UNIVERSITI PUTRA MALAYSIA

SOCIO-ECONOMY, LIFESTYLE, NUTRITIONAL STATUS, BIOCHEMICAL PARAMETERS AND BLOOD PRESSURE ASSOCIATED WITH CARDIOVASCULAR DISEASE RISK MARKERS AMONG MALAY EMPLOYEES IN UNIVERSITI PUTRA MALAYSIA

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By

NORSHAFAWATI ABD AZIMI

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfillment of the Requirements for the degree of Master of Science

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

SOCIO-ECONOMY, LIFESTYLE, NUTRITIONAL STATUS, BIOCHEMICAL PARAMETERS AND BLOOD PRESSURE ASSOCIATED WITH CARDIOVASCULAR DISEASE RISK MARKERS AMONG MALAY EMPLOYEES IN UNIVERSITI PUTRA MALAYSIA

By

NORSHAFAWATI ABD AZIMI

July 2013

Chairman: Rosita Jamaluddin, PhD

Faculty: Medicine and Health Sciences

Cardiovascular disease (CVD) has become the major health problem in the developed and developing countries. The objective of this cross-sectional study was to determine the associations between socio-economic status, lifestyle factors, nutritional status, biochemical parameters and blood pressure with CVD risk markers among Malay academic and non-academic staff aged 30-55 years-old at Universiti Putra Malaysia (UPM). Data collection was carried out from October 2011 until January 2012. All subjects were systematically selected by using a sampling frame from a name list obtained from the registrar office. Subjects who were pregnant, lactating, on study or long medical leave, having fever, cough or cold, injury, and on medication, except for hypertension, diabetes and hyperlipidemia during data collection were excluded from

this study. A set of questionnaire was used to determine socio-demographic information, medical and family history, tobacco use, physical activity, scale of depression, anxiety and stress, and dietary intake. Anthropometric measurements were conducted by measuring body weight, height, waist and hip circumference and blood pressure (BP).A 10ml of fasting blood was collected to determine levels of homocysteine, C-reactive protein (CRP), blood glucose, and lipid profiles of the subjects. Data were analysed by using SPSS version 19.0.

A total of 122 subjects (40.2% male, 59.8% female, response rate of 97.6%) agreed to participate in this study with mean age of 41.93 ± 8.26 years-old. More than half of the subjects had household income more than RM4000. Only 12.3% of the subjects were current smokers and majority never smoked. About 32% of the subjects were passive smokers. Majority of the subjects had high physical activity level, normal score for depression, anxiety, stress and were overweight. Almost half of the subjects were at high risk waist circumference (WC) while only a few of them were at high risk waist-hip ratio (WHR). Foods and drinks that were highly consumed by the subjects were plain water, cooked rice, green leafy vegetables, sugar, marine fish, and tea. Majority of the subjects were categorized as prehypertensive for systolic BP and normal for diastolic BP. Majority of them had borderline levels for total cholesterol (TC), near or above optimal levels for low density lipoprotein (LDL), high levels of high density lipoprotein (HDL), normal levels of triglyceride (TG), at low risk of TC:HDL ratio, and normal fasting blood glucose. Almost 38% of them were at average risk of high sensitivity (hs) CRP and majority of them had moderately high levels of homocysteine.

Bivariate analysis showed that log hs-CRP were associated with age, anxiety, WC, systolic BP, diastolic BP, BMI, TC, TG, LDL, TC: HDL ratio, and log fasting blood glucose. In addition, there were associations between homocysteine with sex, not a passive smoker, WC, diastolic BP, WHR, TC, TG, and TC:HDL ratio. Multivariate analysis revealed that BMI was the strongest factor in predicting the level of log hs-CRP while sex (female) and TG was the strongest factor in predicting homocysteine level. Thus, this study suggests that sex (female), BMI and TG level have an important role in the development of CVD event among Malay employees in a higher learning institution.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

SOSIO-EKONOMI, GAYA HIDUP, STATUS PEMAKANAN, PARAMETER BIOKIMIA DAN TEKANAN DARAH BERKAITAN DENGAN PENANDA RISIKO PENYAKIT KARDIOVASKULAR DALAM KALANGAN KAKITANGAN BERBANGSA MELAYU DI UNIVERSITI PUTRA MALAYSIA

Oleh

NORSHAFAWATI ABD AZIMI

Julai 2013

Pengerusi: Rosita Jamaluddin, PhD

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Penyakit kardiovaskular (PKV) telah menjadi masalah kesihatan yang utama di negara-negara maju dan membangun. Objektif kajian keratan rentas ini adalah untuk menentukan perkaitan antara status sosio-ekonomi, faktor gaya hidup, status pemakanan, penilaian biokimia dan tekanan darah dengan penanda risiko PKV di kalangan kakitangan akademik dan bukan akademik kaum Melayu yang berumur 30-55 tahun di Universiti Putra Malaysia (UPM). Pengumpulan data telah dijalankan dari Oktober 2011 hingga Januari 2012. Semua subjek telah dipilih secara sistematik dengan menggunakan rangka sampel dari senarai nama yang diperolehi daripada pejabat pendaftar. Subjek yang hamil, menyusu badan, sedang cuti belajar atau cuti sakit, demam, batuk atau selesema, mengalami kecederaan dan sedang mengambil ubat

kecuali ubat untuk tekanan darah tinggi, diabetes dan hiperlipidemia semasa pengumpulan data adalah dikecualikan daripada menyertai kajian ini. Satu set borang soal selidik telah digunakan untuk mendapatkan maklumat sosio-demografi, sejarah perubatan dan keluarga, penggunaan tembakau, aktiviti fizikal, skala kemurungan, kebimbangan dan tekanan, serta pengambilan makanan. Ukuran antropometri telah dijalankan dengan mengukur berat badan, ketinggian, lilitan pinggang dan pinggul serta tekanan darah. Sebanyak 10ml darah berpuasa telah diambil untuk menentukan paras homosistin, protein C-reaktif (CRP), glukosa dalam darah, dan profil lipid di kalangan subjek. Data dianalisis dengan menggunakan perisian SPSS versi 19.0.

Seramai 122 orang subjek (40.2% lelaki, 59.8%wanita, 97.6% kadar maklum balas) bersetuju untuk menyertai kajian ini dengan purata umur 41.93 ± 8.26 tahun. Lebih separuh daripada subjek mempunyai pendapatan isi rumah lebih daripada RM4000. Hanya 12.3% daripada subjek adalah perokok tegar dan majoriti tidak pernah merokok. Kira-kira 32% daripada subjek adalah perokok pasif. Majoriti subjek mempunyai tahap aktiviti fizikal yang tinggi, normal untuk kemurungan, keresahan, tekanan, dan berlebihan berat badan. Hampir separuh daripada subjek adalah berisiko tinggi untuk lilitan pinggang manakala hanya beberapa daripada mereka adalah berisiko tinggi untuk nisbah pinggang-pinggul. Makanan dan minuman yang sangat tinggi dimakan oleh subjek ialah air kosong, nasi, sayur-sayuran berdaun hijau, gula, ikan laut, dan teh. Majoriti daripada subjek telah dikategorikan sebagai pra-darah tinggi untuk tekanan darah sistolik dan normal untuk tekanan darah diastolik. Majoriti daripada meraka mempunyai paras kolesterol di sempadan, paras yang hampir atau di atas optimum

untuk lipoprotein berketumpatan rendah, paras yang tinggi untuk lipoprotein berketumpatan tinggi, paras trigliserida yang normal, kurang berisiko untuk nisbah jumlah kolesterol: lipoprotein berketumpatan tinggi dan paras glukosa dalam darah berpuasa yang normal. Hampir 38% daripada mereka berada di paras sederhana untuk protein C-reaktif bersensitiviti tinggi (hs-CRP) dan majoriti daripada mereka mempunyai paras homosistin yang sederhana tinggi.

Analisis bivariat menunjukkan bahawa paras log hs-CRP berkait dengan usia, keresahan, lilitan pinggang, lilitan pinggul, tekanan darah sistolik, tekanan darah diastolik, Indeks Jisim Tubuh (IJT), jumlah kolesterol, trigliserida, lipoprotein berketumpatan rendah, nisbah jumlah kolesterol: lipoprotein berketumpatan tinggi, dan log glukosa dalam darah berpuasa. Di samping itu, terdapat perkaitan antara homosistin dengan jantina, bukan perokok pasif, lilitan pinggang, tekanan darah diastolik, nisbah pinggang-pinggul, jumlah kolesterol, trigliserida, dan nisbah jumlah kolesterol: lipoprotein berketumpatan tinggi. Analisis multivariat menunjukkan bahawa IJT adalah faktor terkuat dalam meramalkan tahap log hs-CRP manakala jantina (wanita) dan trigliserida adalah faktor terkuat dalam meramalkan tahap homosistin. Oleh itu, kajian ini menunjukkan bahawa jantina (wanita), IJT dan paras trigliserida mempunyai peranan yang penting dalam pembentukkan berlakunya PKV dalam kalangan kakitangan berbangsa Melayu di institusi pengajian tinggi.

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I certify that a Thesis Examination Committee has met on 17 July 2013 to conduct the final examination of Norshafawati binti Abd. Azimi on her thesis entitled "Socio-Economy, Lifestyle, Nutritional Status, Biochemical Parameters and Blood Pressure Associated with Cardiovascular Disease Risk Markers among Malay Employees in Universiti Putra Malaysia" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the degree of Master of Science.

Members of the Thesis Examination Committee were as follows:

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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Professor and Dean
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Date:

DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institution.

_____

NORSHAFAWATI ABD. AZIMI

Date: 17 July 2013

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CHAPTER 1

INTRODUCTION

1.1 Background

Cardiovascular disease (CVD) has become the number one cause of death globally with more people dying annually from this disease (WHO, 2007). In 2005, World Health Organization estimated 35 million deaths will be caused by chronic diseases and 17,528 million deaths will be due to cardiovascular disease. The deaths are estimated to increase by 17% between 2005 and 2015 (WHO, 2005).

Research has shown that each year, at least 4.9 million people worldwide die as a result of tobacco use, 2.6 million die because of being overweight or obese, 4.4 million die due to raised total cholesterol levels and 7.1 million die because of raised blood pressure. Other than that, cardiovascular disease has also become the major cause of death in various countries including Brazil, Canada, China, India, Pakistan, Russia and United Kingdom (WHO, 2005).

CVD includes arterial disease that affects the blood supply to the heart (coronary heart disease), the brain (cerebrovascular disease), or to the peripheral regions (peripheral vascular disease) of the body. It involves processes of atherosclerosis and thrombosis, as well as changes to the function of the arterial lining (Frayn & Stanner, 2005). Other than that, according to American Heart Association (2009), CVD include hypertension, coronary heart disease, myocardial infarction, angina pectoris, heart failure, stroke and congenital cardiovascular defects.

Coronary heart disease (CHD) is the most common form of cardiovascular disease and it is usually caused by atherosclerosis in the coronary arteries. Coronary arteries that supply the heart with vital oxygen and nutrients in the blood become narrowed and inelastic because of atherosclerosis (Kandiah *et al.*, 2007). Atherosclerosis is the accumulation of lipids and other materials in the arteries. The accumulation can cause formation of plaques and clots at damage points. Blood flow becomes restricted and the heart has to exert more pressure to deliver blood to tissues. When plaques and clots accumulate until the point of total blockage, the blood flow to the heart is cut off and this will result in heart attack where the heart muscle of that area dies. Otherwise, transient ischemic attack or stroke may result if the blood flow to the brain becomes restricted (Whitney & Rolfes, 2005; Grundy *et al.*, 1987).There are several risk factors that have been identified to cause CVD and many of them are related to dietary intake and lifestyle factors (Kandiah *et al.*, 2007).

According to the National Cholesterol Education Program (NCEP), individuals who have positive risk factors for coronary heart disease are individuals with current cigarette smoking habits, hypertension with blood pressure ≥140/90 mmHg or on antihypertensive medication, low high density lipoprotein cholesterol (HDL-C) at <40 mg/dL, raised low density lipoprotein cholesterol (LDL-C) at >190 mg/dL, family history of premature coronary heart disease where in a male first-degree relative <55 years old or in a female first-degree relative <65 years old, presence of coronary heart disease risk equivalents in men age >45 years old while women age >55 years old (National Institutes of Health, 2002).

Biomarkers (risk markers) are characteristics that can be objectively measured and evaluated as indicators of normal biological processes, pathogenic processes or pharmacologic responses to a therapeutic intervention. Thus, it can serve many unique purposes, including confirmation of diagnoses, monitoring of treatment effects or disease progression, and prediction of clinical outcomes (Vasan, 2006). A biomarker may be measured on a biosample such as blood, urine or tissue test, recording obtained from a person such as blood pressure, electrocardiogram (ECG) or Holter or an imaging test such as echocardiogram or computed tomography (CT) scan. There were some biomarkers that have been shown to have good and strong evidence used for identifying vulnerable patients which can be linked to the disease prospectively such as abnormal lipid profile, high sensitivity C-reactive protein (hs-CRP), interleukin-6 (IL-6), homocysteine, fibrinogen and blood pressure (Vasan, 2006).

The two risk markers that have been chosen for current investigation are homocysteine and C-reactive protein. Homocysteine is a sulphur-containing amino acid derived from methionine (Clarke, 2005). It is a potent toxin to epithelial cells that lines blood vessels and interacts with specialized proteins and cells in the blood causing blood to easily clot (WHO, 1994). Genetic defects, vitamin deficiency or renal impairment can cause elevation of plasma total homocysteine concentration in the blood (Clarke, 2005). Epidemiological studies have shown that overloading of homocysteine in the blood plasma is related to a higher risk of coronary heart disease, stroke and peripheral vascular disease (Ganji & Kafai, 2003; Rasouli *et al.*, 2005; Panagiotakos *et al.*, 2005). Studies also suggested that elevated homocysteine level is a modest independent risk factor for CHD and stroke in healthy population (The Homocysteine Studies Collaboration, 2002; Clarke, 2005). Meta-analysis study had shown that a 25% reduction in homocysteine level can be associated with about 10% risk reduction in CHD and 20% risk reduction in stroke (Clarke, 2005).

C-reactive protein (CRP) is an emerging risk factor for cardiovascular disease. CRP is one of the acute phase reactant that is synthesized by the liver and released from the body in response to acute injury, infection or other inflammatory stimuli (WHO, 1994;

Yaqoob & Ferns, 2005). It is suggested that CRP might also play a direct role in atherogenesis (Blake & Ridker, 2003) and as a powerful predictor of first and recurrent cardiovascular events (Pearson *et al.*, 2003). Moreover, level of CRP circulated in the body are positively associated with a number of classical cardiovascular risk factors such as age, body mass, systolic blood pressure and smoking. However, its circulation is negatively associated with physical activity and high density lipoprotein cholesterol (HDL-C) (Yaqoob & Ferns, 2005).

1.2 Problem Statement

In Malaysia, cardiovascular disease has been identified as the principal cause of admission and death in government hospitals (Zambahari, 2004). According to Ministry of Health (2009), 6.99% cause of hospitalizations in government hospitals were due to the disease of the circulatory system. The percentage of heart disease and disease of the pulmonary circulation increased from 15.70% (2006) to 16.54% (2008) and have become the number one killer in Malaysia (MOH, 2007; MOH, 2009).

The changes in lifestyles that are related to unhealthy diet intakes, socio-economic pressure, smoking and physical inactivity are some of the risk factors for the chronic disease. Besides that, this disease gives a negative impact to the economic development of this country. Currently, the cost for CVD treatment is high. This poses an economic burden not only to the families directly but also to the community and country indirectly. The deaths caused by cardiovascular disease can be prevented and the risk of complications should be controlled so that it would not be a burden to the country.

Furthermore, in Malaysia, studies on CVD are abundant. However, studies that determine the risk markers of CVD (such as homocysteine and hs-CRP) among adults with different socioeconomic status and lifestyle are limited. At present, the newer risk markers that can be used for predicting CVD event are homocysteine and C-reactive protein. According to Myers (2004), homocysteine and C-reactive protein may sharpen our visual acuity in the future, further expanding our ability to predict and treat CVD.

The studies on associations between socio-economic status, lifestyle factors, nutritional status, lipid profiles, blood glucose and blood pressure with CVD biomarkers are important because biomarkers not only can be used as screening tools to detect organ damage at earlier stages but also provide valuable information for patient to seek early medical intervention. This is because all individuals (regardless of age and ethnic background) are susceptible of getting CVD including academic and non-academic staff, which may be facing stressful working environment or position.

Thus, this study was conducted to determine the common CVD risk factors present amongst academic and non-academic Malay staff aged 30-55 years-old at Universiti Putra Malaysia and to study the associations between socio-economic status, lifestyle factors, nutritional status, biochemical parameters and blood pressure with CVD risk markers.

This study involved subjects who worked at a higher learning institution because data on CVD risk markers among this study population are limited and not well explored or studied. Subjects in this study population might face a higher workload than others in ensuring the success of an educational system which may influence disease progression. In addition, academic and non-academic Malay staff aged 30-55 years-old at Universiti Putra Malaysia were chosen as the study subjects because statistics had shown that Malays, semi government employees, and adults within this age group are at high risk of developing CVD (Institute of Public Health, 2011).
Research questions:

1. What are the socio-economic status, lifestyle factors, nutritional status, biochemical parameters, blood pressure, homocysteine and C-reactive protein levels among Malay employees in a higher learning institution?
2. Are socio-economic status, lifestyle factors, nutritional status, biochemical parameters and blood pressure positively associated with CVD risk markers among Malay employees in a higher learning institution?
3. What are the contributing factors that affect the levels of risk markers among Malay employees in a higher learning institution?

1.3 Importance of the study

The prevalence of CVD has increased over the years in Malaysia and it has become the main cause of deaths in the government hospitals (MOH, 2009). By identifying how biomarkers can help the population to practice healthy lifestyle, the government or any related organizations can plan for suitable education or intervention programs that can increase population awareness towards practicing healthy lifestyles in order to reduce biomarkers in the system, thereby reducing the incidence of cardiovascular diseases. It is commonly known that prevention is better than cure. Therefore, results from this study can be used by the government and non-government organizations to create awareness or intervention programs that are related to the cardiovascular risk factors so that, the risks of CVD especially among Malay academic and non-academic staff can be reduced. Increased public awareness about effects of unhealthy lifestyle may help to lower risk factors that can lead to CVD.

UPM is one of the research universities in Malaysia. In order to sustain the title, the academic and non-academic staffs are expected to achieve specific requirement which indirectly increase the staff workload and might increase the risk to develop chronic

disease. Apart from the routine yearly health checkups provided to the staff, knowing the levels of CVD risk markers among UPM staff is an additional parameters towards predicting the risk factors of diseases. Thus, the university can plan an appropriate intervention program toward its staff, such as body weight management program, healthy eating diet program or smoking intervention program that can reduce the level of risk markers. Moreover, the university also can create a more friendly working environment for its staff that can reduce their stress which cause by heavy workload.

1.4 Study Objectives

1.4.1 General Objective

To determine associations between socio-economic status, lifestyle factors, nutritional status, biochemical parameters and blood pressure with cardiovascular disease (CVD) risk markers among Malay academic and non-academic staff aged 30-55 years-old at Universiti Putra Malaysia.

1.4.2 Specific Objectives

1.4.2.1 Univariate

To determine the socio-economic status (age, sex, educational level, marital status, household size, household income, personal income, working position, medical history and family history of chronic diseases) of subjects.

To determine lifestyle factors (tobacco use, physical activity, rate of depression, anxiety, stress and dietary intake), nutritional status (Body Mass Index (BMI), Waist Circumference (WC), Waist-Hip Ratio (WHR), hip circumference) and blood pressure (BP) of subjects.

To measure the levels of total cholesterol (TC), high density lipoprotein cholesterol (HDL-C), low density lipoprotein cholesterol (LDL-C), triglycerides (TG), TC-HDL ratio, fasting blood glucose (FBG), high sensitivity C-reactive protein (hs-CRP) and homocysteine of subjects.

1.4.2.2 Bivariate

To determine the relationship between socio-economic status, lifestyle factors, nutritional status, biochemical parameters and blood pressure associated with the level of risk markers.

1.4.2.3 Multivariate

To investigate the contribution of independent factors (socio-economic status, lifestyle factors, nutritional status, biochemical parameters and blood pressure) towards dependent factors (hs-CRP and homocysteine) of subjects.

1.5 Null Hypothesis

There are no significant relationships between socio-economic status with the level of homocysteine and hs-CRP of subjects.

There are no significant relationships between lifestyle factors with the level of homocysteine and hs-CRP of subjects.

There are no significant relationships between nutritional status with the level of homocysteine and hs-CRP of subjects.

There are no significant relationships between biochemical parameters with the level of homocysteine and hs-CRP of subjects.

There are no significant relationships between blood pressure with the level of homocysteine and hs-CRP of subjects.

There are no significant contribution of socio-economic status, lifestyle risk factors, nutritional status, dietary intake, biochemical parameters and blood pressure towards level of homocysteine and hs-CRP of subjects.

1.6 Conceptual Framework

From the conceptual framework (Figure 1), this study analyzed the associations between all components in the socio-economic status (age, sex, educational level, marital status, household size, income, working position and family history), lifestyle factors (tobacco use, physical activity, psychological distress and dietary intake), nutritional status (BMI, WC and WHR), biochemical parameters (LDL, HDL, TG, TC and fasting blood glucose) and blood pressure, which are the possible risk factors of CVD with dependent variables (homocysteine and C-reactive protein) that are the CVD risk markers. Literatures had shown that each of the component might influence the level of homocysteine (Vollset *et al.*, 2001; Dinavahi & Falkner, 2004; Clarke, 2005; Albert *et al.*, 2006; Vrentzos *et al.*, 2006)and C-reactive protein (Lemieux *et al.*, 2001; Miller,

Zhan, & Havas, 2005; Yaqoob & Ferns, 2005; Hamer, Molloy, & Stamatakis, 2008; Sethi *et al.*, 2008) that are related to the development of CVD. Thus, this study has investigated which of these risk factors can predict the progression of the risk markers and influence its levels in the body.

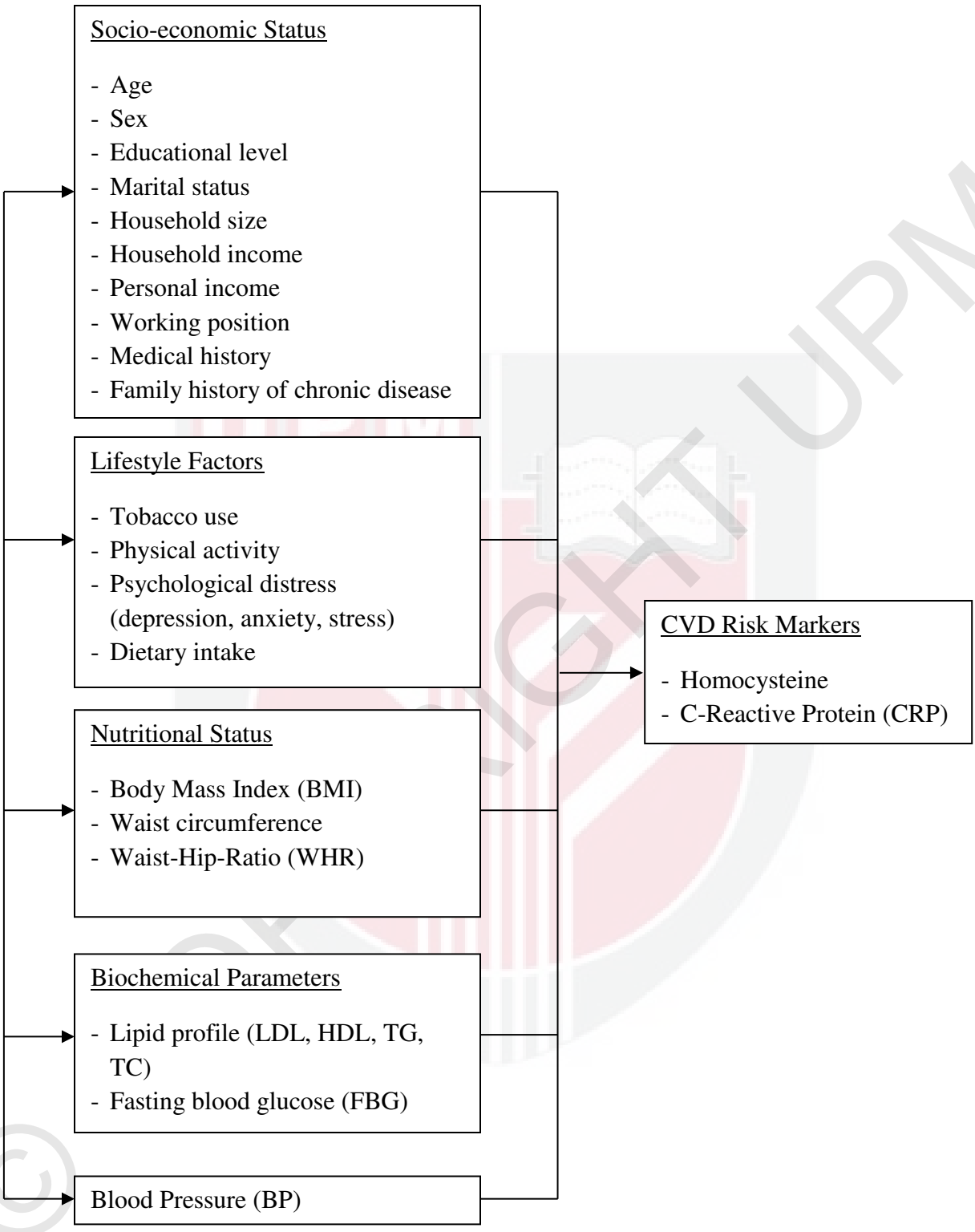

Figure 1: Conceptual framework of the study

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