

**ASSOCIATION BETWEEN KNOWLEDGE OF  
CARDIOVASCULAR DISEASE AND HEALTHY  
LIFE STYLE AMONG HYPERTENSIVE PATIENTS  
ATTENDING OUTPATIENT CLINIC OF  
UNIVERSITI SAINS MALAYSIA HOSPITAL**

PUNITHA ARINIMA

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## LIST OF ABBREVIATIONS

ATP Adult Treatment Panel

BMI Body Mass Index

DALY Disability-adjusted life-years

IHD Ischaemic Heart Disease

USM Universiti Sains Malaysia

## ABSTRACT

Association between healthy life style and knowledge of cardiovascular disease among hypertensive patients attending outpatient clinic of Universiti Sains Malaysia Hospital.

*Introduction:* Hypertension is one of the risk factors for cardiovascular disease. Having good knowledge is believed to be fundamental for one to practice a healthy life style as a preventive effort. However, there is limited data available on the level of knowledge of cardiovascular disease among hypertensive patients and studies on the preventive measures for healthy life style among the Kelantanese. Hence, this study was performed to assess the association between the healthy life style and knowledge of cardiovascular disease among the hypertensive patients attending outpatient clinic of Hospital Universiti Sains Malaysia.

*Objective:* To determine the association between healthy life style (dietary practice, smoking and physical activity) and the knowledge of cardiovascular disease among hypertensive patients.

*Methodology:* This is a cross sectional study involving 314 hypertensive patients attending outpatient clinic of USM Hospital from September to December 2015. Those who fulfilled the inclusion and exclusion criteria were then selected via systemic random sampling. The hypertensive patients were interviewed based on a set of questionnaires consist of questions on socio demographic, knowledge on cardiovascular disease and healthy life style, which includes dietary, smoking status and physical activity. The sociodemographic data was analysed using descriptive statistic. Data for

each objective was analysed with the simple logistic regression. The association between variables were analysed with multiple logistic regression.

*Results:* The proportion of hypertensive patients who followed the recommended dietary practice, non-smoker and physically active are 7.3%, 92% and 34.4% respectively. Meeting the dietary recommendations was not associated with knowledge (OR = 0.7; CI95% 0.28;1.75). There was no significant association between smoking and cardiovascular knowledge (OR = 0.9; CI95% 0.39;2.09). There was no significant association between physical activity and knowledge (OR = 21.5; CI95% 0.43;1.14)

*Conclusion:* Knowledge of cardiovascular disease among the hypertensive patients is not significantly associated with healthy lifestyle i.e. dietary practice, smoking and physical activity. This suggests that other factors that may contribute to healthy lifestyle has to be identified and studied.

## ABSTRAK

Kaitan antara cara hidup sihat dan pengetahuan penyakit kardiovaskular di kalangan pesakit darah tinggi yang hadir ke klinik pesakit luar Hospital Universiti Sains Malaysia.

*Pendahuluan:* Darah tinggi merupakan salah satu faktor risiko untuk penyakit berkaitan dengan kardiovaskular. Ilmu pengetahuan dipercayai sebagai asas untuk seseorang mengamalkan cara hidup yang sihat untuk mengelakkan daripada penyakit. Namun, tiada banyak sumber mengenai tahap pengetahuan penyakit kardiovaskular dan usaha-usaha yang dilakukan untuk mengelak penyakit tersebut dalam masyarakat di Kelantan. Oleh itu, kajian ini dilaksanakan untuk mendapatkan kaitan antara amalan hidup sihat dengan pengetahuan penyakit kardiovaskular, dalam pesakit darah tinggi yang menerima rawatan di klinik pesakit luar, Hospital Universiti Sains Malaysia.

*Objektif:* Untuk menentukan kaitan antara pengamalan cara hidup sihat (menerusi pemakanan, tabiat merokok dan aktiviti fizikal) dan pengetahuan kardiovaskular dalam pesakit darah tinggi.

*Kaedah:* Ini ialah kajian hiris lintang melibatkan 314 pesakit darah tinggi yang hadir ke Klinik Rawatan Keluarga dan Klinik Staff Hospital Universiti Sains Malaysia dari bulan September ke bulan Desember tahun 2015. Setiap pesakit darah tinggi di temuramah berpandukan borang soal selidik yang terdiri daripada soalan demografik social, pengetahuan penyakit kardiovaskular dan pengamalan cara hidup yang sihat, termasuk pemakanan, tabiat merokok dan aktiviti fizikal. Maklumat yang diperolehi di analisa menggunakan statistic deskriptif dan regresi logistik.

*Keputusan:* Dalam kajian ini, didapati proporsi pesakit darah tinggi yang mengamalkan pemakanan yang mengikut rekomendasi, tidak merokok dan aktif secara fizik adalah 7.3%, 92% and 34.4%. Walaubagaimanapun, kajian ini mendapati bahawa tidak ada kaitan yang signifikan antara pengetahuan kardiovaskular dan pemakanan, tabiat merokok dan aktiviti fizikal.

*Kesimpulan:* Pengetahuan kardiovaskular dalam pesakit darah tinggi tidak berkaitan dengan pemakanan, tabiat merokok dan aktiviti fizikal.

## **CHAPTER 1: INTRODUCTION**

### **1.1 Background**

Hypertension is known as an increase in the blood pressure. It has been an important public concern as it is a chronic health problem and debilitating disease. Hypertension is characterised by having a systolic blood pressure of 140 mmHg or more, and/or diastolic blood pressure of 90 mmHg or more (World Health Organization, 2013). The National Institute for Health and Care Excellence targeted the blood pressure to be less than 140/90 mmHg for hypertensive patients who are on treatment, if they are less than 80 years old. Whereas, those above 80 years old has a higher target, which is 150/90 mmHg. Both systolic and diastolic blood pressure plays an important role in sustaining our body function without complications, especially to the heart, kidneys, brain and other organs (World Health Organization, 2013).

The prevalence of hypertension varies in different region of the world, thus the socio-demographic factor plays a significant role to it (Kearney et al., 2004, Krishnan et al., 2013) . It was estimated that the global prevalence of hypertension in 2015 was 1.39 billion patients (Bloch, 2016). Out of this estimated number, 31% were adults. This shows a marked increase from 5.2% in the year 2010 compared to year 2010. Despite having a controlled and reduction in the number of case in developed countries, its prevalence in developing countries, such as, those in South East Asia is on the rise (Mohan et al., 2012). A study which was conducted in 154 countries shows an increase in the number of patients diagnosed with hypertension from the year 1990 to 2015 (Forouzanfar et al., 2017). These result does not only affect the patients but adds on the

burden to the country. However, Malaysia's prevalence of hypertension is in contrast to the world wide's hypertension prevalence. According to the Malaysian National Health Survey in 2015, there is a reduction in the prevalence of hypertension in Malaysia, whereby it has reduced from 32.7% in 2011 to 30.35 in 2015 (Abd Kadir et al., 2015). However, the number of patients diagnosed hypertension is still an ice berg phenomenon. It is evidenced by the unchanged proportion of "undiagnosed hypertension" which remains at 17.2% in 2011 and 2015 (Abd Kadir et al., 2015).

Hypertension is known to have a very strong association with cerebrovascular disease, cardiovascular disease and renal disease. Hypertension results from the increment in cardiac output and their systemic vascular resistance. While both affects the blood pressure, the stiffening and hardening of the artery reduces the elasticity of the vasculature especially in older age group. This is also another contributor to the increase of blood pressure. The after effect of these will cause diastolic dysfunction and decrease in blood supply to the heart itself (Katholi and Couri, 2011). Eventually all these will lead to coronary artery disease (Foëx et al., 2004).

Coronary artery disease is the blockage of arteries that supplies blood to the heart due to atherosclerosis (Natali et al., 2000). Coronary artery disease includes myocardial infarct and angina, is one of the cardiovascular disease. It is highly associated with hypertension (Natali et al., 2000). The increase of estimated annual death and also loss of disability-adjusted life-years (DALYs) caused by cardiovascular disease is proportionate to the increasing number of hypertensive patients (Forouzanfar et al., 2017). These may be reduced by acting on prevention of cardiovascular disease.

The cardiovascular risk can be reduced by controlling the risk factors. Those risk factors are divided into modifiable and non-modifiable risk factors. Modifiable risk factors are hypertension, dyslipidaemia, diabetes, prediabetes, overweight, obesity, smoking, lack of physical activity, unhealthy diet and stress. Whereas non-modifiable risk factors are age, gender, and family history of coronary heart disease.

Lifestyle changes is the first approach that is advocated to reduce the modifiable risk of cardiovascular disease (Watson and Jamerson, 2003). It can be adopted since young, for example having a healthy meal with the family, not smoking cigarette and being physically active. It also controls multiple risk factors of cardiovascular disease at the same time. Having knowledge on cardiovascular disease is essential, especially for those who already have a risk factor like hypertension. The knowledge is believed to plays an important role for a person to have a good practice of healthy life style (Harrison et al., 1992). There are many awareness campaigns and programmes initiated to increase the knowledge on healthy lifestyle.

The Nutrition Society of Malaysia was among the pioneers to promote healthy life style. In the year 2002, “Resepi Sihat, Pilihan Bijak” book was introduced. This book was launched with recipes from all parts of Malaysia, giving ideas and guidance for having healthy local cuisine that benefits the health. “Tak Nak Merokok” campaign was later launched in the year 2004. Subsequently many other campaigns came along to encourage healthy life style among Malaysians. However, the number of cardiovascular disease and smoking in Malaysia seems to be in rising trend (Rampal et al., 2008, Fasoro et al., 2013). Despite not having a registry on the other healthy life styles, the

speculation can be made that the number of those practicing healthy life style are not declining either.

## **1.2 Justification of the Study**

There is an upward trend in the prevalence of cardiovascular disease and hypertension throughout the world, and the situation does not differ much in Malaysia. There are many literatures proved the correlation between both diseases. It is known that multiple factors contribute to cardiovascular disease, other than hypertension. Besides having a good blood pressure control, a healthy lifestyle also helps to reduce the risk of cardiovascular disease among these hypertensive patients.

According to the Health Belief Model, good knowledge is predicted to change a person's behaviour towards a disease (Sharma and Romas, 2012). There are many studies done to assess the knowledge of cardiovascular disease among healthy general population. Despite the increasing trend of hypertensive and knowing that it a major risk factor for cardiovascular disease, there is limited data available on the level of knowledge of cardiovascular disease among hypertensive patients, especially in Kelantan. Limited studies also found on the preventive measures as in a healthy life style, taken to reduce risk of this complication of hypertension among the Kelantanese.

This study is designed to evaluate the knowledge of cardiovascular among the hypertensive patients in Kelantan. The result of this study will be helpful in planning and make policies to enhance the knowledge of cardiovascular diseases among hypertensive patients. Besides that, by identifying the current life style (diet, smoking

and physical activity) on cardiovascular prevention, more awareness campaigns for hypertension patients via different media can be planned in future. This plans and policies are for the ultimate result, that is to reduce the burden of cardiovascular to the country.

## **CHAPTER 2: LITERATURE REVIEW**

### **2.1. Hypertension and cardiovascular disease**

Hypertension is a chronic elevation of blood pressure that, in the long-term, would cause end-organ damage and result in increased morbidity and mortality. Blood pressure is the product of cardiac output and systemic vascular resistance (Foëx et al., 2004). This can adversely affect the health status of the individual, family and community and directly affects the quality of health and possibly of life of the general population.

Raised blood pressure is mostly asymptomatic, but without being noticed produces a variety of structural changes in arteries that supply blood to the brain, heart, kidneys and elsewhere (World Health Organization, 2002). Even though it is an expensive disease to treat, but treating hypertension reduces the risk factor for coronary heart disease, cerebrovascular accidents, congestive heart failure and renal failure. The risk of cardiovascular disease depends on blood pressure levels, coexistent risk factors, and whether there is hypertensive damage to target organs (Blood Pressure Lowering Treatment Trialists, 2014).

While the real mechanism of hypertension is still unknown, there are few theories on the causes of hypertension and it varies between the different age group. In a study done by Foex et al (2004), it was revealed that the common cause of hypertension in younger age group was increased cardiac output. Meanwhile in older age group, it is

caused by the elevation of systemic vascular resistance and increased stiffness of vasculature. These amplify the load imposed on the left ventricle, inducing left ventricular hypertrophy and subsequently causing left ventricular diastolic dysfunction.

At the same time, ageing process stiffens the aorta and reduces the elasticity of the arteries, which results in increased pulse pressure. The changes in the systemic vascular and elasticity of the arteries, subsequently elevates the systolic blood pressure and reduces the diastolic blood pressure (Rigaud and Forette, 2001). These cause the widening of the pulse pressure. The widening of the pulse pressure alongside ageing is another strong predictor of coronary heart disease (Foëx et al., 2004).

Coronary artery disease is associated with, and accelerated by, chronic arterial hypertension, leading to myocardial ischaemia and myocardial infarction. Clinically the incidence of three-vessel disease is higher among the hypertensive patients compared to normotensive patients (Natali et al., 2000). Thus, hypertension is an established risk factor for death from coronary artery disease (Rigaud and Forette, 2001, Foëx et al., 2004, Forouzanfar et al., 2017).

## **2.2 Knowledge of cardiovascular disease**

Knowledge is defined as facts, feelings or experience known by a person or group of people (Collin, 2017). It is also means an awareness, consciousness, or familiarity gained by experience or learning. However, there are many factors that contribute to an individual to attain knowledge.

Concerning knowledge on cardiovascular disease, there are various aspects of knowledge has been assessed over various region of the world and between different populations and groups. Among those were the types, symptoms, risk factor, prevention and treatment of cardiovascular diseases. However, research on the cardiovascular knowledge has some diversifying results. A study done by Awad and Al-Nafisi (2014) among 816 Kuwaiti nationals found that there is a deficiency in the level of knowledge of cardiovascular disease. The median (IQR) knowledge score of hypertensive patients was 10.0 (8.0) out of a maximum score of 25. The knowledge of cardiovascular disease was strongly associated with gender, age, education, eating healthy diet, and family history of cardiovascular disease ( $p < 0.05$ ) (Awad and Al-Nafisi, 2014). This study reflected that the knowledge was significantly greater among females compared to males ( $p = 0.022$ ), and among those aged 50–59 years compared to other age groups ( $p = 0.007$ ). The study participants were found to be more knowledgeable about cardiovascular disease if they had high level of education ( $p = 0.036$ ), had healthy diet everyday ( $p < 0.001$ ), and had family history of CVD ( $p < 0.001$ ).

Another study was done by Vaidya *et al.* (2013) among the urbanised community in Nepal to assess the knowledge on causes of heart attack and warning signs of heart attack. Similarly, respondents with education level higher than high school had better knowledge on causes of heart attack than others. On top of that, the score was also high among the respondents who were government employees and the younger age group (<35 years) (median 13.7% vs 10.3%,  $p = 0.01$ ). Respondents from certain ethnicities (Brahmin, Newer and Chhetri) had less knowledge than those in the other caste/ethnicity group (median 13.8% vs 6.9%,  $p = 0.001$ ) (Vaidya et al., 2013). The

proportions of each warning sign were not statistically different in terms of gender ( $p>0.05$ ), age ( $\chi^2=3.39$ ,  $p=0.49$ ), caste/ethnicity ( $\chi^2=6.25$ ,  $p=0.4$ ) and education ( $\chi^2=5.50$ ,  $p=0.53$ ).

Despite being an important risk factor for cardiovascular disease, there were not been many studies done to assess knowledge of cardiovascular disease among this group of patients. Most patients with underlying hypertension aware that the myocardial infarct, cardiovascular disease and renal dysfunctions are complications of this disease (Kisokanth et al., 2016). A study was done in Korea among the rheumatoid arthritis patients, who are at higher risk of cardiovascular disease. The mean score of knowledge on cardiovascular disease was high. The average overall knowledge score was 9.93 out of 13 (Boo et al., 2017).

Regardless of having the similar demography as Malaysia, Singapore is advanced in their socio-economy status and falls under advancing economy country. A study to assess the knowledge of cardiovascular disease was done among 4192 Singaporean by Joy Li *et al.* The study revealed that the current level of knowledge for both signs and symptoms of heart attack and stroke was reasonable regarding both conditions, in almost equivalent proportions, i.e. 57.8% and 57.1%, respectively (Joy Li et al., 2014). The respondents scored an overall mean of 5.0 (SD 2.4) out of 8 for heart attack, and with an overall mean of 6.8 (SD 2.9) out of 10 for stroke. The level of knowledge was greater among the respondents  $\geq 50$  years and respondents with higher level of education. This is consistent with previous studies (Awad and Al-Nafisi, 2014, Vaidya et al., 2013).

Bush *et al.* (2008) conducted a study among 162 outpatient female attendees of urban, tertiary care and teaching hospital in Texas. It was to observe the knowledge and awareness of peripheral vascular disease among females, and the cardiovascular disease was categorized into three risk levels of cardiovascular diseases; low, moderate and high. He stated that the knowledge was low irrespective of the risk level. Kandula *et al.* (2010) studied 270 South Indians in Chicago who attended one federally qualified health centre and five community centres. This study perceived knowledge breaches and misconceptions about coronary heart disease among Indian and Pakistani residents of United States. The level of education was absolutely associated with the level of knowledge. On a later study, Lambert *et al.* (2013) explored the relationship between the knowledge and the risk of heart attack and stroke in the emergency department in a suburban, public tertiary-care academic medical centre in United States. He noticed that the knowledge level was low among the people with high risk score.

A very limited study was done in the low and middle-income countries, focusing on finding factors associated with the public knowledge on cardiovascular disease and its risk factors. The education level, income bracket and residence are positively associated with the knowledge on coronary heart disease in Pakistan (Jafary *et al.*, 2005). Similar studies in India and Jordan indicated the same association (Saeed *et al.*, 2009, Mukattash *et al.*, 2012).

Level of education has always been associated with higher level of knowledge. Exposure on certain subjects also plays a vital role in obtaining awareness on certain field. A study was conducted by Ibrahim *et al.* (2016) to assess the knowledge, attitude

and practice among undergraduate students of all the six faculties in International Islamic University, Kuantan campus, the on the risk factors of cardiovascular disease. There is a significant difference in terms of knowledge score between the students from different faculty. The students from the faculty of Science, Pharmacy, and Dentistry has higher knowledge on cardiovascular disease compared to those from Medicine, Allied Health Sciences, and Nursing. The respondents acceptably know that cardiovascular disease is associated with certain disease circumstances, such as stress, obesity, dyslipidemia, smoking, sedentary lifestyle, high abdominal fat, and lack of sleep, respectively (Ibrahim et al., 2016).

A study done among females in Kelantan revealed that about 55.6% of participants has good knowledge on cardiovascular disease (Muhamad et al., 2012). Although less than 40% of them knew that cardiovascular disease is the main cause of death in Malaysia, but 87.1% and 79.3% of them answered correctly for smoking and hypertension, respectively in the risk factor questions.

## **2.3 Healthy life style and its association to cardiovascular disease**

### **2.3.1 Therapeutic Lifestyle Changes**

There are many risk factors of cardiovascular disease. These is further divided into modifiable and non-modifiable risk factors. The risk of getting cardiovascular disease can be reduced by lowering the risk factors, which can be done with pharmacological approach and life style changes.

One of the instances of lifestyle approach is Therapeutic Lifestyle Changes. It is recommended by numerous health organizations, such as, the American Diabetes Association, American Heart Association, and The Obesity Society, among others, as a comprehensive therapeutic strategy for overweight or obese persons at risk for type 2 diabetes and/or coronary heart disease (Klein et al., 2004, Buse et al., 2007).

Therapeutic Lifestyle Changes is the lifestyle component of the Third Report of the NCEP Adult Treatment Panel (ATP) III guidelines (National Cholesterol Education Program, 2002). The lifestyle changes mainly focused on the diet, weight management, and physical activity to reduce the risk of coronary heart disease. The ATP III guidelines specifically target LDL because of its strong, positive association with coronary heart disease risk (National Cholesterol Education Program, 2002). Although drug therapy may also be used, ATP III places a foremost emphasis on Therapeutic Lifestyle Changes as a crucial therapy for persons at risk for coronary heart disease (National Cholesterol Education Program, 2002). The collective effect of the Therapeutic Lifestyle Changes diet components can reduce low density lipo-protein level by 25-30% compared to a typical United States diet, which is similar to the effect of drug therapy (National Cholesterol Education Program, 2002).

On the other hand, the NICE guideline emphasizes on lifestyle changes to promote primary and secondary prevention of cardiovascular disease. In addition to dietary modification, increased physical activity, body weight reduction as advocated by the ATP III guideline, reduction in alcohol consumption, smoking cessation are

recommended to reduce the risk of cardiovascular disease (National Institute of Care and Excellence, 2014).

The PREHIPER Study revealed that the life style changes reduced the risk of cardiovascular disease in prehypertension patients. A six month programme with dietary modification, physical activity and educational session proven to reduce the Framingham risk score from 5 to 3.5, and the probability of a cardiovascular event at 10 years decreased from 5.29 (3.88) to 4.24 (2.86) ( $P < .05$ ) (Márquez-Celedonio et al., 2009).

A good health behaviour has always been assumed to have correlations with good knowledge. However, a concise analysis and update of the literature from high income nations revealed consistency with little controversy. Thompson in the heart European leader panel (HELP) study group of five European countries reported the results of surveying the awareness and attitudes on coronary heart disease among the general population, high risk group, and patients post myocardial infarction and their family members. It was found that although participants were having reasonable knowledge about coronary heart disease they did not act upon their knowledge (Thompson, 1998). Nevertheless, Muhamad *et al.* (2012) found positive association between knowledge, attitude and practice independent of socio-demographic factors among female patients in primary care clinic in Kelantan- Malaysia.

### **2.3.2 Diet**

Diet and nutrition have been extensively investigated as risk factors for major cardiovascular diseases like coronary heart disease (CHD) and stroke and are also linked to other cardiovascular risk factors like diabetes, high blood pressure and obesity. A person who habitually adopt one healthy dietary practice are more likely to adopt other healthy dietary habits as well as practice regular physical activity and abstinence from smoking.

Global Strategy on Diet, Physical Activity and Health was developed by World Health Organization in 2004 to reduce the risk factors of major cause of morbidity and mortality based on its previous report on non-communicable disease, which were causing high mortality and morbidity worldwide. The World Health Organization strategy addresses diet and physical activity, two of the major risk factors responsible for the growing burden of non-communicable diseases, and emphasises the need to limit consumption of salt, saturated fats and refined sugars, and to increase consumption of vegetables and fruit and levels of physical activity (World Health Organization, 2004). It also identifies the need to address the role of consumer education and communication.

While the consumption of fruit and vegetables has been widely believed to promote good health, evidence related to their protective effect has only been presented in recent years (Nestle, 1999, Law and Morris, 1998, Ness and Powles, 1997). A systematic review reported that nine of ten ecological studies, two of three case control studies and six of sixteen cohort studies found a significant protective association for

CHD with consumption of fruit and vegetables or surrogate nutrients (Ness and Powles, 1997). For stroke, three of five ecological studies and six of eight cohort studies found a significant protective association (Ness and Powles, 1997).

Higher intake of fruits and vegetables, as part of a healthy dietary pattern, may only contribute a modest beneficial effect to hypertension prevention, possibly through improvement in body weight regulation (Wang et al., 2012). During 12.9 years of follow-up, 13,633 women developed hypertension. After basic adjustment including age, race, and total energy intake, the hazard ratio and 95% CI of hypertension was 0.97 (0.89-1.05), 0.93 (0.85-1.01), 0.89 (0.82-0.97), and 0.86 (0.78-0.94) comparing women who consumed 2-<4, 4-<6, 6-<8, and  $\geq 8$  servings/day of total fruits and vegetables with those consuming <2 servings/day. These associations did not change after additionally adjusting for lifestyle factors but were attenuated after further adjustment for other dietary factors. When fruits and vegetables were analysed separately, higher intake of all fruits but not all vegetables remained significantly associated with reduced risk of hypertension after adjustment for lifestyle and dietary factors.

A study to observe the associations of fruit and vegetable intake with incidence of CHD among 67,211 women (40–70 years) and 55,474 men (40–74 years) living in Shanghai, China suggested that a high consumption of fruits reduces the risk of CHD in Chinese women (Yu et al., 2014). However, there was no association between consumptions of fruits and vegetables with the incidence of males in their study. During a mean follow-up of 9.8 and 5.4 years, 148 events in women and 217 events in men were documented and verified, respectively. After adjustment for potential confounders,

women in the highest quartile of total fruit and vegetable intake (median: 814 g/d) had a hazard ratio (HR) for CHD of 0.62 (95% CI 0.38, 1.02) ( $P$  for trend=0.04) compared with those in the lowest quartile (median: 274 g/d). This association was primarily driven by fruits (the HR for the highest vs. the lowest intake in women: 0.62; 95% CI, 0.37, 1.03).

The changes in behaviour that could result from enhancing knowledge (Harrison et al., 1992). Thus, it is important to increase the knowledge of an individual so that it will lead to healthier lifestyle. A study was conducted at the Nutrition clinic of the National Hospital of Sri Lanka from March to December 2013, among 423 participants with diabetes, hypertension, and/or dyslipidemia of less than 5 years. Despite the majority (66%) of participants had a moderate mean knowledge score ( $6.66 < \text{Mean Score} \leq 13.33$ ), only one-third ate at least 2 portions of vegetables per day; and general portion size reduction was practiced irregularly by 52% of participants during the past 6 months (Amarasekara et al., 2016). An earlier study was done by Chaturvedi *et al.* comparing patients with coronary heart disease and normal populations in Jaipur city, India, to observe the association of knowledge of cardiovascular disease and their attitude and practice. Observation of demographic profile of both the groups were almost similar, in terms of age, marital status and educational level, but there were 65.7 percent hypertensive subjects among the first group and 12 percent of hypertensive subjects in the latter group. The study revealed that knowledge were not statistically correlated to the diet practice (Chaturvedi et al., 2012).

Since there were discrepancy in the dietary practice despite having good knowledge, some researchers were interested in investigating on other factors influencing in the dietary practice (Riediger et al., 2007, Bihan et al., 2010, Krige et al., 2012). As such is the study conducted by Riediger *et al.*, where a total of 130,000 adolescents from all provinces and territories of Canada were included in this survey. It was discovered that low total household income has significant association with low fruits and vegetable consumption, whereas higher level of education in the household, children living with both parents and female gender has higher consumptions of fruits and vegetables with statistical significance (Riediger et al., 2007).

While ethnic and cultural differences have no association with the fruit and vegetable consumption. Later, Bihan (2010) recruited 295 participants who were undergoing health examination at a deprived area in suburb of Paris and revealed that levels of education lower than the tertiary level, age less than 55 years old, and insufficient financial means for buying fruits and vegetables daily were independently associated with low frequency of fruit and vegetable consumption. The mean age of the participants were 44.8 years; 133 men and 162 women, with 3 levels of educations and half suffering from poor financial situation. There were only 14.6% and 3.3% of participants estimated their fruit and vegetable intake frequency to  $\geq 3$  times/day respectively.

Nearly 30% of participants did not eat fruits and 29.4% did not eat vegetables. This low consumption was reported in 32.5% of participants between 30 and 54 years of age and in 13.6% of those aged 55–60 years old. Among 31.6% of participants ate fruits

and vegetables at least 3 times daily, and 7.0% participants consume fruits and vegetables at least 5 times/day (Bihan et al., 2010). In the previous two studies, a significant association between socioeconomic status to the healthy diet practice was observed. Thus, Krige *et al.* investigated further on the correlation of socio-demographic factors and eating practices in a multicultural society. The discovery from this study with parameters such as; age, level of education, occupation and relationship between family members, was significant and positively associated to dietary practice (Krige et al., 2012). Adherence to recommended diet increased with increasing age and level of education, while it was lower adherence among office workers and professionals.

Hence, dietary practice is an important healthy lifestyle practice to reduce the risk factors of cardiovascular disease and there are many factors contributing to it. It is beneficial to know the factors that influence the participants in this study.

### **2.3.3 Smoking**

Tobacco is the only permitted drug that widely available in the market despite knowing it's potential danger. The American Heart Association and British Heart Foundations highly recommend the public to quit smoking to reduce morbidity and mortality potentially caused by cardiovascular disease (Lichtenstein et al., 2006, Ahmadi-Abhari et al., 2017). Despite all the actions taken by the government and non-governmental organizations, the prevalence of smoker is still high internationally and in Malaysia (Lim et al., 2013). This perhaps due to Malaysia being the one of the main

production centre for the cigarette manufactures like British American Tobacco, Philips Morris and Japan International Tobacco (Statista, 2016).

In 2015, the National Health and Morbidity Survey reported that there were 22.6% adult current smokers of any smoked tobacco products among the Malaysians. Out of these, 42.5% was men who had smoked any tobacco products compared to only 1.3% female. The number of current adult smokers has decreased from 23.1% in 2011, but the number of female smokers has increased from 1% to 1.3% over the 4 year (Institute of Public Health, 2012). Most smokers were from the 25-44 years old age group (28%), followed by the 45-64-year-old age group (20%). Comparing the smokers from urban and rural areas, the latter has the most number of smokers which is 23.1%, while 19.1% was from urban areas. But, the prevalence of smoking any tobacco product was higher among the secondary education group (27.8%), compared to tertiary education group (15.2%). It was noted that current smokers who smoked manufactured cigarettes were the same among secondary education group and tertiary education group, which is almost the similar percentage (14.3% vs 14.6)(Institute of Public Health, 2015). In Kelantan per se, the prevalence of ever and current smokers was recorded at 34.0% and 25.1% ( $p < 0.001$ ) in 2004 (Rampal et al., 2004). Four years after the “Tak Nak” campaign, there was a reduction in the percentage of current smokers by 2% in Kelantan, yet it was leading in the prevalence of current smokers. Kelantan is followed closely by Terengganu, Pahang, Kedah, Johor and Negeri Sembilan (Rampal et al., 2008).

The World Health Organization report in 2010 observed that the prevalence of male smokers was highest among the 15-24 years old age group, whereas female smokers in the 70 plus age group. It is targeted to have 30% reduction of tobacco use globally by the year 2025. The current effort to reduce the number of smokers in Malaysia is not adequate, it will be difficult to achieve the World Health Organization's target by the year 2025. Subsequently, it is speculated that 18% of Malaysians will be smokers by 2025 (World Health Organization, 2015b).

Cigarette smoking has been related to so many medical conditions. Smoking has significant association to cardiovascular disease (Raihan and Azmawati, 2013) and several types of cancer; such as, the oral cavity, esophagus, colon, pancreas, breast, larynx, kidney and leukemia especially myeloid leukemia. Besides that, passive smokers and children exposed to environmental tobacco smoke are implicated in developing cardiovascular diseases (Saha et al., 2007). Therefore, continues measures are researched and put to test to reduce and eliminate cigarette smoking.

As aforementioned, knowledge has always been linked to healthy behaviour. This is supported by a study done by Chaturvedi. Knowledge has positive correlations with smoking practice among the patients with coronary heart disease and normal population (Chaturvedi et al., 2012). There were lesser number of smokers among the patients with coronary heart disease compared to the general population. The latest study by Izzati *et al.* (2016) discovered that knowledge has weak positive association with attitude and habit of smoking. The r-values between knowledge with attitude and practice were +0.193 and +0.206 respectively.

In contrast to the above study, Al-Haqwi *et al.* (2010) observed that knowledge is inversely correlated to smoking practice among the medical students in Riyadh. About 25% out of 215 medical students in the study remained smokers despite having good knowledge of its danger (Al-Haqwi *et al.*, 2010). The main reasons stated were peer pressure and stress. Heydari *et al.* (2013) found the similar results with Al-Haqwi *et al.* (2010) among the clergyman and teachers of Iran. The odds ratio of smoking cigarette in clergymen (OR = 3.1; 95% CI: 2.0-4.6) and teachers (OR = 2.7; 95% CI: 1.9-4.0) with poor knowledge was significantly higher than those with moderate or good level of knowledge (Heydari *et al.*, 2013).

Regardless of having high levels of knowledge, the number of smokers remains quite high, but conveys no relation to the level of the practice. Hence, other factors affecting smoking practice are also investigated. Smoking is highly associated with increasing age (Amirul-Hisham and Norsaladah, 2016), male domain (Amirul-Hisham and Norsaladah, 2016, Fasoro *et al.*, 2013) and lower educational level (Fasoro *et al.*, 2013).

A review of smoking in Malaysia was done by Wee *et al.*, where two hundred and seventy-one published materials regarding tobacco use from the year 1996 to 2015 were analysed. Smoking in adults was interrelated to the male domain, alcohol abuse, intravenous drug use, older age, low income, marital status, ethnicity, religion, lower education level, peer influence, employment status, residential area, family income, role in the family, parental knowledge, lifestyle and health status (Wee *et al.*, 2016) .

Noting the fact that smoking cessation reduces the risk of many debilitating illnesses and it is attributed to many factors, it is crucial to identify the factors affecting the local population for the right intervention to be carried out.

#### **2.3.4 Physical activity**

Physical activity has been promoted as part of healthy life style to prevent many diseases since ancient times. Many studies and articles are found to relate physical activity to a group of diseases; such as coronary heart disease, type 2 diabetes mellitus, hypertension, osteoporosis, depression, anxiety, obesity and others. Globally, it is projected that physical inactivity is accountable for 6% of the burden of disease from coronary heart disease with the following range: 3.2% in South-east Asia to 7.8% in the Eastern Mediterranean region; 7% of type 2 diabetes (3.9% to 9.6%), 10% of breast cancer (5.6% to 14.1%), and 10% of colon cancer (5.7% to 13.8%) (Lee et al., 2012). Besides that, 9% of premature mortality (5.1% to 12.5%), or >5.3 of the 57 million deaths that occurred worldwide in 2008 are caused by physical inactivity.

Jerry Morris was the pioneer who investigated the state of physical inactivity and physically active among the London Transport bus drivers and bus conductors. The study was carried out in the year 1953 with 3 years of follow up among 15,500 drivers and 9,500 conductors, aged between 35 to 64. It was an eye opener when the results revealed that the bus conductors had 50% less mortality caused by coronary heart disease compared to their fellow colleagues who were the bus drivers (Morris and Raffle, 1954). This was due to the nature of their occupation where the conductors are

always mobile while the bus drivers were more static throughout their duty. These studies were then followed by many shoe-leather epidemiology.

The correlation between physical inactivity and coronary heart disease has a specific characteristic that has been seen in different settings, where it is strongly associated to each other. The level of physical activity predates the occurrence of coronary heart disease. It is biologically graded, where the risk increases as the physical activity decreases and it is plausible as reflected by scientific knowledge (Bijnen et al., 1994).

Initiating physical activity is equally advantageous as continuing it for survival (Knight, 2012). The world's population life expectancy is postulated to increase by 0.68 years if physical inactivity is lessened. And by reduction of 10% or 25%, >533,000 and >1.3 million deaths would be avoided respectively per year (Lee et al., 2012). Despite so many researchers emphasizing the benefits of physical activities, there is no dramatic decline in the rate of physical inactivity.

Physical activity is contributed by multiple factors. Currently, many sports events are participated equally by both genders. Nevertheless, study shows that adolescent females are physically inactive (Bastos et al., 2008), the adult females are found to be more active (Marques et al., 2016). Later, Biernat & Tomaszewski found a contrasting result as there were no differences in the number of both genders among the inactive respondents. Biernat and Tomaszewski (2015) also found that two thirds of their respondents were active, while one third of them were not. However, physical

inactivity has positive association with obesity, overweight, having living in partners and having regular leisure activities, but there was no significant correlation with education (Biernat and Tomaszewski, 2015).

On the other hand, Moniruzzaman *et al.* (2017) observed the physical activity in rural and urban areas of Bangladesh by calculating the median MET-minute of total physical activity per week and revealed that the prevalence of physical activity was generally low. The percentage of physical inactivity was 50.3% (95% CI: 46.8–53.8) with urban 59.5% (54.7–64.3) and rural 41.9% (37.0–46.8). The inadequate physical activity was significantly correlated to urban residence (OR = 2.2; 95% CI: 1.5–3.2), women (2.1; 1.4–3.9), oldest age group 55–64 years (15.6; 7.5–32.2) compared to youngest age group 25–34 years, graduates or higher education (8.6; 4.1–17.7), and higher socio-economic class (2.4; 1.4–4.2) compared to the poor (Moniruzzaman *et al.*, 2017).

Marques *et al.* (2016) observed a dissimilarity to the above study whereby age above 55-64, those who had secondary level of education, lived in rural areas and had at least three or more people living together at home had a likelihood of practicing physical activity as recommended. Whereas, physical inactivity was more likely among those who are unemployed, students, retired participants and those who were having higher household income (Marques *et al.*, 2016). There are not many latest studies found on sociodemographic factors affecting the physical activity in Malaysia.