Original Article

Determinants of blood pressure among Indonesian elderly individuals who are of normal and over-weight: a cross sectional study in an urban population

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Cardiovascular disease has become the first cause of death in Indonesia. The highest morbidity is found in the aged, and among cardiovascular disorders or diseases, the prevalence of hypertension is the highest. Many studies of the relationship between nutritional factors and hypertension have been conducted, especially with reference to the metabolic syndrome, but studies to understand determinants of blood pressure in Indonesia are lacking. There is an urgent need to gather information about various blood pressure risk factors in Indonesian elderly, which will allow policy makers to provide appropriate intervention programs. The primary purpose of this study was to investigate various determinants of blood pressure in Indonesian elderly who differed in body composition. A cross sectional study was undertaken in Jakarta on 556 elderly using multistage random sampling. Data were collected through interview using structured questionnaires, anthropometric measurements, biochemical blood analysis, and blood pressure measurements. Daily nutrient intake was analyzed using the World Food 2 Dietary Assessment Program. General Linear Model and Multiple linear regression analysis were performed to determine determinants of systolic and diastolic blood pressure. Monounsaturated fatty acid, saturated fatty acid, and sodium intake, plasma total cholesterol level, the ratio of total cholesterol to HDL-cholesterol and a sport Index were determinants of blood pressure in the normal weight elderly individuals, while potassium intake, calcium intake and BMI were determinants of blood pressure in the overweight elderly individuals.

Key Words: Obesity, fat intake, sodium, potassium, calcium, physical activity, blood pressure, Jakarta

INTRODUCTION

Indonesia is one, amongst other South East Asian countries, facing an increased number of older people. It is projected that by the year 2020, the number of elderly people in Indonesia will be three times the number of elderly in 1990.[1]

Aged individuals often live with their health and nutritional problems and underlying socio-cultural and socio-psychological backgrounds. Indonesian data reveal 4 major health problems affecting the elderly, namely bone and joint diseases (49%), cardiovascular diseases (15.2%), infectious respiratory tract diseases (7.4%) and metabolic/endocrine diseases (3.3%).[2] The Indonesian Household Survey[3] showed the highest prevalence of cardiovascular disease and hypertension amongst individuals aged 55 and older. On the other side of the coin, available data on CVD risks amongst Indonesian aged population are limited, despite their importance for preventive measures. Identification of CVD risks or determinants and their interplay is crucial.

Indonesia is a nation in transition with a double burden of "malnutrition", perhaps better referred to as dysnutrition., at all ages. Under nutrition, especially sarcopenia and osteopenia,is rampant in aged individuals. In this age group, there is paradigm shift in the understanding of nutrition-related so-called degenerative or chronic diseases. For example, whilst coronary heart disease has been recognized as related to over nutrition, especially reflected in abdominal obesity, it is now clear that it is related to nutritional deficiency as well, extending back to fetal life and continuing through growth and development, into adulthood. It is therefore, timely to review and re-evaluate our understanding of the nutritional features of CHD risk.

MATERIALS AND METHODS

Subjects

This epidemiological study was undertaken in Jakarta, the capital city of Indonesia. DKI Jakarta has 5 municipalities, namely North, East, West, South and Central Jakarta.

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A total number of apparently healthy 600 individuals aged 55-80 years old were recruited from the Elderly Clubs of 15 Public Health Centers located in 15 Sub Districts of Jakarta Municipalities. These aged individuals are those who have formal access to a supervised program of the Public Health Center and participate in health promotion, regular sport, recreation, hobby development and social gathering. The group, also underwent regular health examination.

Out of these 600 aged subjects invited to join the study, 556 subjects enrolled on the designated day, giving a response rate of 93%. These 556 subjects underwent interview for general socio-demographic and health status, food intake, and had anthropometric and blood pressure assessments. Of the 556 subjects, 400 had their fasting blood lipids measured. They were recruited from 10 of 15 Public Health Center, located in 15 sub-districts.

Methods

Structured questionnaires were used to obtain information on socio-demographic and general health status. Anthropometric indicators, biochemical indicators and blood pressure were measured.

Dietary assessment

The 24-h dietary recall method was used to obtain information on the type and frequency and to estimate the quantity of foods consumed. Subjects were asked to recall any foods (solid and liquid), consumed the previous day, starting from the first meal early in the morning until late at night before going to bed. They were also encouraged to report any foods consumed during night-time awakening. Portion size was estimated using household measures or oral description by subjects or their relatives using food models. The WorldFood2 Dietary Assessment System used was developed by INFOODS (the International Network of Food Data Systems) and the University of California/FAO instrument was used to convert foods into nutrients. Food items listed in the WorldFood2 Program originated from diet surveys performed in six different countries, including Indonesia. The Indonesian food items included in the program were consistent with the Indonesian Food Composition Tables of 1989; Fruits and fruit culture in Dutch East Indies 1931; Vegetables of the Dutch East Indies 1931; Local common names of Indonesian Fishes, 1952; and the Food Composition Table for use in East Asia, 1972. Sodium intake in this study was estimated only from food intake; other sources of sodium supplement like table salt, soy sauce were not assessed. The reliability of the 24-h food recall method in this population was confirmed in a sub-group of 152 subjects by comparing findings with those from 6 separate and averaged 24-h recalls, which showed similar results

Anthropometric measurement

Anthropometric indicators like body weight, height, abdominal and hip circumferences, and four skinfold thicknesses (biceps, triceps, subscapular and suprailiac) were measured using a standard anthropometric method described by Lohman.[4] All measurements were done twice, and the average was used for further analysis. SECA electronic scale (model 770 alpha, Hamburg, Germany), Microtoise, were used to measure body weight and height respectively.

Harpenden skinfold caliper (John Bull Ltd, UK) was used to measure skinfold thicknesses. Body mass index (BMI) was calculated by dividing weight (kg) by height (m^2). Abdominal-hip ratio was calculated by dividing abdominal circumference (cm) by hip circumference (cm).

The validity of the measurement was guaranteed by comparing the trainee's measurement with the measurement by the trainer. The reliability of test was checked by comparing the measurement of the same and a different subject performed by 5 assessors and the minimal intra and inter- individual variation from 3 assessors were taken into account in selection of assessors.

Blood collection

Venous blood was collected early in the morning at 8-10 am after a fasting period of 10–12 hours. Blood specimens were transported immediately to the laboratories. Serum total cholesterol, LDL-cholesterol, HDL-cholesterol, triglycerides; and fasting blood glucose were performed within 3-4 hours after blood collection.

Standard procedures of lipid assessment were applied using kits from Boehringer Manheim. A standard curve was made for each procedure. Only one trained laboratory technician did all the blood collection and analyses, and these were done at the SEAMEO-TROPMED RCCN laboratory in Jakarta..

Blood pressure measurement

Blood pressure was measured using a sphygmomanometer, by two of the researchers during the course of the study. Subjects were seated for at least 5 min before the actual measurement was taken. The cuff was placed at the mid part of the arm and it was ensured that air tubes were not in contact with the stethoscope. The arm to be measured and the sphygmomanometer were at the same level was the heart. As recommended by the American Heart Association, the first Korotkoff phase represented systolic blood pressure value and the fifth Korotkoff phase (when sound just disappears) was taken as the diastolic blood pressure. Two measurements were taken with a 5 min interval, and the average value was used.

Statistical analysis

Data analyses were performed using SPSS programs for Windows Release 10.0. Standard Version.

Frequency distribution or cross tabulation was done to cross check the data and describe the distribution of the population and its attributes.

General Linear Model (GLM) was used to analyze differences between population groups. The GLM Multivariate procedure provides regression analysis of variance for multiple dependent variables by one or more factor variables or covariates.

Multiple Linear Regression analysis was performed to determine the predictive power of independent variables for outcome variables. Linear Regression estimates the coefficients of the linear equation, involving one or more independent variables. A forced entry (enter-method) regression analysis was selected, and a significant level of 0.05 was set for entry into and 0.10 for removal of

variables from the model. The Partial Correlations procedure computes partial correlation coefficients that describe the linear relationship between two variables while controlling for the effects of one or more additional variables. Partial correlation square (x 100) describes the contribution of each independent variable to R square (percent variance explained by the model). *p*-value less than 0.05 was considered significant.

RESULTS

In this study the elderly men were 4 years older than the elderly women (65.6 ± 6.4 in elderly men vs 61.9 ± 5.9 in elderly women). As far as ethnicity was concerned, most of the subjects were Javanese (53%). Other ethnicities in this study (47%), were Betawinese, Sundanese, Balinese, Buginese and Minang. In general, the elderly men were more educated than the elderly women. Most of the elderly men were retired, while elderly women were mostly housewives. The majority of respondents were living with their spouses.

Table 1 show that the elderly men had higher energy, protein, carbohydrate, fat, monounsaturated fatty acid, dietary fibre, potassium, and magnesium intakes than the elderly women. Further analyses were made by classifying the subjects into those with normal weight and overweight. This analysis excluded subjects who were underweight. Using WHO criteria to define protein-energy status (WHO, 1997), ≈ 8 % elderly were underweight, ≈ 50% normal weight, ≈ 30% overweight and more than 5 % were obese. In the normal weight elderly individuals, significant differences between men and women were found in energy, carbohydrate, dietary fiber, potassium and magnesium intakes. In the overweight elderly individuals, the elderly men had higher energy, protein, monounsaturated fatty acid and carbohydrate intake than women.

After adjustment for age, smoking, and activity index, the elderly women had higher plasma total cholesterol and LDL cholesterol than the elderly men (Table 2). In the normal weight elderly, elderly individuals women had higher plasma total cholesterol and LDL cholesterol than men. In the overweight elderly individuals, elderly women had higher plasma LDL cholesterol than men (Table 2).

With respect to anthropometric indicators of the study population table 2 shows that the elderly men had higher body weight, abdominal circumference, fat free mass, and percent fat free mass; but lower hip circumference, sum of four skinfolds, fat mass and percent fat mass than the elderly women after adjustment for age, activity index and smoking status.

In the elderly, mean diastolic blood pressure (DBP) in overweight elderly individuals, elderly men were significantly higher than normal weight elderly men.

Hypertensive elderly subjects had higher plasma total cholesterol, triglycerides and total cholesterol to HDL cholesterol ratio than the normotensive elderly. Amongst the normal weight elderly, the hypertensive elderly subjects had higher cholesterol to HDL cholesterol ratio than the normotensive elderly. In the overweight elderly, hypertensive elderly subjects had higher triglycerides than normotensive elderly.

Most subjects in this study did not consume alcohol, ≈ 62% of the elderly men were smokers, and they were classified as current smokers (≈ 28.1%) and past smokers (≈ 33%).

Physical activity index were divided into three categories: < 5.6 (low activity); 5.6-7.9 (middle activity); > 7.9 (high activity), most of the elderly had high physical activity (more than 43% elderly men and women).

Stress score were divided into four categories: < 40 (type B personality); 40-53.9 (type A/B personality); 54-63.9 (prone to CVD personality); 64-80 (very high risk CVD personality). Most of the elderly in population were classified as type A/B personality. Around 7% of guided elderly were classified as prone to CVD personality.

A multiple linear regression analyses were performed using different category of BMI, to examine as to what extent the variation in systolic blood pressure and diastolic blood pressure, were explainable by nutrients intake, anthropometry indices, lipid profiles, and other life-style

Table 1. Energy and nutrients intakes of the elderly population by gender

Nutrients intake	Men (n= 161)	Women (n= 395)
Energy (Kcal/day)	1257 (33.3)***	1090 (20.4)
Protein (g/day)	51.6 (3.4)**	43.1 (1.2)
Carbohydrate (g/day)	170 (4.1)***	143 (2.6)
Fat (g/day)	42.9 (1.7)*	39.2 (1.1)
SFA (g/day)	25.1 (1.0)	23.4 (0.7)
MUFA (g/day)	7.8 (0.4)**	6.9 (0.2)
PUFA (g/day)	6.2 (0.3)	5.6 (0.2)
Cholesterol (mg/day)	164 (12.3)	157 (14.4)
Fibre (g/day)	8.1 (0.3)**	7.2 (0.2)
Sodium (mg/day)	198 (18.4)	161 (12.5)
Potassium (mg/day)	1895 (94.9)*	1634 (41.9)
Calcium (mg/day)	397 (21.2)	379 (13.1)
Magnesium (mg/day)	240 (15.0)*	203 (5.4)
Arginine (mg/day)	2857 (106.9)	2696 (71.9)

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; Standard errors are in brackets. SFA, Saturated fatty acid; MUFA, Mono unsaturated fatty acid; PUFA, Polyunsaturated fatty acid

Table 2. Anthropometric indicators, blood pressure and lipid profile of the elderly subjects by gender

Total	Men (n=161)	Women (n=395)
Anthropometric Indicators		
Height (cm)	161 (0.4)***	150 (0.3)
Body Weight (kg)	61.0 (0.8)***	54.4 (0.5)
Body Mass Index (kg/m^2)	23.6 (0.3)	24.3 (0.2)
Abdominal circumference (cm)	85.7 (0.8)**	82.6 (0.5)
Hip circumference (cm)	90.6 (0.7)	94.9 (0.5)**
Abdominal to hip ratio	0.95 (0.0)***	0.87 (0.0)
Sum of four skinfolds	47.9 (1.5)	59.5 (0.9)***
Fat mass (%)	26.6 (0.5)	40.7 (0.3) ***
Blood Pressure		
Systolic blood pressure	141 (1.75)	138 (1.23)
Diastolic blood pressure	83.6 (0.88)	82.5 (0.62)
Lipid Profile		
Total Cholesterol (mg/dl)	242 (5.04)	253 (2.56)*
LDL-Cholesterol (mg/dl	139 (4.09)	158 (2.16)***
HDL-Cholesterol (mg/dl	72.7 (3.91)	66.8 (1.86)
Triglycerides (mg/dl	147 (5.46)	147 (3.22)
Ratio TC to HDL-C	4.1 (0.22)	4.6 (0.14)

* $p < 0.05$, ** $p < 0.01$, *** $p = < 0.001$; TC, Total Cholesterol; HDL-C, HDL-Cholesterol; Standard Errors are in brackets

factors. Independent variables included in the model, were adjusted for age, stress factor and smoking status.

Independent variables analyzed to determine determinants for diastolic blood pressure in the normal weight elderly (BMI 18.5- 24.9 kg/m^2) were fat mass, sum of skinfolds, abdominal circumference, abdominal to hip ratio, LDL, total cholesterol (TC), ratio TC/HDL, and mono-unsaturated fatty acid (MUFA), animal protein, sport index and saturated fat intake. From 196 elderly women in this group, only 150 had blood lipid assessment.

In the elderly women, saturated fatty acid (SFA) and total cholesterol (TC) had positive correlations with increased diastolic blood pressure (DBP) and contributed 3.42% and 4.24% to the DBP variance respectively. While mono-unsaturated fatty acid (MUFA) and "sport activity" had negative correlations (protective effect) with DBP and contributed 4.12% and 1.49% to its variance respectively (Table 3).

In the elderly population with normal weight, independent variables analyzed to determine determinants for systolic blood pressure were "sport index," work index, percent fat mass, abdominal circumference, abdominal to hip ratio, LDL, total cholesterol (TC), ratio TC/HDL, triglycerides, animal protein, mono unsaturated fatty acid (MUFA), saturated fatty acid (SAFA), arginine, carbohydrate, cholesterol, protein and sodium intake. From 196 elderly women in this group only 150 underwent blood lipid assessment. For elderly women, MUFA had negative correlations (protecting effect) with SBP and contributed 6.60% of its variance. SFA, TC, ratio total cholesterol to HDL cholesterol and sodium intake had positive correlation with SBP and contributed 3.84%, 3.13%, 2.25% and 1.54% of its variance respectively (table 3).

In the higher BMI category (≥ 25 kg/m2), independent variables analyzed to determine determinants factors for diastolic blood pressure in the overweight elderly individuals, were "sport index", BMI, fat mass, sum of skinfolds, abdominal circumference, and arginine, cal-

Table 3. Determinants of diastolic and systolic blood pressure in the normal weight elderly women (n=196)

Blood Pressure	*Regression Coefficient*		
	Parameter Estimate	Standard Error	Partial R^2 (x 100)
Diastolic Blood Pressure			
MUFA intake (g/day)	-0.677	0.251	4.12
SFA (g/day)	0.220	0.090	3.42
TC (mg/dL)	0.057	0.021	4.24
Sport Index	-0.694	0.435	1.49
Percent variance explained by the model	10.5%		
Constant	69.0		
Significance of the model	0.001		
Systolic blood pressure			
MUFA intake (g/day)	-1.901	0.554	6.60
SFA intake (g/day)	0.482	0.187	3.84
TC (mg/dl)	0.101	0.044	3.13
Ratio TC/HDL	1.469	0.747	2.25
Sodium intake (mg/day)	0.020	0.013	1.54
Age (Yr)	0.899	0.290	5.42
Percent variance explained by the model	16.1%		
Constant	47.1		
Significance of the model	0.000		

Table 4. Determinants of diastolic and systolic blood pressure in the overweight elderly women (BMI ≥ 25 kg/m^2) (n=168)

	Regression coefficient		
	Parameter Estimate	Standard Error	Partial R^2 (x 100)
Diastolic			
Ca Intake (mg/day)	-0.007	0.004	2.10
BMI	1.458	0.359	9.12
Sport index	-0.819	0.439	2.07
Percent variance explained by the model	13.5%		
Constant	47.9		
Significance of the model	< 0.001		
Systolic Blood Pressure			
Potassium intake (mg/day)	-0.005	0.002	2.66
Age (yr)	0.732	0.357	2.46
Percent variance explained by the model	5.5%		
Constant	104		
Significance of the model	0.01		

cium, carbohydrate, energy, mono unsaturated fatty acid (MUFA), magnesium, potassium and protein intakes There were 168 elderly women and 59 elderly men in this group. For elderly women, calcium intake and "sport index" had negative correlations (protective effect) and contributed 2.10% and 2.07% of the variance of DBP, respectively. BMI had positive correlations with DBP, and contributed 9.12% of its variance (Table 4).

Independent variables analyzed as determinants of systolic blood pressure were BMI, fat mass, abdominal circumference, total cholesterol, arginine, carbohydrate, energy, fiber, protein and potassium intake. There were 168 elderly women and 59 elderly men in this group. For overweight elderly women (BMI ≥ 25 kg/m^2), potassium had negative correlations with increased of SBP, and contributed 2.66% to the variance in SBP (Table 4).

DISCUSSION

In many studies which consider various determinants of hypertension in the elderly, the question is what are the key factors determinants of hypertension. The interplay between nutritional factors and hypertension is much discussed.[5] Further, it may be asked, what factors could be as or more prevalent than the nutritional factors in an elderly population, and lead to hypertension. WHO Scientific Group[6] reported that both nutritional and non-nutritional factors such as physical activity, alcohol and stress can be additional risks for hypertension. Attention should be paid to all of these risk factors rather than single risk factors.

The primary purpose of this study was to investigate the various determinants of hypertension in Indonesian "over-nourished "and "normal/undernourished "elderly, by considering nutrient intake, nutrition-related biochemical status and body composition and their interactions. Attempts were also made to answer the question as to whether differences in nutritional status, added predictive power to the putative determinants of hypertension.

Analysis of 24-h recall in this study revealed that the estimated energy in takes were low. Most elderly consumed energy less than 2/3 RDA (1452 kcal per day). Based on this finding it seems that the intake of energy of many Indonesian elderly is below that required for maintenance of good nutrition.[7] Thus some people although below the recommended levels, may still be well nourished. In this study 57.8% elderly had energy intakes below 1200 kcal per day.

One of the most easily recognized consequences of over-nutrition is obesity, which is a risk factor for other diseases such as non-insulin-dependent diabetes mellitus, cardiovascular disease and hypertension. If nutritional disorders are identified and managed appropriately, the health of many elderly people can be significantly improved.[8] The Framingham Study reported that obesity was shown to be one of the major determinants of hypertension in the general population.[9]

Multiple regression analyses shows that BMI was a significant determinant for diastolic blood pressure, and contributed 9.12% of the variance of DBP in overweight elderly women (Table 4). These analyses showed that there was positive correlation between diastolic hypertension with BMI, and BMI was a significant determinant for diastolic blood pressure.

The prognostic significance of serum cholesterol levels is of particular importance in hypertensive. Hypercholesterolemia is more common in hypertensive than normotensives. The excess risk of their joint presence was one of the earliest findings of cohort studies such as Framingham study. Further, some anti-hypertensive pharmacologic regimens cause an increase in total serum cholesterol or a more atherogenic lipoprotein profile. Of particular concern, in clinical trials of anti-hypertensive treatment, is the excess risk of coronary heart disease (CHD), in contrast to stroke, which has not been reduced in the amount predicted from observational studies; this may be in part due to the high prevalence of untreated hypercholesterolemia in hypertensive. Cardiovascular disease and death have been associated with raised levels of low density lipoprotein cholesterol (LDLC) or total cholesterol, or with lowered levels of high- density lipoprotein cholesterol (HDLC), whereas the role of very-low-density lipoprotein cholesterol or triglycerides is less convincing.[10]

This study showed (Table 3) that in normal weight elderly women, total cholesterol was a significant determinant for diastolic blood pressure and contributed 4.24% of the variance of DBP. Table 4 showed that total cholesterol and the ratio of total cholesterol/HDL cholesterol were significant determinants for systolic blood pressure in overweight elderly women and contributed 3.13% and 2.25% of the variance of SBP in elderly women respectively.

In a randomized controlled trial, resting blood pressure was significantly lower at the end of a MUFA diet (olive oil) compared with a PUFA diet. Daily drug dosage was significantly reduced during the MUFA, but not the PUFA diet. Ferrara noted that a slight reduction in saturated fat intake, along with the use of olive oil, markedly lowered daily antihypertensive dosage requirement, possibly through enhanced nitric oxide levels stimulated by polyphenols.[11]

This study (Table 3) showed that in the normal weight elderly individuals, monounsaturated fatty acid (MUFA) had a negative correlation and it was a significant determinant for diastolic blood pressure and systolic blood pressure (contributed 4.12% of DBP variance and 6.60% of SBP variance). Saturated fatty acid (SFA) had a positive correlation and was a significant determinant for diastolic blood pressure and systolic blood pressure (contributed 3.42% of DBP variance and 3.84% of SBP variance).

The need to reduce the amount of salt in the diet has remained a very controversial issue in spite of strong evidence from animal experimental and human studies that increased salt intake is associated with increased blood pressure levels. The fundamental problem is the confusion between clinical, preventive medicine, and public health approaches. Reducing salt intake is not as effective as drug therapy to treat hypertension (clinical model). Individual preventive medicine approaches aimed at high risk populations are effective, but the efficacy is limited by the size of the population at risk and the intensity of the intervention. The public health approach to gradual reduction of available salt in the diet is likely to result in decreased morbidity and mortality with little inconvenience to the public.[12]

Multivariate analyses in this study show a significant correlation between sodium intakes with blood pressure. In the normal weight elderly, sodium intake had positive correlation with systolic blood pressure and contributed 1.54% of its variation (Table 3).

The effect of potassium on blood pressure is modest, with an estimated decrease of 0.10 to 0.12 mm Hg in systolic blood pressure and 0.3 to 0.7 mm Hg decrease in diastolic for each 1 mmol increase in potassium intake. Earlier data demonstrated that administration of potassium had a more dramatic antihypertensive effect in a small number of individuals with salt-sensitive hypertension.[5]

Increased potassium intake should be included as a recommendation for prevention and treatment of hypertension, especially in those who are unable to reduce their intake of sodium.[13]

Multivariate analyses showed that potassium intake had negative correlation (protecting effect) and was a significant determinant for systolic blood pressure in overweight elderly women, and contributed 2.66% of its variance (Table 4).

Yamamoto[14] (1995) suggested that calcium supplementation may have resulted in a DBP decrease in white women and that response modifiers in this subgroup might have included lower initial urinary calcium levels, urinary sodium levels, or lower body mass index. However, overall analyses indicated that calcium and magnesium supplements are unlikely to lower blood pressure in adults with high-normal DBP.

Belizan *et al.* [15] found a reduction in blood pressure of young men and women when calcium was supplemented.

This study showed that in the overweight elderly, calcium intake had a negative correlation and it was a significant determinant for diastolic blood pressure (contributed 2.10% of DBP of the variance (Table 4). These analyses showed that calcium had a negative correlation (protective effect) and is a significant determinant for DBP, especially given that calcium intake of the respondents in this study is lower than RDA for calcium (500 mg/day). It is probably worth recommending that elderly have an adequate calcium intake in accordance with the nationally agreed RDA.

McCarron observed that, in patients with mild to moderate hypertension, the level of dietary calcium intake should be assessed. Patients whose intake is deficient should be encouraged to maintain calcium intake at 800 to 1000mg/day[16].-this is in a Western dietary context, however.

Regular physical activity clearly attenuates many of the risks associated with overweight or obesity. Physical activity appears not only to attenuate the health risks of overweight and obesity, but active obese individuals actually have lower morbidity and mortality than normal weight sedentary individuals. Inactivity and low cardio respiratory fitness are as important as overweight and obesity as mortality predictors.[17]

Multivariate analyses in this study showed that a " sport index "had a negative correlation (protective effect) with diastolic blood pressure in the normal weight and overweight elderly, contributing 1.49% and 2.07% of its variance, respectively (Table 3 and 4)

In conclusion this study identified monounsaturated fatty acid, saturated fatty acid , and sodium intake, plasma total cholesterol level, ratio of total cholesterol to HDL-cholesterol and "sport index" as determinants for blood pressure in the normal weight elderly individuals, while potassium intake, calcium intake and BMI were determinants for blood pressure in the overweight elderly individuals.

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印尼體重正常及過重老人血壓決定因子：一個城市族群的橫斷性研究

心血管疾病已經成為印尼第一死因。老年人的罹病率較高，而心血管失調或疾病者，其高血壓盛行率是最高的。很多研究已探討營養因子與高血壓之間的相關性，特別涉及代謝症候群這一部分。然而，在印尼瞭解血壓決定因子的研究闕如。有迫切需要去收集有關於印尼老年人的各種血壓危險因子之資訊，讓政策制訂者提供適當的介入計畫。本研究主要目的為研究不同體位的印尼老年人之血壓決定因子。採用多步驟隨機抽樣，共有 556 名在雅加達的老年人完成此橫斷性研究。數據是以結構性問卷面訪取得，收集體位、血液生化分析及血壓。每日營養素攝取是以 World Food 2 飲食評估系統分析。以一般線性模式及複迴歸分析評估收縮壓與舒張壓決定因子。單元不飽和脂肪酸、飽和脂肪酸及鈉的攝取、血漿總膽固醇量、總膽固醇與 HDL-膽固醇比值及運動指數是正常體位的老年人血壓的決定因子；鉀及鈣的攝取及 BMI 則是體重過重的老年人之血壓決定因子。

關鍵字：肥胖、脂肪攝取、鈉、鉀、鈣、體能活動、血壓、雅加達。