibitor or Angiotensin Receptor Blockade (ARB) (Lüders *et al.*, 2008) (Julius *et al.*, 2006).

Table 2. 1: Definition and classification of hypertension (adapted from Chia, 2008)

JNC-6 and 2007 ESH and ESC definition				JNC-7 and Malaysian CPG	
Category	Systolic		Diastolic	Definition	
Optimal	<120	and	<80	Normal	<120/80
Normal	<130	and	<85		
High Normal	130-139	and/or	85-89	Prehypertension	120-139 or 80-89
Hypertension				Hypertension	
Stage 1	140-159	and/or	90-99	Stage 1	140-159 or 90-99
Stage 2	160-179	and/or	100-109	Stage 2	≥160 or ≥100
Stage 3	>180	and/or	>110		

2.3 Prevalence of prehypertension

Since the introduction of the term pre-hypertension by JNC- 7 in 2003, various studies have attempted to estimate the prevalence of pre-hypertension among different populations and most of these studies found the widespread of pre-hypertension to be a significant health problem among the populations, especially in the adult groups. Review on the many studies

about prehypertension had variability of prevalence and multiple associated factors that contribute to this problem.

From national cross sectional analysis done among 4805 adults from age 18 years old and above at United States resulted with almost 60% of the adults have prehypertension or hypertension. The survey done to know the data prevalence of prehypertension and hypertension according to new JNC-7 guideline. Besides, 31% from them, have no awareness about hypertension. There were only 66% or two third of them were informed by healthcare professionals to change their lifestyle to control the disease. Among them, only 13% reported to have controlled hypertension. These data showed that the awareness and management of hypertensive patients still poor (Wang and Wang, 2004). Older age group, low socioeconomic status and overweight groups were contributing to the prevalence of prehypertension and hypertension in United States.

In view of the few data of the impact of new terminology in classification of prehypertension on the cardiovascular incidence, an observational study name Strong Heart Study was done to look at the prevalence of prehypertension for population with high prevalence of diabetes mellitus. The Strong Heart Study was a cohort study involved 2629 participants from American Indian tribes in South Oklahoma with no hypertension or cardiovascular disease were followed up for 12 years. The results showed that prevalence of prehypertension was 48.2% for non-diabetic participants, lower compared to 59.4% among diabetic patients (Zhang *et al.*, 2006). The results showed that prevalence of prehypertension was high in all age groups and also among diabetic and non-diabetic patients. It was also revealed that prehypertension had increased cardiovascular events 1.8-

fold compared to normotensive blood pressure, with absolute increase of 6 cardiovascular events per 1000 patients per year. The other result from this study revealed that those with prehypertension with impaired glucose tolerance or impaired fasting glucose had further increased the cardiovascular risk.

The results from The Strong Heart Study were similar compared with Framingham Heart Study that was done to look at the progression of prehypertension to hypertension in 4 years duration (Vasan *et al.*, 2001). Based on Framingham Heart Study population, there were participants aged equal or less than 65 years old were followed up for 4 years to look at the progression of prehypertension to hypertension. As a result, 27% of them develop hypertension after 4 years. However, there were higher percentage of those aged more than 65 years old, their percentage for progression of the disease much higher, 42% which is almost two times more than those age less than 65 years old (Vasan *et al.*, 2001).

From the other study at The Canadian Hypertension Education Programme for diagnosis of hypertension and recommendation of follow up, the results were to recommend those people with prehypertension were given follow up yearly for early detection of hypertension. This recommendation was due to the evidence from study done showed 40% of patients with prehypertension developed hypertension in 2 years. Furthermore , 63% of patients with prehypertension progressed to hypertension in 4 years (Padwal *et al.*, 2007). For patients with prehypertension or high normal blood pressure, there are few suggested practical measures that can be done to reduce the risk of progression to hypertension. Patients with prehypertension may have other cardiovascular risk factors, like smoking,

obesity or hyperlipidemia. Therefore, the reduction or elimination of these additional risk factors were ethical and effective (Bolli *et al.*, 2007) .

In Asia, there were few studies done to look at the prevalence of prehypertension in this region. A cross sectional study to look for cardiovascular risk factors among Chinese adults done as part of International Collaborative Study of Cardiovascular Disease in Asia (InterASIA) for those aged 35 to 74 years old (He *et al.*, 2004). The prevalence of prehypertension among Chinese adults was 21.9% and the numbers were higher among residents in northern China compared to the southern area. Higher prevalence rate of prehypertension was detected at rural area or northern China. Lack of organized education and promotion at rural area contributed to this result. In addition, the prevalence was higher among men (25.7%) compared to women (18.0%) (Yu *et al.*, 2008). Based on the study done at rural area of China, it was showed that higher prevalence of prehypertension at that area about 47% with many associated factors. Male population with prehypertension were higher 51.2% compared to female 42.6% (Sun *et al.*, 2007). There was also study at Taiwan population to look for prevalence of prehypertension. The data was based on a cross-sectional survey for Nutrition and Health Survey in Taiwan (NAHSIT) and it was found to have 34% of adult in Taiwan had prehypertension. The percentage was slightly higher among men about 36% compared to women 32%. Multiple associated factors for prehypertension from this study and the important factor is obesity had given high impact among Taiwan population (Tsai *et al.*, 2005).

A cross-sectional study was done among 111 young adults aged between 18 to 25 years old at rural community at West Java, Indonesia reported that 34.2% had prehypertension and

17.1% had hypertension. The prevalence of prehypertension was relatively higher among young adults in primary health care of rural area (Widjaja, 2013). Thus, many interventions were done to prevent earlier complications by lifestyle modifications in view of the associated factors were detected higher in obesity and low physical activity.

In Malaysia, there were few studies done to determine the prevalence of prehypertension in our country. There was a data for national sample done in Malaysia to determine the blood pressure status among adult aged 30 years old and above was done. As a result, the prevalence of prehypertension was around 37% and noted to be higher than hypertension respectively (Lim *et al.*, 2000) (Chia and Srinivas, 2008). The result from this study was almost similar to the community cross sectional study done involving 11,288 adults aged ≥ 30 years old in Malaysia for 3 years. The prevalence of prehypertension was 34% and males has higher prevalence (35.4%) compared to females (Nasir *et al.*, 2012). There was a study done to determine the prevalence of prehypertension among pre-university college students aged 18 to 29 years old in Malaysia. The prevalence of prehypertension was 34.2% among young adults and multiple factors associated with this including obesity and low physical activity (Intiaz *et al.*, 2016).

2.4 Factors associated with prehypertension

In regards of the reported data analysis from cross sectional study at United States resulted in almost 60% of the adult population had prehypertension or hypertension, it showed that the awareness and knowledge of adult towards associated factors and complications of hypertension are still poor (Wang and Wang, 2004). Based on this study, it showed that most of the associated factors of prehypertension were from modifiable risk factors such as

overweight and obesity with low physical activity. This highlights the importance of seriousness of the problem and lifestyle modifications need to be implement earlier.

2.4.1 Sociodemographic factors

Male gender has been proven to be one of the important associated risk factors for prehypertension and this has been reported from various studies. In United States, the prevalence of prehypertension was higher among men than women (40% vs 23%) (Wang and Wang, 2004). The similar results reported at Republic of China, it showed male adults (25.7%) had higher prevalence compared to female (18.0%) (Yu *et al.*, 2008). A cross sectional study done among young adults in Malaysia reported as male adult had higher (44.1%) prevalence compared to female (31.1%) (Intiaz *et al.*, 2016).

In addition to this, ethnic group, age, education level and household income were reported as part of the associated factors of prehypertension. As the increasing age, it will give more risk in getting prehypertension and subsequently hypertension if the modifiable risk factors not controlled. In United states, the prevalence of prehypertension was higher (32%) in adult aged 18 to 39 years old compared to adult with hypertension (27%) (Wang and Wang, 2004). A study was done at Korea reported that per 10 years, age increased 1.2 times of risk to develop prehypertension (Choi *et al.*, 2006). Furthermore, as reported from the study, the prevalence of prehypertension was higher among the 20-year-old age group (80%) compared to those in the 18-19 age group (64.8%) (Intiaz *et al.*, 2016). Meanwhile, in United States, Blacks population had the highest rate of prehypertension compared to another race (Wang and Wang, 2004). Malaysia is a multiracial country with the largest ethnic group is Malay and the prevalence of Malay with prehypertension was higher

compared to the other ethnic group in various studies. In 2004, Balami et al reported that Malay group had higher prevalence of prehypertension with 32.4% compared to non-malay group (Balami *et al.*, 2014). In keeping with ethnic group and prehypertension as one of the associated factors, it is still based on the geographical distribution and ethnic population in each country. Furthermore, education level is one of the associated factors in prehypertension. This blood pressure status affected adults with low education group and they had higher proportion of prehypertension (65%) compared to the moderate level of education adults (54%) (Wang and Wang, 2004). From the study in Malaysia, the prevalence of pre-hypertension among those with primary level of education was higher (50%) compared to those from tertiary level of education (Intiaz *et al.*, 2016). However, the results depend on the area of study and background population of the place. Household income is one of the sociodemographic risk factors of prehypertension. There was a study done at suburban area to determine the associated factors of prehypertension in 2016, reported as adults from middle and upper economic status had a higher proportion of prehypertension and hypertension as compared with those in the lower economic (Parthaje *et al.*, 2016). Another data from urban area, the prevalence of prehypertension among those with middle economic status was higher at 34.9% than high economic status (34.3%) (Intiaz *et al.*, 2016). Apart from these factors, positive family history of hypertension had higher prevalence with hypertension as reported in one study in Malaysia, the prevalence of hypertension was higher among those with family history (12%) as compared to those without family history of hypertension (11.3%) (Rampal *et al.*, 2011). However, the presence of family history of hypertension does not associate with development of prehypertension. Furthermore, patients with a family history of hypertension are at a similar

risk of developing pre-hypertension as patients without a family history (Al-Maqbali *et al.*, 2013). Moreover, the development of prehypertension is depending on the modifiable risk factors that can determine the risk of individuals in getting the prehypertension or hypertension.

2.4.2 Lifestyle factors

There is a study in Malaysia showed a significant association between the level of physical activity with pre-hypertension. Higher prevalence of prehypertension was noted among adults with physically inactive (54.1%) as compared to those who are physically active (31.9%) (Intiaz *et al.*, 2016). There was also study done in Asia, adults with low physical activity getting more chances to have prehypertension compared to those adults practice moderate and highly activity (Khanam *et al.*, 2015). The behavioral factors such as smoking status, alcohol intake and dietary intake are associated with prehypertension. Smokers were found to have 1.49 times the odds compared to non-smokers to get prehypertension (95% CI: 0.81,1.61) as reported in this study (Ibrahim *et al.*, 2008). In Widjaja et al, the percentage of young adults smokers with prehypertension was higher (15.8%) compared to those non-smokers (Widjaja, 2013). Similar results found in other studies found that smokers has higher prevalence of prehypertension (Koura *et al.*, 2012) (Glasser *et al.*, 2011). Meanwhile, adults with alcohol drinking habit had 1.19 times the odds compared to non-alcohol drinker to have prehypertension (95% CI:1.08,1.31;p<0.001) (Sun *et al.*, 2007). Adequate intake of vegetables and fruits per day had lower the chances to get prehypertension compared to those lacks fibers intake. According to the study, adults consumed inadequate amount of vegetables and fruits had 1.15 times the odds to get

prehypertension compared to those with adequate amount of fibers (95% CI: 0.54,2.43) (Parthaje *et al.*, 2016).

2.4.3 Body Mass Index and Abdominal obesity

Body mass index and waist circumference are proven to be risk factors for prehypertension. Evidence suggests that the prevalence of obesity and being overweight had reached an epidemic proportion in general population. In recent study, 17.5% of prehypertension adults noted to be overweight or obese (Sun *et al.*, 2007). Adults with BMI overweight or obese were more likely to get prehypertension compared with adults with normal weight (BMI ≥30, OR=1.593). weight reduction is important in prehypertension as a lifestyle modification to reduce the chances for of getting hypertension. In study, weight control and reduction had been proven could lower the odds of hypertension by 77% (He *et al.*, 2000). Hence, weight reduction was necessary for prehypertensive adults with overweight or obese BMI. Furthermore, a nationwide survey in Cambodia was done to assess the associated factors with prehypertension in adults aged 25 to 64 years old. From the results, it showed that higher body mass index (BMI) was the primary associated factor with prehypertension (OR 3.27, 95% CI:2.21,4.82) (Gupta, 2013). There was a meta-analysis done and concluded that higher body mass index and waist circumferences were related to prehypertension and hypertension. From the study, it suggested that obesity was a major determinant of prehypertension even after controlling the other risks, such as age and sedentary lifestyle (Grotto *et al.*, 2006). Similar findings from various studies were concluded that overweight and obesity associated with prehypertension (Parthaje *et al.*, 2016) (Khanam *et al.*, 2015) (Pang *et al.*, 2008). In Malaysia, there was a study done

showed that those who are overweight and obese have a higher (63.6%) prevalence compared to those who are underweight and have normal weight (30.4%) (Intiaz *et al.*, 2016). In keeping with this, there was a study done by Nasarudin et al in 2016, found that adults with high body fat significantly had 1 times higher risk of developing prehypertension (Nasarudin and Ahmad, 2016). In this study, the results showed that 50.2% of adult with prehypertension were having abdominal obesity by waist circumference.

Based on the literature reviews for the prevalence of prehypertension and associated risk factors, it showed that higher prevalence of prehypertension was detected in almost every study that had been done. In addition, the relationship between modifiable and non-modifiable factors has significant associations with increase in blood pressure.
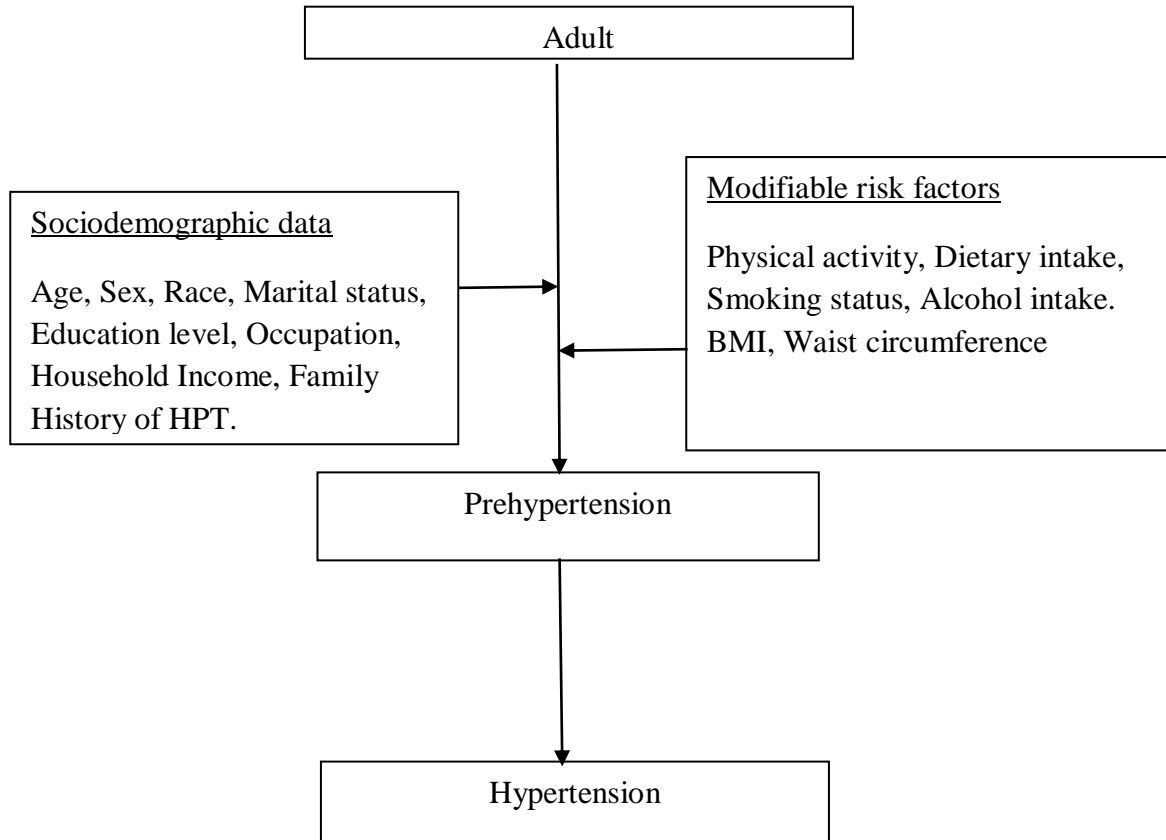
2.5 Conceptual Framework

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                        ┌─────────────────────────┐
                        │          Adult          │
                        └─────────────────────────┘
                                    │
                                    ▼
┌───────────────────────────┐      │      ┌───────────────────────────────┐
│ Sociodemographic data     │      │      │ Modifiable risk factors       │
│                           │      │      │                               │
│ Age, Sex, Race, Marital   │─────►│      │ Physical activity, Dietary    │
│ status, Education level,  │      │◄─────│ intake, Smoking status,       │
│ Occupation, Household     │      │      │ Alcohol intake. BMI, Waist    │
│ Income, Family History    │      │      │ circumference                 │
│ of HPT.                   │      │      │                               │
└───────────────────────────┘      │      └───────────────────────────────┘
                                    ▼
                        ┌─────────────────────────┐
                        │     Prehypertension     │
                        └─────────────────────────┘
                                    │
                                    ▼
                        ┌─────────────────────────┐
                        │      Hypertension       │
                        └─────────────────────────┘
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Figure 2. 1: Conceptual Framework

CHAPTER 3: OBJECTIVES & HYPOTHESIS

3.1 Research Question

The study will investigate the following research questions:

1. What are the proportions of prehypertension among adult attending outpatient clinic Universiti Sains Malaysia Hospital?

2. What are the factors associated with prehypertension among adult attending outpatient clinic HUSM?

3.2 General Objective

- To determine the proportion of prehypertension and its associated factors among adult attending Outpatient Clinic Universiti Sains Malaysia Hospital

3.3. Specific objectives

1. To determine the proportion of prehypertension

2. To identify the sociodemographic, lifestyle status and anthropometry associated factors for prehypertension among patient attending Outpatient Clinic Universiti Sains Malaysia Hospital.

3.4 Research Hypothesis

Socio-demographic, lifestyle status and anthropometric data are significant associated factors for prehypertension among adults attending outpatient clinic in Universiti Sains Malaysia Hospital.

3.5 Operational definition

- Prehypertension is defined as people with systolic BP (SBP) of more than 120 to 139 mmHg or diastolic BP (DBP) of more than 80 to 89 mmHg according to The Seventh Report of the Joint National Committee (JNC-7) on Prevention, Detection, Evaluation and Treatment of High Blood pressure in 2003.

CHAPTER 4: METHODOLOGY

4.1 Study area and background

This study was conducted at outpatient clinic Universiti Sains Malaysia Hospital. This clinic is currently being run by almost 50 staffs including medical officers, family medicine lecturers, family medicine master students and nurses. This clinic open on daily basis during weekdays at office hours and serve patients from appointment or walk in registration. This is an integrated clinic and managed variety of cases including chronic and acute cases with extended scope including Men's Health clinic, Women's health clinic and Quit smoking clinic.

4.2 Research design

This study is a cross sectional study

4.3 Reference population

The reference population is adults in Kota Bahru, Kelantan.

4.4 Source population

The source population is adults attending Outpatient clinic, Universiti Sains Malaysia Hospital.

4.5 Sampling Frame

Adults attending outpatient clinic HUSM from 1st of June 2015 until 30th of September 2015 at Outpatient clinic, Universiti Sains Malaysia Hospital, Kubang Kerian, Kelantan.

4.6 Study population

Adults attending outpatient clinic HUSM from 1st of June 2015 until 30th of September 2015 at Outpatient clinic, Universiti Sains Malaysia Hospital that fulfill the inclusion and exclusion criteria.

4.6.1 Inclusion criteria

      I.   Adults aged at 18 years old and above

4.6.2 Exclusion criteria

      I.   Established hypertension

     II.   Pregnant

   III.   Chronic non-communicable diseases, such as, diabetes, hypertension, hypercholesterolemia, chronic and end stage renal disease and cancer.

4.7 Sampling size determination

For objective 1, single proportion formula was used to determine the appropriate sample size for estimating the proportion of prehypertension in study population. The sample size was calculated with confidence interval was 95% and precision (Δ) was 10%. For this single proportion sample, the sample size calculation is based on this formula. All the parameters are as follow:

n = (zα/Δ)2 x [P(1-P)]

z = confidence interval of 95% = 1.96