PHYSICAL ACTIVITY, DIETARY HABITS AND BLOOD PRESSURE AMONG HYPERTENSIVE PATIENTS IN PHUTTHAMONTHON DISTRICT, NAKORNPATHOM PROVINCE, THAILAND

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A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF PRIMARY HEALTH CARE MANAGEMENT FACULTY OF GRADUATE STUDIES MAHIDOL UNIVERSITY 2009

Thesis
entitled

PHYSICAL ACTIVITY, DIETARY HABITS AND BLOOD PRESSURE AMONG HYPERTENSIVE PATIENTS IN PHUTTHAMONTHON DISTRICT, NAKORNPATHOM PROVINCE, THAILAND

was submitted to the Faculty of Graduate Studies, Mahidol University
for the degree of Master of Primary Health Care Management
on
March 23, 2009

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ACKNOWLEDGEMENTS

This thesis was made possible through the generous, dedicated and collective efforts of many individuals. I wish to express my gratitude to all who directly or indirectly contributed to this study for their valuable suggestions, guidance, cooperation and assistance.

I have had the good fortune to conduct this study under the supervision of a number of outstanding persons. Their support and encouragement were essential for the completion of this thesis. I gratefully acknowledge the interest and vigilance of my mentors: Dr. Wirat Kamsrichan and Dr. Napaporn Sowatanangoon who were kind enough to acquaint me with the errors that they found during the process of study, and who also made constructive suggestions for improving them. It was my great fortune to have Dr. Napaporn Sowatanangoon as my co-advisor whom I found an excellent advisor, editor and critic. I will remain forever in debt for her extraordinary tolerance in dealing with countless revisions, erratic work schedules and urgent deadlines. I owe tremendous debts of gratitude to both of them for their superb guidance.

I have been fortunate to have had sophisticated guidance from Assoc. Professor Dr. Jiraporn Chompikul on the data analysis in this study. My deepest thanks are expressed to her. I am also very grateful to Mr. Peregrine Whalley, Foreign Expert with the AIHD, who carefully reviewed and proofread this thesis, and made perceptive and valuable suggestions. He undoubtedly has a wonderful critical eye and spared no efforts to identify errors and enhance the clarity and readability of the thesis.

I also deeply appreciate Dr. Watana Tiempathom, Director of Phutthamonthon District Hospital, and other staff of the hospital for their kind cooperation, coordination and support during data collection. I am indebted to my research assistants for their fine efforts, hard work and kind assistance during the study.

This thesis could not have been completed without the understanding and support of my family. My heartfelt thanks are due to my family who has been a constant source of love, support, inspiration and encouragement.

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ABSTRACT

Hypertension is an important and major risk factor of many diseases and is rapidly emerging as a major public health problem in developing countries, including Thailand. This hospital based cross sectional study of hypertensive patients aged forty five years and above was conducted at the Phutthamonthon District Hospital from 8 January to 28 January 2009. The study group comprised 153 participants selected by purposive sampling. Data was collected using a structured questionnaire and self report technique. The research objective was to ascertain the extent and nature of physical activity of hypertensive patients and their dietary habits, and to examine the relationship of these behavioral factors with hypertension.

This research revealed that the majority of patients were leading sedentary lifestyles and consuming unhealthy diets. Lifestyle related risk factors particularly excess body weight, low levels of physical activity, excess consumption of salt and fat were evident in hypertensive patients. A statistically significant negative (inverse) linear relationship was found between vegetable consumption and diastolic blood pressure ($r = -0.185$, $p < 0.05$). The study found no significant relationship between physical activity or other dietary habits such as consumption of salt, fat or fruit, and hypertension.

The results have highlighted the extent, nature and patterns of physical activity, and the dietary habits of hypertensive patients. It emphasizes the need for intervention programs to promote blood pressure control through lifestyle measures such as exercise, healthy diets (decreased consumption of salt and fat, and increased consumption of fruit and vegetables), controlled body weight, and reduced alcohol consumption. It also demonstrates the need for further research to explore the relationship between behavioral factors and hypertension more exhaustively.

KEY WORDS: PHYSICAL ACTIVITY/ DIETARY HABITS/ HYPERTENSION/ BLOOD PRESSURE

89 pages.

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LIST OF ABBREVIATIONS

AHA	:	American Heart Association
ACE	:	Angiotensin Converting Enzyme
BINRH	:	Belgian Interuniversity Research on Nutrition and Health
BMI	:	Body Mass Index
BP	:	Blood Pressure
CHD	:	Coronary Heart Disease
CVA	:	Cerebrovascular Accident
DBP	:	Diastolic Blood Pressure
DM	:	Diabetes Mellitus
DALY	:	Daily Adjusted Life Years
ESH-ESC	:	European Society of Hypertension and European Society of Cardiology
HDL	:	High Density Lipoprotein
IDDM	:	Insulin Dependent Diabetes Mellitus
IRS	:	Insulin Resistance Syndrome
ISH	:	International Society of Hypertension
LDL	:	Low Density Lipoprotein
LVH	:	Left Ventricular Hypertrophy
NIDDM	:	Non Insulin Dependent Diabetes Mellitus
NSAIDs	:	Non Steroidal Anti-inflammatory Drugs
OCP	:	Oral Contraceptive Pills
SBP	:	Systolic Blood Pressure
TIA	:	Transient Ischaemic Attack
WHO	:	World Health Organization
WHR	:	Waist Hip Ratio

CHAPTER I
INTRODUCTION

1.1 Rationale and Justification

Hypertension is a medical condition in which blood pressure is chronically elevated [1]. According to World Health Organization (WHO) criteria, the systolic blood pressure (SBP) of a person equals 140 mmHg or above and diastolic blood pressure (DBP) 90 mmHg or above is considered a case of hypertension. It is diagnosed by measuring the blood pressure by mercury sphygmomanometer either by the placatory or auscultatory method [2, 3, 4].

The prevalence of hypertension differs according to country. Within countries there may also be variations in its prevalence. According to WHO World Health Report 2002, there are approximately 600 million people suffering from hypertension in the world. It causes an estimated 50 millions premature deaths and 13% of global fatalities worldwide [3, 4]. High blood pressure contributes 10.9% of disability-adjusted life years (DALYs) in developed countries, whereas 5% in developing countries with low mortality rates. Cardiovascular disease is one of the major leading causes of deaths in developed countries. Hypertension is the most important risk factor of cardiovascular disease [3].

Trends have changed in recent years. There are epidemiological and demographic transitions taking place in developing countries with declining rates of communicable disease and increasing rates of non-communicable diseases [5]. The life expectancy of people in developing countries has increased. There are significant changes in the lifestyle and socio-economic status of people. People in developing countries are adopting a western lifestyle. Urbanization, industrialization, and ageing

of the population are growing very rapidly in developing countries; all play important role behind the increasing prevalence of hypertension. However there is a scarcity of health resources and infrastructure, which leads to an inadequate control of hypertension [5, 6, 7, 8].

In Thailand the prevalence of hypertension in 2004 was 22% with 10.1 million people affected by this problem. Disease of the circulatory system has become the principal cause of death and is responsible for 18.6% of deaths from all causes. More than half are due to cerebrovascular diseases. Hypertension is the main important risk factor of cerebrovascular disease. According to Thailand's health profile, cardiovascular diseases contributed 6.3% of total illnesses among Thai people in 2006. In addition, cardiovascular disease was responsible for 22.2 % of total disabilities. 65.1 % of DALYs were due to non communicable diseases among Thai people in 2006 which was approximately three times as many caused by communicable diseases (20.2 %). In the same year 2006, the hospital admission rate due to hypertension and the mortality rate due to heart disease were 618.5 and 28.4 per 100,000 population respectively [9].

With demographic changes, there have been significant changes in lifestyle of people in developing countries including Thailand. There has been decline in physical activity. People have become more materialistic. According to the WHO report, an estimated 1.9 million deaths are attributable to physical inactivity annually worldwide. Approximately one third of adults are not physically active at all. Inactivity increases with age and is more prevalent among females. Physical inactivity itself is an important independent risk factor of many chronic diseases such as hypertension, diabetes mellitus and heart diseases. It increases the risk of cardiovascular diseases. Approximately 3.3 percent of DALYs in developed countries are due to physical inactivity [3]. According to the surgeon's general report, more than 60 percent of adults do not get the recommended amount of exercise [10]. In Thailand, only 29.1 percent of people, 32.8 % of males and 25.4 % of females were found to be exercising regularlyin 2004. Regular physical exercise significantly reduces the risk of heart disease [10].

Similarly unhealthy diets along with physical inactivity are two of the main risk factors of many chronic diseases. With the changes, food consumption behaviour and dietary habits of people have also changed. An unhealthy diet is also an independent risk factor of chronic disease in itself. There are an estimated 2.7 million deaths due to low fruit and vegetable intakes annually worldwide. Increasing consumption of foods rich in saturated fats and sugar (calories) are primary reasons for a growing epidemic of obesity globally [10], which is also a major risk factor for the development of hypertension and other serious health problems like diabetes mellitus and heart diseases. Even in Thailand, the food consumption behaviour of ordinary people has changed. The majority of people now prefer high fat rich food. Approximately 97.4 percent of people have more affinity towards meat and meat products, 86.3 percent of people prefer high fat food, and only 10.1 percent people have dietary supplements. Moreover, although 98.9 percent people consume fruits and vegetables, the quantity consumed is lower than the recommended intake for health promotion and disease prevention, which is 400 to 800 grams per day. In Thailand, men on average consume 268 grams of fruit and vegetable per day, whereas women consume 283 grams per day, which is not adequate or sufficient [9].

Hypertension is a non- curable disease [11]. Although it cannot be cured completely, it can be prevented and controlled by modification of modifiable risk factors and drug therapy. Pharmacological treatment alone is not sufficient for the control of blood pressure, but the combination of both pharmacological and non-pharmacological treatment is an appropriate modality to control blood pressure. It helps to maintain blood pressure with the lower doses of anti hypertensive drugs. It also minimizes the adverse effects and improves the quality of life compared with either treatment alone. It can also help to reduce cardiovascular risks. The goals of prevention and control of hypertension can be achieved only by an integration of an individual and population approach.

Hypertension is an important and major risk factor of many diseases [1, 12]. If blood pressure is not kept under control within the normal range, it may lead to several hazardous complications such as congestive heart failure, myocardial

infarction, angina pectoris, cerebrovasular accident, stroke, hypertensive retinopathy, hypertensive nephropathy and multi organ failure [1, 11, 13]. Efforts should therefore be made to improve detection, treatment, prevention and control of hypertension to prevent and minimize the adverse consequences due to it. Nevertheless morbidity of non-communicable diseases is increasing in developing countries and mortality due to cardiovascular disease is also increasing along with increased prevalence of hypertension. Formulation and implementation of guideline to reduce hypertension, therefore, has now become an urgent imperative for medical doctors, public health experts, and related organizations worldwide [5].This will not be achieved by either clinical or epidemiological research alone. Integration of both approaches is important to conduct extensive research and ascertain the main etiologies, and their association with high blood pressure.

Thai people are at increased risk of developing hypertension. Lifestyle related risk factors such as excess body weight, low levels of physical activity, excess consumption of fat and salt, and excess alcohol consumption contributing to the development of hypertension are evident in Thai populations. Hypertension cannot be cured completely, but can be prevented and controlled. The goal of treatment should therefore be the maximum tolerated reduction in blood pressure. The control of blood pressure cannot be maintained by pharmacological treatment alone. Lifestyle measures such as exercise, healthy diets (reduced consumption of salt and fat, and increased consumption of fruit and vegetables) are effective in reducing and controlling blood pressure in hypertensive as well as general populations.

1.2 Research Questions

1.2.1 What is the extent of physical activity among hypertensive patients aged 45 years and above in Phutthamonton district, Nakornpathom province, Thailand?

1.2.2 What are the dietary habits of hypertensive patients aged 45 years and above in Phutthamonton district, Nakornpathom province, Thailand?

1.3 Research Objectives

1.3.1 General objectives:

To examine the relationships between behavioral factors and blood pressure among hypertensive patients aged 45 years and above in Phutthamonton district, Nakornpathom province, Thailand.

1.3.2 Specific objectives

1.3.2.1 To describe the socio-demographic characteristics of hypertensive patients aged 45 years and above in Phutthamonton district, Nakornpathom province, Thailand.

1.3.2.2 To describe the body mass index (BMI) and co-morbidities of hypertensive patients aged 45 years and above in Phutthamonton district, Nakornpathom province, Thailand.

1.3.2.3 To determine the relationship between physical activity and blood pressure.

1.3.2.4 To determine the relationship between dietary habits and blood pressure.

1.4 Research Hypotheses

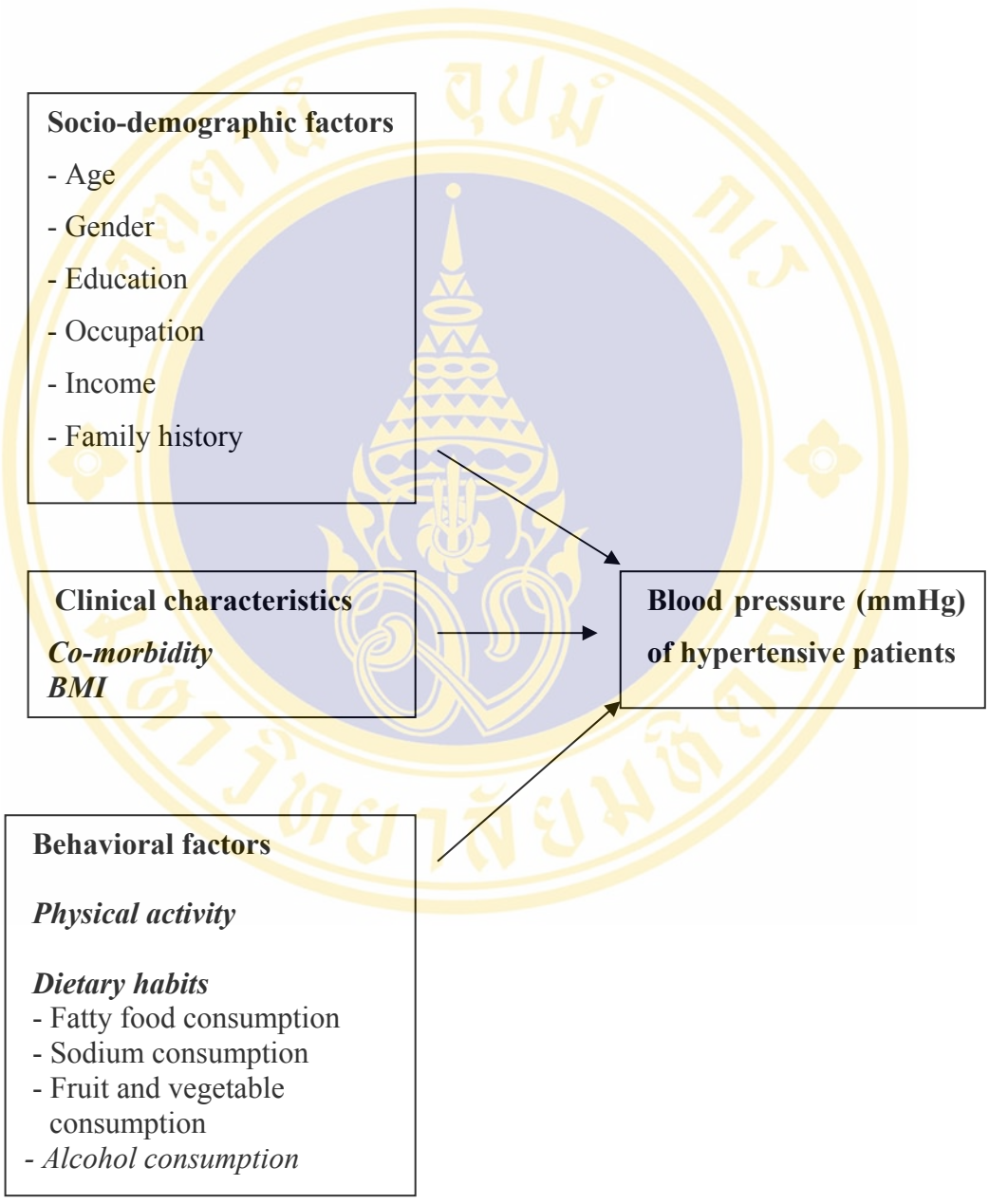
1.4.1 Lack of physical activity may increase blood pressure.

1.4.2 Unhealthy dietary habits may increase blood pressure.

- High fat diets may increase blood pressure.
- Increased sodium consumption may increase blood pressure.
- Low consumption of fruit and vegetable may increase blood pressure.

1.5 Conceptual Framework

Independent variables **Dependent variable**



1.6 Operational Definitions

1.6.1 Dependent variable

1.6.1.1 Hypertension

It is a medical condition in which blood pressure is chronically elevated.

To consider a person as hypertensive the blood pressure should be equal to or more than 140/90 mmHg.

Table 1 As per WHO/ ISH (International Society of Hypertension) and ESH-ESC (European Society of Hypertension and European Society of Cardiology) guidelines: Definition and classification of blood pressure levels

Category	Systolic Blood Pressure (mmHg)	Diastolic Blood Pressure (mmHg)
Optimal	< 120	< 80
Normal	120-129	80-84
High normal	130-139	85-89
Hypertension		
Grade I (mild)	140-159	90-99
Grade II (moderate)	160-179	100-109
Grade III (severe)	≥ 180	≥ 110
Isolated systolic	≥ 140	< 90
Sub group- borderline	140-160	< 90

1.6.2 Independent variables

1.6.2.1 Age

Age means the age of the people who participate in study. Males above 45 years of age and females above 55 years of age are at higher risk of hypertension.

1.6.2.2 Gender

Gender refers to male and female. Generally men are at greater risk of hypertension than pre-menopausal women, but at lesser risk than post menopausal women of same ages.

1.6.2.3 Occupation

Occupation can be classified into different groups particularly farmer, business people, service (government and private sector), housewives etc. Sedentary workers are at higher risk of hypertension.

1.6.2.4 Education

Education is classified into different groups, namely: illiterate (no education), primary schooling (1-6 years of schooling), secondary schooling (7-12years of schooling), college or higher degree.

1.6.2.5 Income

Income refers to total monthly income of a family as a whole.

1.6.2.6 Family History

Family history refers to the first order adult relatives (i.e. parents and siblings). People with family history of hypertension are at greater risk than those with no such history.

1.6.2.7 Dietary Habits

1.6.2.7.1 Sodium intake behaviour

Sodium intake behaviour indicates habit of consumption of salty food as well as addition of salt to cooked food. Excess dietary sodium in the form of a high salt diet may contribute to hypertension.

1.6.2.7.2 High Fat diet

High fat diet refers to the consumption of fatty food, or the addition of fat in cooked food.

1.6.2.7.3 Consumption of fruit and vegetable

Consumption of fruit and vegetables refers to the amount and frequency of fruit and vegetable consumption.

1.6.2.8 Use of alcohol

Drinking alcohol regularly in large amounts increases blood pressure. It means consuming more than one drink daily for females and more than two drinks daily for men. In this case a low blood level of potassium will also be present.

1.6.2.9 Physical activity

Physical activity or exercise indicates any movement of body or part of body produced by skeletal muscles that requires energy expenditure. It includes walking, running, body stretching domestic activities, and weightlifting, and ranges from sedentary to strenuous activities.

1.6.2.10 Co-morbidity

Co-morbidity indicates the presence of one or more disorders or diseases in addition to a primary disorder or disease. Here it refers to clinical conditions associated with hypertension particularly diabetes mellitus, hypercholesterolemia and heart disease.

1.6.2.11 Body Mass Index (BMI)

BMI is an index of weight-for-height that is commonly used to classify underweight, normal, overweight and obesity. Overweight and obese people are at greater risks of developing hypertension.

Obesity – Person with high amount of extra body fat (BMI>=30 kg/m2)

Overweight - Person having extra body weight from muscles, bone, fat and/ or water (BMI >=25 kg/m2).

There is a scientific basis for evaluation of overweight or obesity on the basis of BMI.

BMI :- It is defined as the weight in kilograms divided by the square of the height in meters (kg/m2).

$$BMI = \frac{Weight(Kg.)}{Height(sq.meter)}$$

1.6.2.12 Diabetes mellitus

It is a clinical condition characterized by polyuria, polydypsia and polyphagia. With this condition there is a rise in the level of blood glucose.

1.6.2.13 High cholesterol level (Hypercholesterolemia)

High cholesterol level is another condition associated with hypertension, which is characterized by increased level of lipids in blood.

1.7 Limitation of the Study

Because this research was be carried out only in Phutthamonthon district , it might not represent the whole population of the country, or other districts. Although, it might affect the quality of research, this limitation's due to the shortage of time available.

1.8 Expected Outcome

This research was conducted to ascertain the physical activity and the dietary pattern of hypertensive patients. It would also help to determine the relationship of hypertension with physical activity and dietary habits of hypertensive people. The findings from this study might be helpful or useful in implementing future programmes for the prevention and control of hypertension.

CHAPTER II
LITERATURE REVIEW

2.1 Dependent Variable

2.1.1 Hypertension

Definition and diagnosis

Hypertension is a medical condition in which the blood pressure is chronically elevated [1].

WHO criteria for hypertension:-

The systolic blood pressure (SBP) of a person is consistently140 mmHg or greater and the diastolic blood pressure (DBP) is consistently 90 mmHg or greater is considered as a case of hypertension. It is diagnosed by measuring the blood pressure by mercury sphygmomanometer, either by the palpatory or auscultatory method. Blood pressure can be measured in supine, sitting or standing position but the arm should be at the level of heart. Before the measurement of blood pressure is taken, the patient should be kept in rest at least for 5 minutes in quiet room in comfortable sitting position with arm muscles relaxed and the forearm supported with cubital fossa at heart level. A cuff applied should be of suitable size and is to be evenly applied. Both SBP and DBP should be measured at least twice over a period of not less than three minutes. Both readings should be recorded and the mean value for each is calculated which is considered as result [11, 14].

Epidemiology

According to WHO and ISH, approximately 600 million people have hypertension in the world, and causes 50 million premature deaths every year worldwide and 13 % of global fatalities [2,3,4]

It is an important risk factor for cardiovascular disease [5, 7, 15]. It increases the risk of stroke, myocardial infarction, and cardiovascular death. Only 34 % of hypertensive people are able to reduce blood pressure below 140 / 90 mmHg . Besides developed countries, the hypertension in developing countries is also increasing. There is an epidemiological transition taking place in developing countries with declining communicable disease and increasing non-communicable disease. The major causes for the increased prevalence of hypertension in developing countries are ageing of the population due to increased life expectancy, urbanization, and change in the socioeconomic status of the people. However the control of hypertension is not very effective because of a scarcity of health resources and an insufficient health infrastructure. Socioeconomic change and ageing of population also lead to loss of physical activity or physical inactivity, obesity, and alcohol consumption which eventually leads to development of hypertension as well as other diseases. Hypertension is more frequent in urban communities than rural communities [5, 7].

According to WHO report 1998, it was estimated that 295 million of the hypertensive populations were unaware, 150 million were aware but not treated and 75 million were treated but uncontrolled [5].WHO has been showing its concern with hypertension since 1950s. In October 1958 in Geneva, the expert committee on cardiovascular disease and hypertension gave special consideration to the classification and criteria for the diagnosis of hypertension. In 1961 they described the stage of hypertension but its recommendations were limited for secondary prevention only. In March 1978, a third expert committee met in Geneva and dealt with the epidemiology, prevention and control of hypertension [11]. In 1999 WHO and ISH defined the hypertension as systolic SBP equal to or above 140 mmHg and DBP equal to or greater than 90 mmHg, who are not on medication with anti-hypertensive [16].

In Thailand, currently non communicable diseases have become the leading causes of morbidity and mortality among Thai people. Cardiovascular disease was one of the major causes of illnesses accounting 6.3 % of total causes in 2006. As stated in the report on disabilities survey 2001 by the National Statistical Office [9], 22.2 % of disabled persons were found to have cardiovascular diseases. The result of the burden of disease study revealed that the disease burden in terms of DALYs from non communicable diseases was three times greater than from communicable diseases accounting 65.1% of total compared with 20.2% due to communicable diseases in 2004 [9].

The longer people live, the greater the tendencies for them to have non communicable diseases. The mortality rate due to heart disease was 28.4 per 100,000 populations in 2006 [9]. Inpatient reports showed that the rate of hospitalization of patients with heart disease was 618.8 per 100,000 population, which was very high compared with the admission rate of 109.4 in 1994 [9]. Similar increasing trends also exist with other non communicable diseases like diabetes mellitus and cancers, and may be due to unhealthy food consumption behavior and/or physical inactivity. The prevalence of hypertension as well as diabetes is in increasing trend.

In 1991, the prevalence of hypertension was 5.4%, rising in 1996 to 11.0%. In 2004, it was 22% (10.1 million people) comprising 23.3% in males and 20.9% in females [9].

According to the World Health Report 2002 [3], high blood pressure caused 2.5 % of DALYs in developing countries with high mortality rates, compared with 5% and 10.9 % in developing countries with low mortality rates and developed countries respectively. In Thailand, DALYs in male was 5% and in female 6% in year 2004 [9].

Table 2 Percentage of DALYs in two groups of countries, 2000

Factors	Developing countries *with* high mortality rate	Developing countries *with* low mortality rate	Developed countries
Blood pressure	2.5	5.0	10.9
Smoking	2.0	4.0	12.2
Overweight	--	2.7	7.4
Cholesterol	1.9	2.1	7.6
Low fruit and Vegetable consumption	--	1.9	3.9
Physical inactivity	--	--	3.3
Alcohol	--	6.2	9.2

WHO Health Report 2002

Risk factors

Hypertension is a multi-factorial disease [20]. It develops due to combination of many risk factors. These factors have been classified into non-modifiable and modifiable factors [1, 6, 11, 17-21].

Non modifiable factors:

Age – In most western populations, SBP tends to rise progressively throughout childhood, adolescence and adulthood to attain an average value of 140 mmHg by the 7th or 8th decade. In the same manner DBP also tends to rise with age but at slower rate.

Gender – Before menopause: men are at greater risk of hypertension than women.

After menopause: women are at greater risk than men of the same age.

Genetic factors: People with a positive family history of hypertension are at greater risk.

Race: In blacks, it tends to develop at an earlier age and is more severe than whites.

Modifiable risk factors:

Unhealthy food consumption behavior

High salt intake (high dietary sodium consumption)

Drinking too much alcohol

Smoking

Lack of physical exercise – moderate to intense exercise done regularly improves heart function and promotes healthy arteries.

Stress – Hormones released under stress can increase the blood pressure. It may aggravate higher blood pressure in genetically susceptible individuals.

Medical Conditions:

Obesity – Fatty tissues requires rich blood supply like all other tissues. So that the heart has to work harder to deliver blood to all body tissues in heavier people than in leaner people.

Other conditions associated with hypertension are

Diabetes mellitus

High cholesterol

Kidney diseases

Hormonal disorder

Toxemia of pregnancy

Medications

There are certain medicines that may increase the risk of hypertension or interfere with the action of antihypertensive drugs.

OCP (oral contraceptive pills)

OCP may increase risk of hypertension, particularly in individuals with a family history of hypertension, kidney disease, overweight, high blood pressure during pregnancy.

Steroids, NSAIDs, Decongestants, Diet pills, Antidepressants

Classification of Hypertension

Taking into consideration associated risk factors and development of hypertension-related organ damage, the classification of hypertension provides an easy and reliable method of assessing risk and the most appropriate treatment for each patient. Hypertension can therefore be classified in three ways by: etiology, blood pressure level and extent of damage to the organs.

On Etiological Basis

There are three types of hypertension [1]

1. Essential (primary) hypertension: where the specific cause is not known.
2. Secondary hypertension: where hypertension is the result of other conditions like disease of kidney or tumours (eg. pheochromocytoma and paraganglioma)
3. Resistant hypertension: where a person's blood pressure remains above their target blood pressure despite taking three or more medications to lower it , it is considered as resistant hypertension.

By Blood pressure level

As per WHO/ ISH and ESH-ESC guidelines [11,22]

Table 3 Classification of hypertension by blood pressure levels

Category	SBP (mmHg)	DBP (mmHg)
Optimal	< 120	< 80
Normal	120-129	80-84
High normal	130-139	85-89
Hypertension		
Grade I (mild)	140-159	90-99
Grade II (moderate)	160-179	100-109
Grade III (severe)	≥ 180	≥ 110
Isolated systolic	≥ 140	< 90
Sub group- borderline	140-160	< 90

By extent of organ damage [11]

Stage I : No manifestation of organic change

Stage II: At least one of the following manifestations of organ involvement

Left ventricular hypertrophy

Generalized and focal narrowing of the retinal arteries

Micro-albuminuria, proteinuria and/or slight elevation of plasma creatininine concentration (1.2-2.0 mg/dl)

Radiological or ultrasonographic evidence of atherosclerotic plaque (in aorta or carotid, iliac or femoral arteries)

Stage III: Both signs and symptoms have appeared as a result of organ damage. These include

Heart – Angina pectoris, Myocardial infarction, Heart failure

Brain – Stroke, Transient ischaemic attack (TIA), Hypertensive encephalothy,

Vascular dementia

Optic fundi – Retinal haemorrhages and exudates with or without papilloedema

Kidney – Plasma creatinine concentration > 2.0 mg/dl, Renal failure

Vessels – Dissecting aneurysm, Symptomatic arterial occlusive disease

Management of Hypertension

As hypertension is a non curable disease, the goal of its treatment should be the maximum tolerated reduction in blood pressure. If both SBP and DBP can be kept under control within their normal range, the risks of both stroke and coronary event decrease.

The main objective of treating hypertension, therefore, is to control the blood pressure. Several studies have proposed the management of hypertension [2, 6, 11, 13, 23-28].

Treatment modalities are divided in to two parts:-

a. Non pharmacological treatment (Lifestyle measures)

Non pharmacological treatment should be applied before considering pharmacological treatment with drugs, especially in patients with mild hypertension. Non pharmacological treatment should form an integral component of the overall management programme for all hypertensive patients because it can reduce the overall risk of cardiovascular disease, as well as lower blood pressure [11,23,26].

It is used for the following reasons [11]:-

1. To lower blood pressure in individual patients.
2. To reduce the need for antihypertensive drugs
3. To minimize the associated risk factors in individuals
4. For primary prevention of hypertension and associated cardiovascular diseases generally.

The following lifestyle measures may be applied in treatment of hypertension [11]:

To lower blood pressure:

Reduction of weight
Reduction of alcohol intake
Increased physical activity
Moderation of dietary sodium

To treat associated risk factors –

Cessation of tobacco smoking
Reduction of fat intake
Control of diabetes

b. Pharmacological treatment (Drug treatment)

In the pharmacological treatment of hypertension, there are five classes of drugs that are most suitable for the first line treatment. These are as follows:

1. Diuretics
2. Beta blockers
3. Calcium channel blockers
4. ACE inhibitors

5. Alpha blockers

These antihypertensive drugs can either be used alone or in combination depending upon the situation.

c. Combination of pharmacological and non-pharmacological treatment

This combination therapy helps to maintain control of blood pressure with lower doses of antihypertensive drugs. It also minimizes the adverse effects and improves quality of life compared with either form of treatment alone. Some research suggests that combination therapy provides even greater reduction in cardiovascular risk [11, 26].

Prevention and Control of hypertension

Since hypertension is not a curable disease, emphasis should be placed not only on treatment but also on prevention and control of the disease. The increasing prevalence in developing countries is due to changes resulting from economic development.

It is therefore important to consider prevention and control measures in order to reduce the risk of hypertension and its complications. Several studies have proposed the prevention and control measures of hypertension [2, 6, 11, 28].
WHO has proposed two approaches as a rationale for its prevention and control [11].

a. *Population approach* – This approach focuses on reduction of the risk of developing high blood pressure in the population as a whole in order to prevent complications from high blood pressure.
b. *Individual approach* – This approach identifies hypertensive individuals, who are at greater risk of developing complications.

The combination of both these approaches provides a comprehensive strategy for the prevention and control of hypertension. Since these two approaches have a synergistic effect, the detection and treatment of individuals increases community awareness and facilitates the implementation of population based

strategies. Similarly changes in community behaviour facilitates adherence to lifestyle interventions by individual patients.

Research has shown that only few patients (21%) have their blood pressure below 140/90 mmHg despite drug therapy. In spite of treatment patients with hypertension still have higher risk of morbidity and mortality compared with normotensive persons [5, 11].

Since hypertension is related to both modifiable as well as non-modifiable factors, its prevention can be linked to the elimination of modifiable risk factors and to the promotion of protective factors that help to maintain blood pressure within the desirable range associated with low risk of complication.

Population approach

The goals of this approach are:

1. To increase public awareness that hypertension is a major public health problem.
2. To detect hypertensive cases and high risk population.
3. To advocate lifestyles which minimize, if not eliminate the controllable risk factors of hypertension.

In order to achieve these goals, the population approach relies on the followings components:

1. Public education – About the nature, causes, complications, prevention and treatment of hypertension. The public should also be informed about the usefulness of lifestyle measures in its prevention and management and also the contributory role of other risk factors.
2. Professional education – Physicians and other health professionals should be better trained to detect or diagnose, manage and prevent high blood pressure.

3. Patient education – Patients should be educated about hypertension and its consequences, the need for effective management, the benefits of lifestyle changes, the importance of adhering to health care advice and monitoring and follow up with physicians.

Individual approach

Many people with established hypertension do not respond only to non-pharmacological interventions. For these people it is essential to develop an individual approach to treat hypertension. It is important to continue lifestyle modification in addition to drug therapy.

Complication of hypertension

Although high blood pressure alone is not an illness, it often requires treatment due to its short term and long term effects on many organs. Complications of hypertension include [1, 11, 13]:

1.Cerebrovascular accident (CVA) or stroke
2. Myocardial infarction
3. Hypertensive cardiomyopathy
4. Hypertensive retinopathy
5. Hypertensive nephropathy (renal failure)
6. Hypertensive encephalopathy

2.2 Independent Variables

2.2.1 Age

Blood pressure tends to rise in elderly people. But increased blood pressure is not a routine part of ageing. Ageing is not only a risk factor of hypertension but also the risk factor of many other diseases. In fact, it is not a cause of hypertension but elderly people are more vulnerable to this disease. Isolated hypertension is the commonest type of high blood pressure in older adults [19].

Many studies have shown that there is positive relationship between age and hypertension. Cross-sectional surveys as well as prospective observational cohort studies have consistently demonstrated that there is a positive relation between age and blood pressure with diverse geographical, cultural and socioeconomic characteristics [29].

Most populations in industrialized countries show an increase in SBP and DBP with age, but with DBP decreasing or reaching a plateau. DBP also tends to rise with age but at slower rate than SBP. Increased blood pressure with age is attributed to the effects of environmental factors such as sensitivity to salt, increased BMI, and alcohol consumption [6].

2.2.2 Gender

Men are generally at higher risk than women before menopause. But after menopause women are at slightly higher risk than men [18]. According to the Belgian Interuniversity Research on Nutrition and Health (BIRNH) Study, the prevalence of hypertension in women is lower than men before the age of 54 years. After that there is inversion in prevalence of hypertension in relation to gender [6].

Another study regarding gender difference has shown that the prevalence of hypertension is lower and awareness is higher in women than men. The absolute rate of treatment and control in men is 10 % more than women. But hypertensive women are more often treated for hypertension than men [5, 16].

According to the Framinghan study, blood pressure in younger women is lower than in men, but rises equal to men's blood pressure at about 50 years of age. After the age of 50 years, women's blood pressure tends to rise and exceed men of comparable age group. In men there is rise in SBP in the seventh (7^{th}) decade, but decline in DBP after 56 years [29]. Women develop high blood pressure, particularly systolic hypertension at an increased rate as their age and that this age related blood pressure increase is exaggerated by menopause [16].

2.2.3 Socioeconomic Status

Socioeconomic change with increased socioeconomic status is associated with increased blood pressure [5]. In countries which are in a post transitional stage of economic and epidemiological change, prevalence of hypertension is higher in lower socioeconomic groups of people. It is related to levels of education, income and occupation. In countries in pre-transitional or transitional stage, the prevalence of hypertension is higher in upper socioeconomic groups [11].

2.2.4 Education

Education does not have direct impact on the development of hypertension. But educational status is related to occupation and socioeconomic status. Higher educational status is regarded as being associated with higher socioeconomic status. So there seems to be some association between education and hypertension, although they are not directly related. Moreover educated people are more aware of this problem than uneducated people.

2.2.5 Family History of hypertension

Family history is a well established risk factor for the development of hypertension. Studies have shown that the relationship between family history and hypertension is based on both genetic factors and the family environment. In the study conducted, the subjects were interviewed regarding the history of hypertension in both of their biological parents [30].

Studies of children of parents with hypertension and without hypertension have shown that there is an established family aggregation of increased risk of hypertension. Altered peripheral vascular capacity and response to vasopressor stimuli as measured in a forearm in normotensive individuals are strongly linked to evidence of a positive family history of hypertension [31]. A cross-sectional study has shown that children of hypertensive parents are twice as likely to have hypertension than the off-spring of normotensive parents.

Hypertension is the result of the interaction of multiple genes with multiple environmental factors [6]. It is one of the most common complex disorders with genetic heritability averaging 30 % and the inheritance is multi-factorial [1].

2.2.6 Body Mass Index (BMI)

BMI is an index of weight-for-height that is commonly used to classify underweight, overweight and obesity. Chronic imbalance between energy intake and actual requirement of energy by the body can cause overweight and obesity [3]. Overweight and obese people are more likely to develop hypertension [19].

The prevalence of hypertension is significantly higher in people with obesity and android obesity. The BMI is used to define obesity (BMI > 30 kg/ sq-meter), overweight (BMI > 25 kg/ sq. meter) and the waist to hip ratio (WHR) is used to define android obesity (WHR> 0.9) [7].

The main reasons for growing hypertension epidemic globally are increased physical inactivity and consumption of foods rich in saturated fatty acid and sugar [33]. There is a shift in the burden of obesity and overweight towards lower socioeconomic groups because of their lifestyle changes.

Studies have shown that proportion of overweight people has exceeded the proportion of underweight people in majority of countries. The median ratio of overweight to underweight was 5.8 in urban areas and 2.1 in rural areas.

According to recent burden of disease estimates from WHO, overweight and hypertension are among the top three leading causes of disease burden among women and among the top five leading causes of disease burden among men in central Asia [34]. About one in three adults are overweight or obese, and cardiovascular disease accounts for about two-thirds of all deaths.

Results of several studies show that obesity is associated with eating animal source protein and having smoked in the past. Obese men and women are at

three times greater risk than those with normal BMI, without any dependence on physical activity, dietary habit such as smoking, use of alcohol and other factors. In women, the possible relationship between hypertension and obesity was observed at all levels of BMI whereas for men it was only associated with BMI above 25 kg/m2 [8]. Management of hypertension in obese individuals is more complicated because of poor response to treatment and also increased need for multiple medications.

Epidemiological studies have shown that the age adjusted prevalence of hypertension increases with higher levels of BMI. The linkage between blood pressure and BMI is stronger for SBP than DBP. Central obesity has a stronger effect on high blood pressure than lower body obesity. Blood pressure appears highest in those with a high waist and small hip circumference [22].

Obesity and hypertension can lead to the development of left ventricular hypertrophy (LVH). They have an additive effect in men and synergistic effect in women. Hence obese hypertensive women are at higher risk of developing LVH.

Several mechanisms have been proposed which show the relationship between obesity and hypertension. These are alteration in the rennin-angiotensin-aldosterone system, increased activity of the sympathetic nervous system, insulin resistance, leptin resistance, altered coagulation factors, dysfunction of endothelium, and inflammation of endothelium. Obesity can lead to the development of hypertension by increasing renal sodium absorption, impairing pressure natriuresis, and volume expansion. It may cause chronic renal failure by changing the renal structure. Insulin resistance syndrome (IRS) may cause volume expansion, sodium retention and enhancement of sympathetic nervous system activity. IRS in association with obesity may increase rennin-angiotensin system activity that leads to increased cardiovascular risk. Obesity is also associated with haemodynamic alteration. Although both cardiac output and plasma volume increase, there is significant reduction in peripheral resistance in obese people compared with normal weight individuals [22].

In many epidemiological studies, a clinically significant correlation between BMI and hypertension has been observed [6]. Some evidence from cross sectional and prospective observational studies has shown that there is a direct, strong and consistent relationship between body weight and blood pressure. Overweight is associated with 2 to 6 fold increase in the risk of developing hypertension [11, 37]. Higher BMI is associated with higher SBP and DBP [38].

Table 4 Classification of weight by BMI in adults according to WHO guidelines:

Classification	BMI (kg / m2)
Underweight	< 18.5
Normal weight	18.5-24.9
Overweight	≥ 25.0
Pre-obese	25.0-29.9
Obese	≥ 30.0
Obese class I	30.0-34.9
Obese class II	≥35.0-39.9
Obese class III	≥ 40.0

2.2.7 Physical Activity

Physical activity is essential in improving physical and mental health of people. It reduces the risk of non-communicable diseases like hypertension, heart disease, diabetes mellitus, and also increases social interaction by community engagement. It is not only related to the public health issue but also to the promotion of general well being.

Study suggests that in European region, physical inactivity is responsible for 600,000 deaths (about 6% of total deaths) and 5.3 million DALYs (about 3.5% of total) every year. Physical activity differs among different socio-economic groups. It suggests that people with low socioeconomic status have less leisure time and have to live in environment that do not support physical activity.

There is an inverse relationship between physical activity and prevalence or incidence of hypertension. Low leisure time physical activity increases the risk of hypertension. Physical fitness is inversely related to blood pressure and incidence of hypertension [6].

In post menopausal women with moderate hypertension, regular aerobic exercise significantly lowered blood pressure after 12 weeks [6]. Sedentary and unfit normotensive individuals have a 20 – 50 % higher risk of developing hypertension than active and fit people.

Regular aerobic physical activity has been shown to be beneficial for both prevention and treatment of hypertension [11]. At least 30 minutes per day of regular moderate intensive physical activity is recommended. This will lead to burning of 150 k cal of energy in adults. Exercise lowers SBP and DBP by 5-10 mmHg [11]. Dynamic exercise is more effective compared with static exercise. It is not necessary to do very hard and strenuous exercise. Even a mild level of exercise such as brisk walking for 30 minutes per day at least 3-5 times per week can be more effective [10, 11]. Previous research has shown that a mean reduction in 6.4 mmHg of SBP and 6.9 mmHg of DBP is achieved by regular exercise.

Increased consumption of energy is an important factor for weight control. It can be achieved by regular exercise, which burns more calories. Weight reduction is particularly beneficial because it is also an important factor in controlling blood pressure. Moreover it has also been reported that exercise reduces sympathetic stimulation which ultimately leads to a decline in blood pressure [31].

Other studies have shown that physical activity or exercise decreases plasma catecholamine levels in people with previously high catecholamine levels that was correlated with decrease in SBP. It can be lowered by moderate intense physical exercise such as brisk walking for 30-45 minutes. It has also shown that 30-60 minutes of moderate exercise can significantly reduce the risk of mortality in middle aged men. Moderate exercise can burn 224 kcal of energy and consists of activities like swimming, gardening etc. for 48 minutes [31].

Physical activity is beneficial for both physical and mental well being. It reduces the risk by 50% of certain disorders related to physical inactivity such as hypertension, diabetes mellitus, and heart disease. Other disorders benefitted by physical activity are cancer, stress, anxiety, depression and loneliness. Physical activity also helps to reduce weight and prevent adverse health consequences of obesity. It can be concluded, therefore, that exercise is a very useful means of lowering blood pressure and, in turn, for the prevention and control of hypertension.

According to the survey of National Statistical office Thailand in 2004, approximately 29.1% people exercised regularly [Table 5]. With regard to age and gender, more than half of the people exercising were under 15 years of age and males were exercising more than females. Prevalence of exercise were found to decrease with age. In 2004 the percentage of males who exercised regularly was 32.8%, whereas for females it was 25.4%. With respect to age groups, in 2004 it was highest (43%) for 25-59 years, 30.8% for 15-24 years, 17.55% for 6-14 years and 8.7% for 60 years and above. While considering exercise behaviour based on criteria of physical activity for health, it was found that more than 60% of people exercised more than three days a week and approximately 80 to 90% exercised for 30 minutes or longer each day [9]. With respect to continuity of exercise, 67.5% of Thai people were found to be exercising continuously for more than 7 months, whereas 18.1% for 1-3 months.

According to the Ministry of Public health's policy to promote and support physical exercise among Thai populations across the country, four major campaigns on exercise for health were organized at central as well as provincial levels. The number of people participating in the health campaigns tremendously increased from 0.3 million in 2002 to 8.6 million in 2003 and 43.1 million in 2004. But the number of participants dramatically decreased to only 8.8 million in 2005, which could not meet the target of 33 million set by the Ministry of Public health. The decline in the number of people participating in campaign on exercise for health and lower percentage (29.1 %) of Thai people exercising regularly have indicated that physical inactivity is still pronounced among them [9].

Table 5 Percentage of Thai people who regularly exercised from 1987 to 2004

Year	People exercising regularly (%)		
	Male	Female	Total
1987	27.2	15.6	21.3
1992	31.8	19.7	25.7
1997	36.6	24.8	30.7
2002	35.7	23.7	29.6
2004	32.8	25.4	29.1

Source: Thailand Health Profile 2005 - 2007

2.2.8 Dietary Habits

Unhealthy diet is a principal modifiable risk factor in most of the main chronic diseases such as hypertension, heart disease, and diabetes mellitus. According to the WHO world health report 2002, low fruit and vegetable consumption is responsible for 1.9 % and 3.9 % of DALYs in developing countries with low mortality rates and developed countries respectively, and causes 2.7 million deaths per year globally [3,10].

According to the Thailand health profile, lifestyle changes have caused changes in food consumption behaviour of Thai people. 98.9 % of the population consume fruits and vegetables, 97.4 % meat and meat products, 86.3 % high fat foods, and only 10.1 % of population consume dietary supplements. Although a high percentage of people consume vegetable and fruit, their average intake was only 268 grams per day for males and 283 grams per day for females. This is considerably lower than the recommended daily requirement (400-800 grams/day) for the promotion of good health and prevention of disease. In addition, sugar consumption has also increased from 12.7 kg/person/year in 1983 to 33.2 kg/person/year in 2006. Foods rich in calories and fat are risk factors of cardiovascular diseases [9].

Most fruits and vegetables are rich in nutrients, low in calories and high in fiber. They can lower the blood pressure and improve other risk factors of cardiovascular diseases. Similarly, diets low in saturated fat, trans fat and cholesterol decrease the risk of cardiovascular disease by decreasing low density lipoprotein (LDL) cholesterol. There is a positive linear relationship between saturated fat, LDL cholesterol and cardiovascular disease risk [39].

Table 6 Food Consumption Behaviour of Thai people (in percentage)

Food group	Eating	Not eating
Vegetables & fruits	98.9	1.1
Meat & meat products	97.4	2.1
High fat foods	86.3	13.7
Processed food	83.2	16.8
Carbonated & sweetened drinks	71.7	28.3
Snacks	48.9	51.1
Fast food	15.3	84.7
Dietary supplements	10.1	89.9

Source: Thailand Health Profile 2005 – 2007

The Thailand health profile has presented the data suggesting the prevalence of food consumption behaviour of Thai people. The data regarding the amount of food intake, as recommended by the American Heart Association (AHA) [Table 7] for hypertensive and heart patients, has not been shown in the health profile.

Table 7 AHA: Heart Diet Recommendations

Vegetables	At least 4 servings a day
Fruits	At least 4 servings a day
Grains	Choose whole grains, high fibre
Fish	At least 2 servings a week
Fats	Aim: Cholesterol 300 mg, Trans fat < 1 % of total kcal, Saturated fat < 7 % of total kcal
Salt	Use little or no salt Aim at not more than 2300 mg of sodium per day
Sugar	Minimize sugary foods and drinks to less than 5 servings per week
Alcohol	Limit alcohol intake to no more than 2 drinks a day for men and 1 drink a day for women

2.2.9 Alcohol consumption

Drinking alcohol regularly in large amounts increases blood pressure. Studies have shown that long term ingestion of alcohol increases blood pressure. The correlation of alcohol intake with blood pressure depends on age and gender (Stanford Five City Project) [6]. The Intersalt study has shown that a high amount of alcohol consumption (defined as ≥ 300 ml per week) is independently related to the prevalence of hypertension after adjusting for age, gender, BMI, and urinary excretion of sodium and potassium. Reduction of alcohol consumption by hypertensive individuals decreases the blood pressure and also may reduce the need for antihypertensive drugs.

Study's results showed that alcohol was significantly associated with blood pressure in women above 49 years, and men above 74 years of age. This may be due to a difference in biological responses to alcohol in older men and women with compared to younger individuals [31].

Several pathogenic pathways have been proposed by which an increase in the excretion of catecholamines, disturbance in sodium- lithium counter transport in red cells, and decrease in insulin sensitivity, may contribute to the development of hypertension. However the biological mechanism of long term use of alcohol on blood pressure is not evident [6].

Although the precise nature of the association between alcohol consumption and high blood pressure is not yet known, it is hypothesized that alcohol acts on the central nervous system and modifies neural control of the pressor system.

One study has reported that there is an association between drinking alcohol and stress, specifically financial stress, in men, and negative life events in women. Prevalence of hypertension was fifty percent greater in those who had had 3-4 drinks per day and 100 percent greater in persons consuming 6-7 drinks per day compared with non drinkers [31].

Many cross-sectional and prospective observational studies have shown that the consumption of alcohol is related to high blood pressure. Both the acute and chronic effects of alcohol are noted, which are independent of age, sex, obesity, smoking, and physical activity [11].

The research has shown that there is 6.6 mmHg rise of SBP and 4.7 mmHg rise of DBP in daily drinkers, which is higher than in weekly drinkers. This finding was independent of total weekly quantity [11].

For prevention and control of hypertension, it is advisable to decrease the intake of alcohol to a maximum of 3 drinks per day in men, and 1 to 2 drinks per day in women. Consumption should be limited to 30 ml of ethanol for men, and 15 ml of ethanol for women [24].

The AHA has recommended limiting consumption of alcohol to no more than 2 drinks a day for men, and 1 drink a day for women [39]. Moderate alcohol intake

is associated with reduced cardiovascular diseases. If alcoholic beverages are consumed, they should be consumed with meals [39].

2.2.10 Sodium Consumption

A high salt diet may contribute to hypertension in cases of highly susceptible individuals. Sodium sensitivity may increase with age. Sodium sensitivity is present in subjects with or without hypertension, and may be associated with blood pressure changes that occur with age.

In case of hypertensive individuals, there is stimulation of the sympathetic nervous system which may increase the level of insulin. Increased plasma insulin levels may cause hypertension through retention of sodium. Overeating can cause insulin mediated sympathetic stimulation.

There is an interaction between gene and environmental factors, and salt intake in eliciting rapid increase in blood pressure. In another study, Dahl found that there was a correlation between urinary salt excretion and prevalence of hypertension in human beings. The Multi center Intersalt study showed a positive association of blood pressure with sodium intake, whereas potassium intake was negatively related to blood pressure. Meta analysis of observational data has confirmed that there is a relationship between salt intake and high blood pressure [6].

One study suggested that there was significant increase in mean blood pressure, when there was change from a low salt diet (20 mmol NaCl per day) to a high salt diet (260 mmol Nacl/day). The strength of the association between urinary sodium excretion and high blood pressure increases with age. On the basis of the Intersalt research, an inter population study, a 100 mmol per day lower intake of sodium over a life time has been shown to result in a 9 mmHg smaller rise of SBP for 25 to 55 years of age [11]. 100 mmol of sodium per day or < 6 gm of NaCl per day can be recommended at the population level [6].

According to the AHA, there is a progressive dose response relationship between sodium intake and blood pressure. Reduction in intake of sodium can prevent hypertension, lower blood pressure in patients on medication with anti hypertensive drugs and assist in the control of hypertension. It recommends using little, or preferably, no salt. If one uses salt, it should not exceed 2300 mg (2.3 gm) per day [39].

2.2.11 Potassium consumption

The result of intersalt , cardiac and other studies have shown that there is an inverse relationship between dietary intake of potassium and blood pressure [11]. There was a decrease of 2.7 mmHg in SBP for a 60 mmol per day increase in excretion of urinary potassium. Blood pressure is more closely related to the ratio of urinary sodium to potassium than to either electrolyte alone. It also showed that reduction of the 24 hours urinary sodium- potassium ratio of 3:1 to 1:1 is associated with a 3.4 mmHg reduction in blood pressure [11].

There was an independent correlation between urinary potassium excretion and inter population difference in blood pressure. In US blacks, the prevalence of hypertension is higher than in whites and is related to a relatively low intake of potassium. It is recommended to increase the potassium intake to 100 mmol per day [6].

2.2.12 Metabolic Syndrome

The co-existence of central obesity, IRS, hyperinsulinaemia, glucose intolerance, dyslipidaemia and hypertension has been found in recent years. [11].
Research has demonstrated the association between increased insulin levels in high blood pressure in both obese and non- obese people. Insulin resistance is present before the development of hypertension in genetically predisposed individuals [11]. Insulin resistance was observed in 45 % of patients with hypertension compared to 10 % of normotensive individuals. Hyperinsulinaemia has been found to be an independent predictor of hypertension over an 8 year period in lean individuals [6].

Various biological mechanisms have been proposed to show the linkage between IRS and hypertension. Several authors have suggested that there is an

activation of the sympathetic nervous system in hyperinsulinaemic state. A genetic background displayed a hypeinsulinaemic response to an oral glucose load [6].

2.2.13 Diabetes Mellitus (DM)

Hypertension has higher prevalence in diabetic patients than in non diabetic patients [26]. Study shows that its prevalence is 1.5 to 2 times higher in diabetics. Non insulin dependent diabetes mellitus (NIDDM) or Type 2 DM may be associated with hypertension at, or even preceding, diagnosis, whereas insulin dependent diabetes mellitus (IDDM) or Type 1 DM is associated with hypertension only when albuminuria and early nephropathy develop [40]. More than 70% of hypertensive patients were found in cases of NIDDM.

Complications of cardiovascular and renal diseases are higher in cases of patients with both DM and hypertension than either of disease alone. Insulin resistance is more frequent in obese people, so that lifestyle modifications are beneficial to control hyperglycaemia, dyslipidaemia and hypertension. Insulin sensitivity can be improved by physical exercise and reduction of body weight.

2.2.14 High Cholesterol

Several studies conducted have shown that there is an association between high cholesterol level and hypertension as a risk factor of coronary heart disease (CHD).

Increased levels of low density lipoprotein (LDL) and total cholesterol increase the risk of CHD. Results have shown that a reduction of 0.6 mmol of total cholesterol in men aged 40 years had been associated with 54 % lower risk of CHD, whereas in men aged 70 years, the same difference in cholesterol level was associated with a risk reduction of only 20 %. In cases of high density lipoprotein (HDL), a 0.03 mmol increase in its level can reduce the risk of CHD by only 3 percent. So the effect of HDL on the risk of developing CHD does not appear to be dependent on age [11, 21].

The Framinghan study showed that there was an inverse association between HDL cholesterol and incidence of coronary heart disease in both men and

women. Subsequently, it has been suggested that non-fasting HDL cholesterol and total cholesterol are related to the development of coronary heart disease in both men and women aged 49 years and above. A case control study was conducted and the results showed that HDL cholesterol was lower in person with coronary heart disease than in those without disease, whereas LDL, total cholesterol and triglycerides were higher in persons with CHD. Hence it can be concluded that LDL, total cholesterol and triglycerides are directly related to the prevalence of CHD while HDL cholesterol is inversely related with it [20, 42, 43].

2.3 Summary

The prevalence of hypertension is increasing in developing countries along with demographic and epidemiological transition. Hypertension itself is not a serious disease, but is an important and major risk factor of many diseases. If blood pressure is not kept under control within the normal range, it may lead to several serious complications such as myocardial infarction, angina pectoris, congestive cardiac failure, CVA, stroke, hypertensive nephropathy, hypertensive retinopathy and multi organ failure.

Hypertension is a multi-factorial disease and develops due to combination of many risk factors, both non modifiable and modifiable. The non modifiable factors include age, gender, race and genetic factors. Lifestyle related factors such as excess body weight, low levels of physical activity, excess consumption of diet rich in salt and fat, decreased consumption of fruit and vegetables, and excess consumption of alcohol are modifiable risk factors. Life style modification reduces the risk of developing hypertension.

Since hypertension is non curable disease, the goal of its treatment should be the maximum tolerated reduction in blood pressure. The emphasis should therefore be placed not only on treatment but also on prevention and control of hypertension. Blood pressure can be controlled by application of non pharmacological (life style measures) as well as pharmacological (drugs) treatment. It cannot be effectively

controlled using pharmacological treatment alone. Lifestyle measures that include exercise, decreased consumption of salty and fatty food, increased consumption of fruit and vegetables, reduced alcohol consumption and reduction in body weight have been proven effective in reducing and controlling blood pressure in hypertensive individuals as well as in general populations.

In order to maintain the control of blood pressure with lower doses of antihypertensive drugs, to minimize the adverse effects, and to improve quality of life, a combination of both pharmacological and non pharmacological treatment is more effective than either form of treatment alone. So, for the primary prevention of hypertension, it is imperative to identify and analyze the risk factors, which will enable further health promotion activities to reduce the impact and complications of hypertension.

CHAPTER III
RESEARCH METHODOLOGY

3.1 Study Design

Cross-sectional Study (Hospital Based)

This study was conducted to ascertain the extent and nature of physical activity of hypertensive patients, and their dietary habits. Only patients with a confirmed diagnosis of hypertension or with current blood pressure 140/90 mmHg were recruited and interviewed in order to assess their patterns of physical activity and dietary habits. For this purpose a cross sectional study design was suitable and appropriate, and was used to conduct this research.

3.2 Study Area

Phutthamonthon District (community) Hospital
(Phutthamonthon district, Thailand)

Phutthamonthon district is one among 7 districts of Nakornpathom province in Thailand. It has 3 sub districts; namely: Salaya, Klong Yong, and Mahasawad. Total area of this district is 76,329 square kilometer. The total population of the district is 29,912, with 15,478 males and 14,434 females from 13,715 households with an average of 2.18 persons per household. It is located at 20 km west of Bangkok city and 30 km east of Nakornpathom.

Phutthamonton District Hospital is a community hospital under the ministry of public health which is responsible for the whole district. It has got 30 beds for the admission of the patients. The total staff members in the hospital are 104, which comprises 4 medical doctors, 3 dentists, 3 pharmacists, 39 nurses, and 55 other staffs. This hospital provides both primary and secondary health care services. The

hospital has very good referral system. The cases those cannot be managed in this hospital are referred to the Nakorn pathom provincial or regional hospital, which has got specialist facilities. The total number of hypertensive patients registered, and being treated on regular follow up basis in this hospital are 400.

3.3 Study Population

The population of the study were hypertensive patients (patients with a confirmed diagnosis of hypertension for at least six months or with current blood pressure ≥ 140/90 mmHg) aged 45 years and above from Phutthamonthon district, Nakorn pathom province Thailand.

3.3.1 Selection of study population (Respondents)

Cases of hypertension were selected on the basis of blood pressure screening record at Phutthamonthon district hospital or their current blood pressure status.

Inclusion Criteria

Thai people aged 45 years and above, irrespective of their genders with confirmed diagnosis of hypertension for at least six months or with current blood pressure ≥ 140/90 mmHg were included in the study.

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Exclusion Criteria

Patients below 45 years of age were excluded from the study. Hypertensive patients with complications such as hypertensive retinopathy, cardiomyopathy, nephropathy, encephalopathy, CVA due to hypertension were also excluded.

3.4 Sample Size

Based on cross-sectional study design, physical activity and dietary habits were considered the major factors to be studied. Since there was no exact data available regarding the prevalence of physical activity and dietary habit among

hypertensive patients in the proposed study, it was assumed as 50%. With 95% confidence interval and 0.08 degree of accuracy, the total required sample size in this study was calculated using the following formula:

$$n = \frac{Z^2 P(1-P)}{d^2} = 151$$

$= (1.96)2 \times 0.5\ (1\text{-}0.5) / (0.08)2$

$= 0.9604/0.0064$

$= 150.06 = 151$

Where,

n = estimated sample size

z = Reliability coefficient at 0.05 level of significance

(at 95% confidence interval)

p = assumed prevalence of physical activity and dietary habit

1-p = 1-0.5 = 0.5

d = degree of accuracy or deviation from p (0.08)

3.5 Sampling Technique

The respondents were selected by purposive sampling.

Since the site of data collection in the study was Phutthamonthon District Hospital, we had to rely on the patients for recruitment, while coming for check-up. The hospital had outpatient clinic for hypertensive patients only three days, namely: Tuesday, Wednesday and Thursday in a week. The name list of hypertensive patients coming for checkup was provided by the nurse working in the hypertension clinic. The data was therefore purposely collected only on those three days in a week. The hypertensive patients who met the inclusion criteria were approached and asked to participate in the study and those who did not meet the criteria were excluded from the study.

3.6 Data Collecting Tool:

Structured Questionnaire

Structured questionnaire was used as a tool for collection of data. The questionnaire format was modified for greater ease of understanding and clarity from a standard questionnaire [50, 51, 52]. The questionnaire used in this study consisted of the following four parts:-

Part I: Socio-demographic
Part II: Hypertension and co-morbidity
Part III: Physical activity during the past month
Part IV: Dietary habit during the past month

Part I: Socio-demographic part

This part elicited data about the non-modifiable factors such as age, gender, family history, as well as modifiable factors such as education, occupation and family income. Questions asked in this part are quite clear and straight.

Part II: Hypertension and co-morbidity

This part focuses on clinical characteristics; obesity, and co-morbidities such as diabetes mellitus, heart disease and hypercholesterolemia. Body mass index (BMI) calculated by measuring weight (in kg) and height (in cm) was an important parameter in assessing obesity. Diabetes mellitus, hypercholesterolemia (high cholesterol) and heart disease were assessed by interviewing the patients about their clinical history. Patients were given options and asked to select an answer recorded in the form of "yes or no".

It also consisted of questions regarding hypertension in terms of its diagnosis by medical persons, time or duration of diagnosis and intake of oral antihypertensive medicines.

Part III: Physical activity during the past month

The questions relating to physical activity focused on patient's lifestyles which ranged from sedentary life style to hard or strenuous physical activity. Physical activity was classified into four types, namely: sedentary activity, mild, moderate and strenuous physical activity. Different types of work or physical activities that have

been included under different categories, depending upon their characteristics. This category also included the frequency of physical activities they perform in the form of days per week. The frequency of work has been divided into four categories, namely: never, less than 3 days per week, 3-5 days per week and 6 days or more per week. The points given to them were 0, 1, 2 and 3 respectively. Questions about the duration of work or physical activities have also been asked in this part and fall into three categories namely never doing physical activities, doing physical activities for less than 30 minutes and doing physical activities 30 minutes or more. The points given were 0, 1 and 2 respectively.

Part IV: Dietary habit during the past month

Questions regarding dietary habits concerned, first food preferences of food and, second frequency of food consumption. For this study, food was classified into fatty food, fruits, vegetables and salty food. For each of these categories a list of food items was prepared. Since patients might not have been aware of, or familiar with macronutrients, they were allowed to select the food items they consumed. Frequency of food intake was recorded in the form of days per week and number of times per day. With regard to frequency of food consumption, 0, 1 ,2 and 3 points were awarded for intakes of food never, less than 3 days per week, 3 to 5 days per week and 6 days or more per week respectively.

With regard to frequency in terms of number of times per day, it was divided into three categories namely never, less than twice per day and twice a day or more. The points given to them were 0, 1 and 2 respectively.

Respondents were also asked about the addition of salt and fat to their cooked food. The answers were recorded in the form of “yes or no”.

Alcohol consumption behavior was also addressed in the questionnaire. Question was asked in the form of “yes” or “no”. If the answer was ‘no’, then it was not necessary to ask further questions and was advised to stop interview. In case of answer ‘yes’, it was asked to specify the type of alcohol they consumed, frequency of

consumption in terms of days per week and quantity of alcohol in terms of number of drinks (glasses) per day.

3.7 Data Collecting Procedure or Technique

Self Report Technique

The self report technique was adopted as the data collection technique. After research ethic committee granted approval for the research (COA. No. MU-IRB 2008/278.3012), the permissions were sought from provincial health office, Nakorn pathom and Phutthamonthon District Hospital. The director of the district hospital was requested for co-operation and permission, and other clinical staffs were also requested for their assistance and co-operation. The data collection was carried out from 8 to 28 January, 2009. Total 153 individuals participated in the research and none of them withdrew from the study.

Questionnaires were translated into the Thai language and then supplied to the participants. Data was collected with the help of well trained Thai research assistants and health staffs. Prior to data collection, the research assistants were provided with training regarding appropriate techniques of interview, measurement of blood pressure, approach to the participants, and the inclusion and exclusion criteria of the study. Blood pressure measurement was carried out by researcher himself and other health staffs.

Since large number of participants had difficulty in reading or writing except giving signatures, the research assistant asked them questions and wrote down their responses without any manipulation. In terms of educated persons, they were asked to answer the questions by themselves and then put it into the boxes provided there.

3.8 Data Analysis

After collecting the data, its statistical analyses were performed.

3.8.1 Statistical Method

Univariate analysis

Descriptive Statistics was used to calculate frequency, percentage, mean, median and standard deviation of independent variables such as socio-demographic factors (age, gender, occupation, education, income, family history), co-morbidity (diabetes mellitus, high cholesterol level, heart disease, BMI), physical activity, dietary habit, alcohol consumption as well as dependent variables (SBP and DBP).

Bi-variate analysis

Since independent variables in the data were ranked, non parametric test was used. Spearman rank correlation coefficient analysis was used to find the relationship between independent variables (socio-demographic factors, co-morbidity, physical activity, dietary habit) and dependent variables (SBP and DBP). The level of significance for statistical analyses was set at 0.05.

CHAPTER IV
RESULTS

The data obtained from the current study are presented in this chapter. This cross-sectional study aimed to ascertain the patterns of physical activity and dietary habits of hypertensive patients aged 45 years and above living in Phutthamonthon district, Nakornpathom province, Thailand, and also to examine their effect, if any, on hypertension. Data collection was conducted at the Phutthamonthon District (community) Hospital from 8-28 January, 2009. Based on formula used to calculate minimum sample size, 153 patients were selected. The findings of this study are presented under the following headings.

Part I: Description of independent variables

a. Socio-demographic factors
b. Co-morbidity
c. Physical activity
d. Dietary habits
e. Alcohol consumption

Part II: Description of dependent variables (SBP and DBP)

Part III: Analysis of relationship between independent and dependent variables

Socio-demographic characteristics

Age

The mean age of the patients involved in this study was 63.54 years, ranging from 45 to 83 years. 35.9 % of participants were aged between 65 and 74 years; 32.7 % were between 55 and 64 years; 19% were between 45 and 54 years; and 12.4 % were aged 75 years and above (see Figure 1).

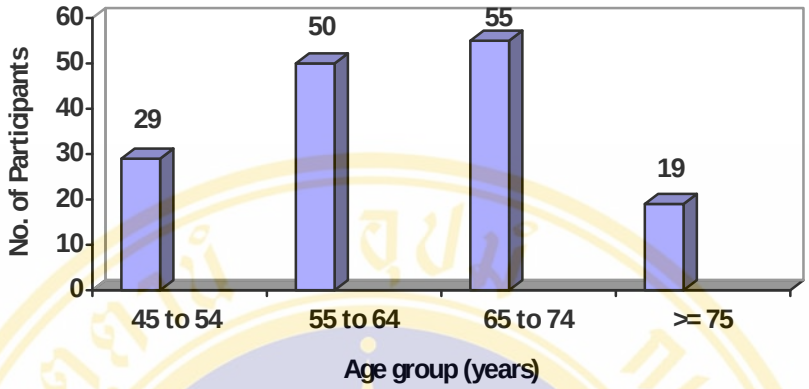


Figure 1 Participants by age (in years)

Gender

Figure 2 shows the number of men and women involved in the study. Overall there were more females than males comprising 64.1 and 35.9 percent respectively.

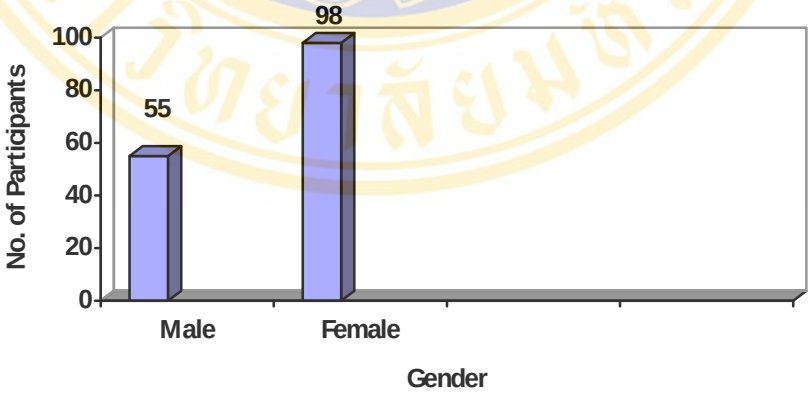


Figure 2 Number of participants by gender

Occupation

The 40.5 % of all participants were housewives, 15.7 % were farmers, and 16.3 % were retired with no occupation. 8.5 % of the participants worked in the

government sector, and 7.8 % worked in the private sector. Almost 11.1 % reported running their own businesses (see Figure 3).

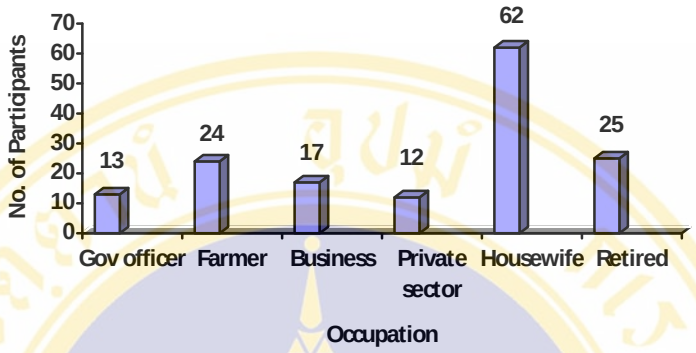


Figure 3 Number of participants by occupation

Education

Although most participants were literate, only 2 % reported having received a college or higher degree; almost 6 % attended secondary school. The majority of participants (75.2 %) received only primary education. Almost 13.7 % of participants were illiterate (see Figure 4).

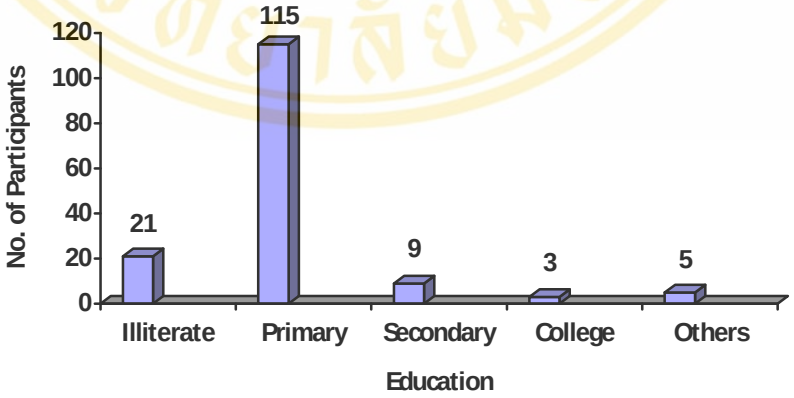


Figure 4 Participants by Education

Family history

Of the 153 participants, 65.4 % reported negative histories of hypertension in their families. 21.6 % of all participants reported that their parents (father or mother) had suffered from hypertension; 3.9 % reported hypertension in their siblings; and approximately 4 % reported hypertension in their children. About 5.2 % of the participants were not aware of hypertension (see Figure 5).

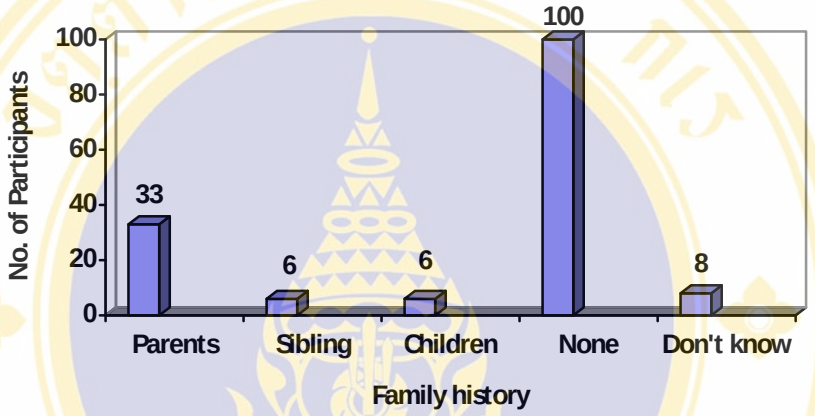


Figure 5 Family History of Hypertension

Income

The majority of participants (73.9 %) reported low monthly incomes (less than 5000 baht per month), whereas 17.0 % earned between 5000 and 10000 baht per month; only 9.2 % earned more than 10,000 baht per month (see Figure 6).

Of the 153 participants, 152 (99.3 %) reported that they were diagnosed by a medical person. Duration of diagnosis ranged from 1 to 30 years, with a mean of 6.05 years. 148 participants (96.7 %) reported taking oral anti hypertensive drugs in order to control their BP.

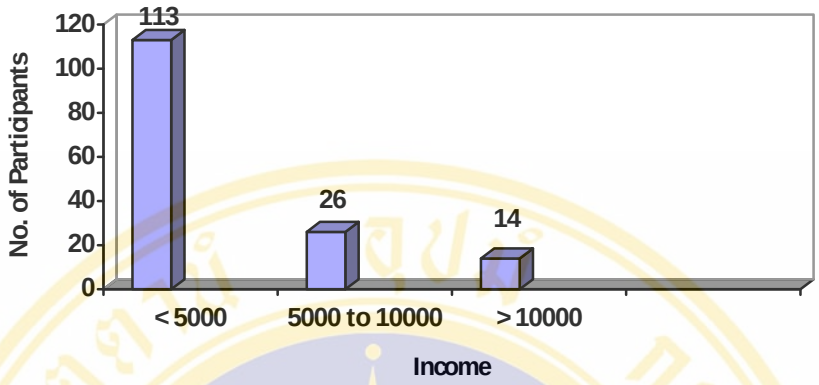


Figure 6 Participants by Monthly Income

BMI (Body Mass Index)

The BMI is a simple index of weight-for-height that was used to classify underweight (BMI < 18.5 kg/m2), normal (18.5-24.99 kg/m2), overweight (25.0-29.99 kg/m2) and obese (≥30.0 kg/m2). It was calculated as the weight in kilograms divided by the square of the height in meters (kg/m2). The minimum and maximum values of BMI were 15.92 and 45.83 kg/ sq. meter respectively with mean value 25.9 and standard deviation 4.623. A majority of participants were found to be either overweight (35.9 %) or obese (18.3 %); 41.8 % of the participants were found to be normal, and 3.9 % underweight. The participants by BMI is shown in Figure 7.

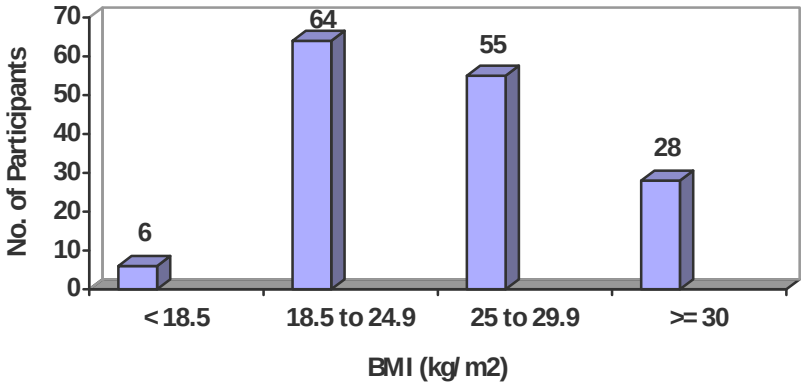


Figure 7 Participants by BMI

Co-morbidity

The co-morbidity of all participants is presented in Figures 8 to 10

Diabetes Mellitus

The majority of participants had a positive history of diabetes mellitus in addition to hypertension. 77.8 % of all participants had had a diagnosis of diabetes mellitus and 22.2 % reported no clinical history of diabetes mellitus (see Figure 8).

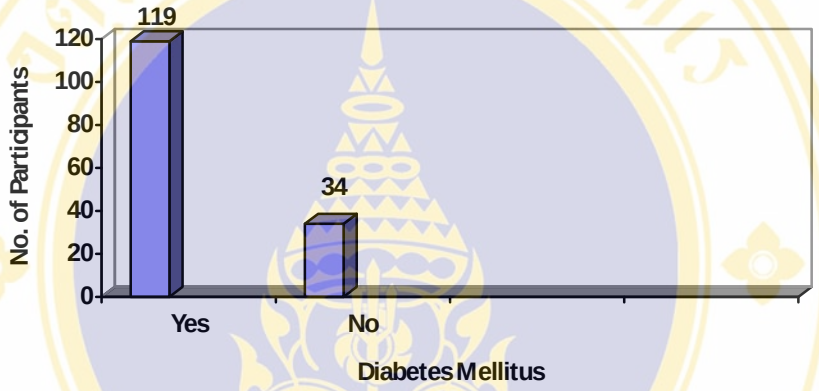


Figure 8 Participants and diabetes mellitus

High cholesterol level

Overall, 69.9 % of all participants had been diagnosed with high cholesterol levels (hypercholesterolemia); only 30.1 % participants reported a negative history (see Figure 9).

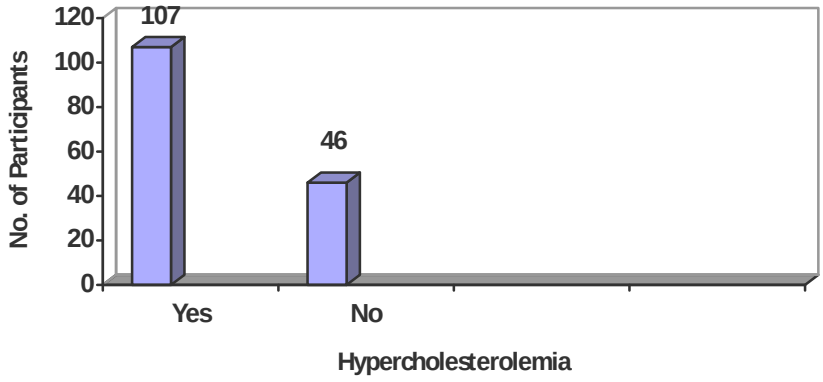


Figure 9 Participants and Hypercholesterolemia

Heart disease

58.8 % of all participants had been diagnosed with heart disease, whereas 40.2 % were found to be free from this problem (see Figure 10).

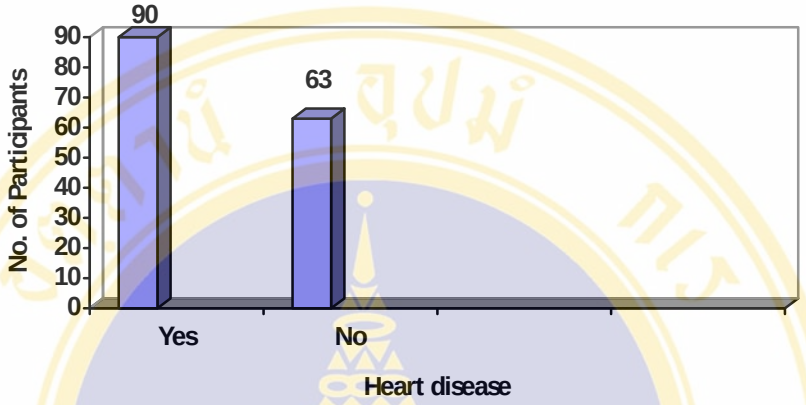


Figure 10 Participants and Heart Disease

Other problems

None of the participants were found to have other problems apart from diabetes mellitus, hypercholesterolemia and heart disease.

Physical Activity

Type of physical activity

The majority of participants were found to lead sedentary life styles although a very small number was engaged in strenuous or hard physical activities. The percentages of participants with sedentary, mild, moderate and hard or strenuous physical activities were 54.2, 23.5, 16.3 and 5.9 percents respectively (see Figure 11).

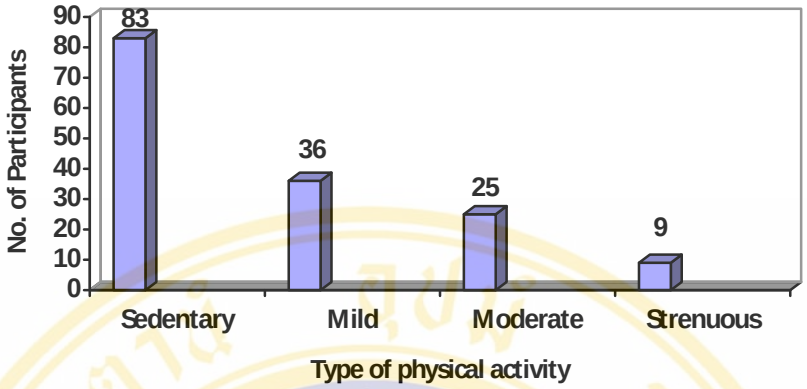


Figure 11 Participants and Type of Physical activity

Frequency of physical activity

Overall, 68 % of participants reported physical activities particularly household activities on 6 to 7 days per week, whereas only 1.3 % were completely physically inactive. The percentages of participants with their physical activities for less than 3 and 3-5 days per week were 10.5 and 20.3 percents respectively (see Figure 12).

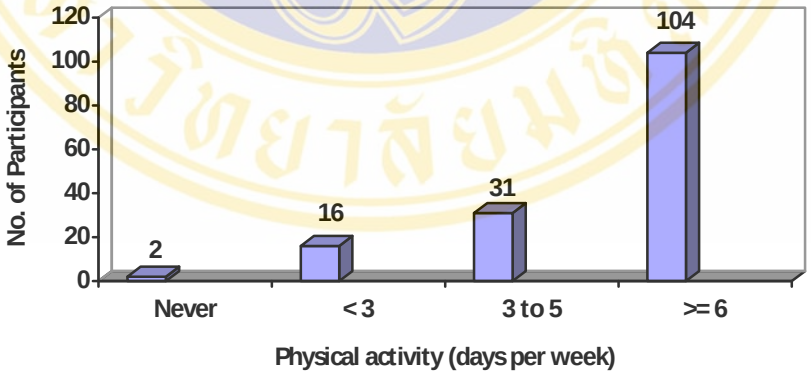


Figure 12 Physical activity by participants (days per week)

Duration of physical activity

The majority of participants reported that they engaged in physical activity particularly household activities for more than 30 minutes per day. 73.2 % undertook

physical activity for more than 30 minutes per day, and 25.5 % for less than 30 minutes per day (see Figure 13).

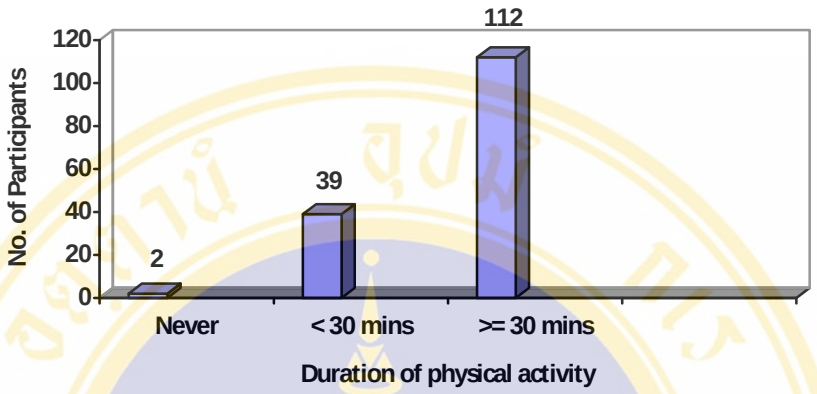


Figure 13 Duration of physical activity per day

Dietary habits

Fatty food

Of the 153 participants involved in the study, 67 (43.8 %) reported consuming fatty food on fewer than 3 days per week, and 55 (35.9 %) reported no fatty food in their diets. 13.1 % were found to consume fatty food on 3-5 days in a week, while 7.2 % had consumed fatty food for 6-7 days per week during the past month (see Figure 14).

Similarly, 49.0 % of participants had fatty food in their diet only once a day, and 15.0 % of them had had fatty food two or more times per day. Of all participants, 55 (35.9 %) never had fatty food in their diet (see Figure 15).

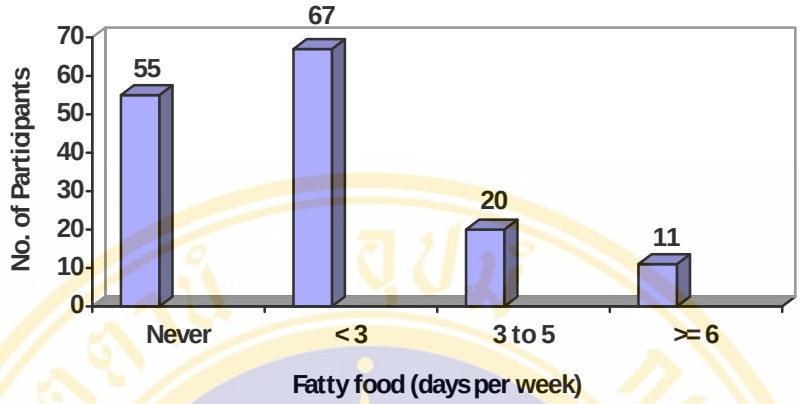


Figure 14 Consumption of fatty food (days per week)

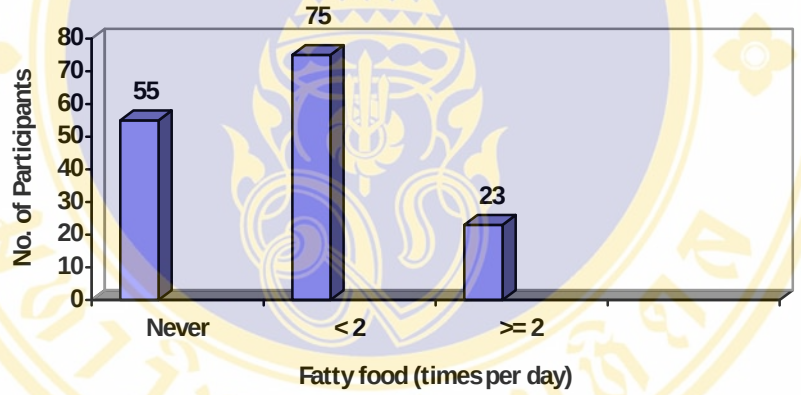


Figure 15 Consumption of fatty food (times per day)

Fruit

Of all participants, 58.8 % reported regular fruit consumption on 6-7 days per week during the past month; 5.2 % did not consume fruit in their diet; 8.5 % had eaten fruit on less than 3 days in a week and 27.5 % had eaten fruit on 3-5 days per week during the previous month (see Figure 16).

97 participants (63.4 %) reported having consumed fruit twice or more daily during the previous month, and 48 (31.4 %) once a day (see Figure 17).

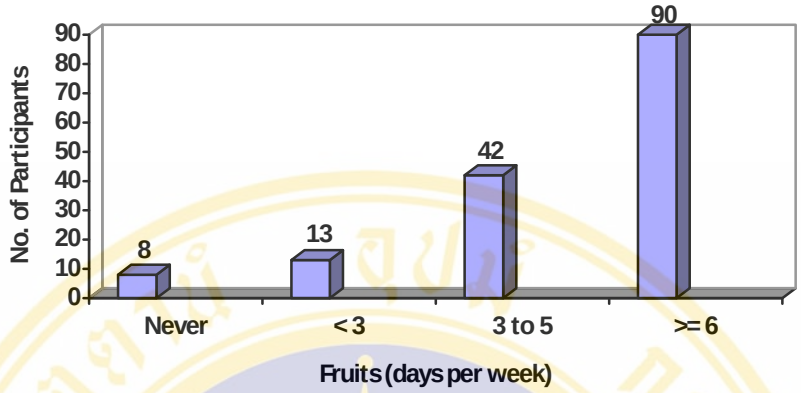


Figure 16 Consumption of fruit (days per week)

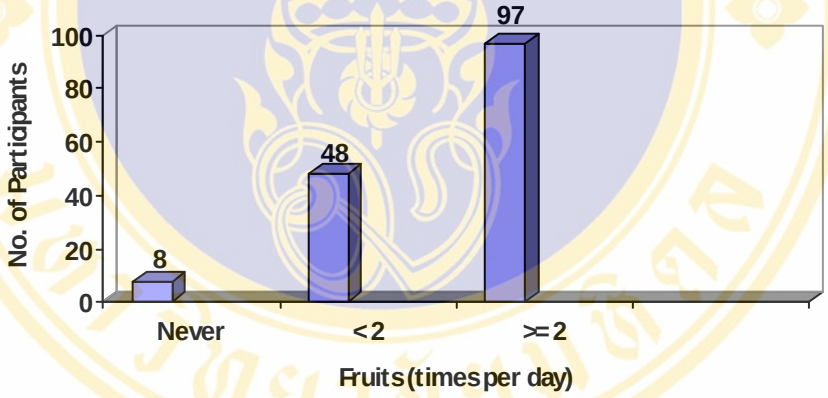


Figure 17 Consumption of fruit (times per day)

Vegetables

The majority of participants reported consuming vegetables. Of all participants, 110 (71.9 %) reported vegetable consumption on 6-7 days per week during the past month. 22.2 % of participants consumed vegetables on 3-5 days per week and 2.6 % on less than 3 days per week.. Only 5 individuals (3.3 %) reported not having eaten vegetables during the previous month (see Figure 18).

75.8 % of participants reported eating vegetables twice a day or more, and 20.9 % only once a day during the previous month (see Figure 19).

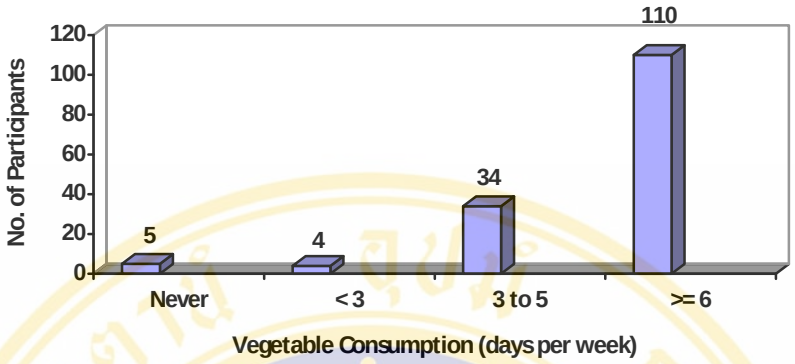


Figure 18 Consumption of vegetables (days per week)

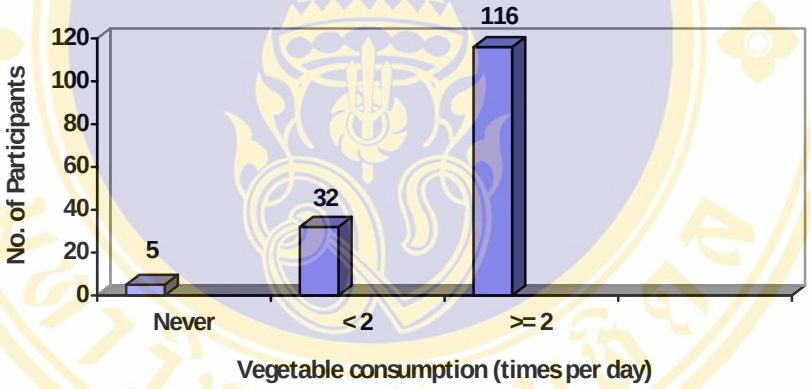


Figure 19 Consumption of vegetables (times per day)

Salty food

Of all participants, 49.7 % reported not consuming salty food, and 39.9 % had salty food on less than 3 days per week during the previous month. 6.5 % reported intake of salty food on 3-5 days, and 3.9 % on 6-7 days in a week during the previous month (see Figure 20).

45.1 % of participants reported intake of salty food only once a day, and 5.2 % twice or more per day (see Figure 21).

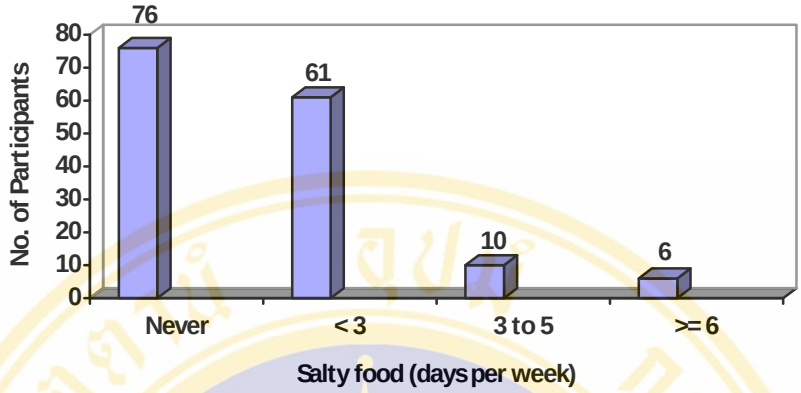


Figure 20 Consumption of salty food (days per week)

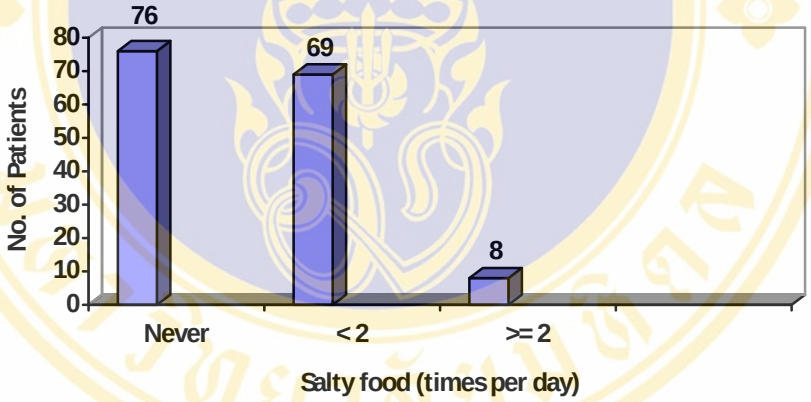


Figure 21 Consumption of salty food (times per day)

Addition of salt to cooked food

Figure 22 shows the addition of salt to cooked food. The majority of participants (70.6 %) reported adding salt to cooked food, and 29.4 % reported not adding salt to cooked food.

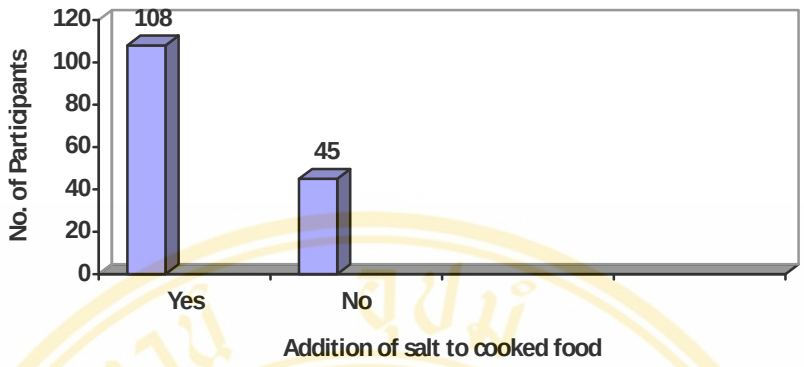


Figure 22 Addition of salt to cooked food

Addition of fat to cooked food

The addition of fat to cooked food is shown in Figure 23. Of all participants, 144 (94.1 %) reported adding fat to cooked food. Only 9 individuals (5.9 %) did not add fat to cooked food.

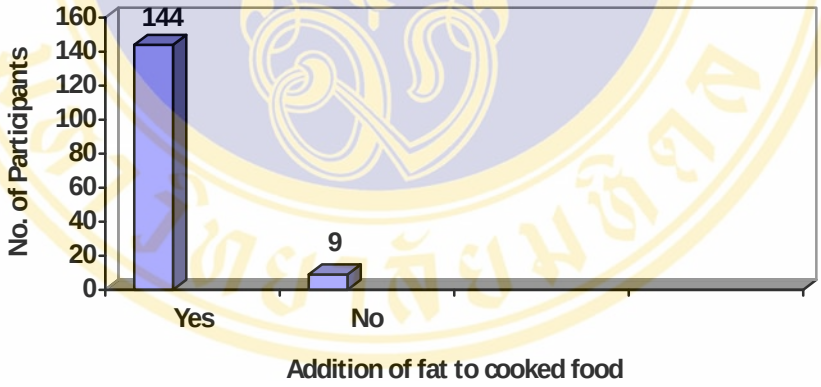


Figure 23 Addition of fat to cooked food

Alcohol consumption

The alcohol consumption behaviour of participants involved in this study is presented in Figures 24, 25 and Table 8.

Of participants, only 17 (11.1 %) were found to consume alcohol, and 136 (88.9 %) did not (see Figure 24).

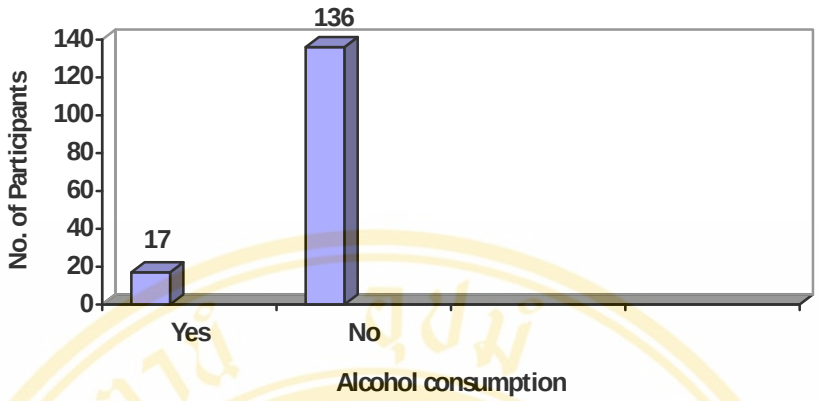


Figure 24 Alcohol consumption

Type of alcohol

Of the 17 who consumed alcohol,, 14 (82.4 %) reported drinking hard liquor, and 3 (17.6 %) beer (see Figure 25).

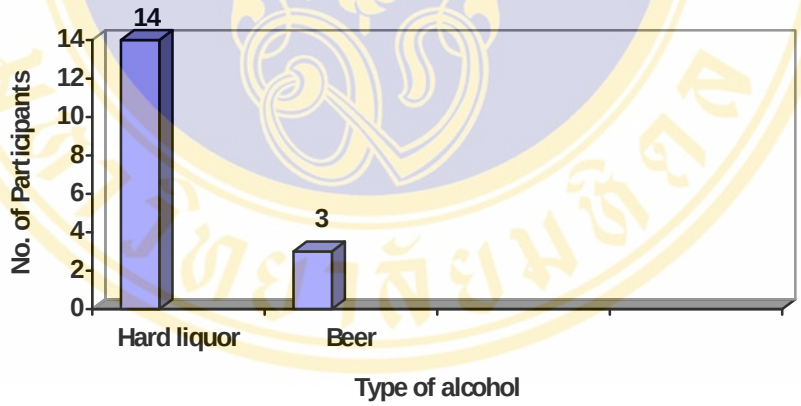


Figure 25 Type of alcohol

Frequency of alcohol consumption

The participants those consumed alcohol were found to drink from once a week to almost everyday in a week with an average of 3-4 days in a week (mean 3.29).

Quantity of alcohol consumed

The amount of alcohol consumed per day ranged from 1 glass to 10 glasses. The average number of drinks consumed per day was 2 (mean 2.06).

Table 8 Descriptive statistics for alcohol consumption

Alcohol	Min	Max	Mean	S. D.
Frequency of drinking (days per week)	1	7	3.294	2.687
Quantity of alcohol (drink or glass per day)	1	10	2.06	2.410

Blood pressure

The blood pressures of participants are presented in Table 9.

Systolic blood pressure (SBP)

The systolic blood pressure of participants involved in this study ranged from 110 to 220 mmHg. The minimum SBP recorded was 110 mmHg, while the maximum was 220 mmHg. The mean and median values of SBP were 143.05 and 140 mmHg respectively with standard deviation 17.219.

65.4 % of participants were found to have their SBP equals 140 mmHg or above, and 34.6 % below 140 mmHg (see Figure 26).

Diastolic blood pressure (DBP)

The minimum DBP of participants involved in this study was recorded 53 mmHg and the maximum was 116 mmHg. The mean and median values of DBP were 83.34 and 80 mmHg respectively with standard deviation 9.205.

59.5 % of participants were found to have their DBP below 90 mmHg, and 40.5 % equals 90 mmHg or above (see Figure 27).

Table 9 Descriptive statistics for SBP and DBP

Blood pressure	Min	Max	Mean	S. D.
SBP	110	220	143.05	17.219
DBP	53	116	83.252	9.205

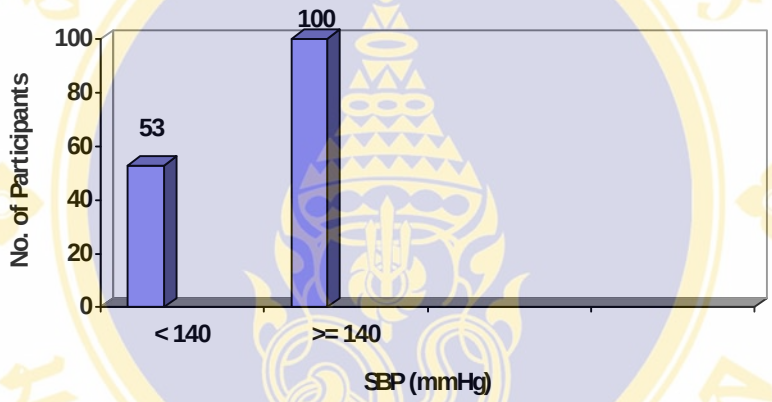


Figure 26 Participants and SBP

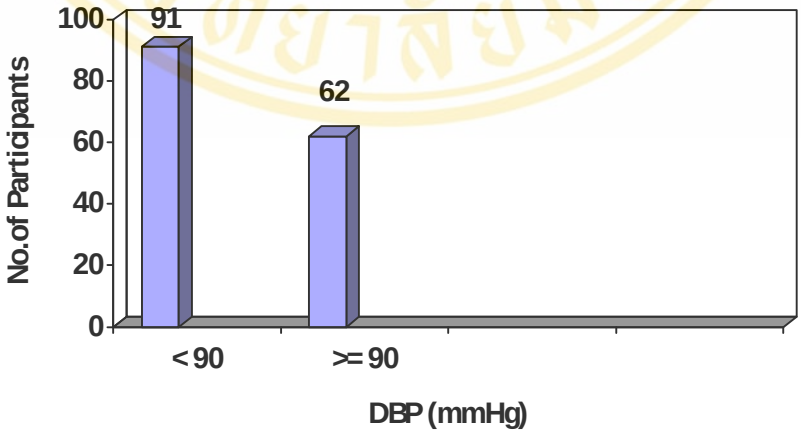


Figure 27 Participants and DBP

Part III

Analysis of relationship between independent and dependent variables

Hypothesis 1 contemplated that low physical activity might increase blood pressure. The correlation between physical activity and blood pressure is presented in Table 10. The spearman rank correlation coefficient analysis demonstrated no significant relationship between physical activity, and SBP and DBP.

Hypothesis 2 contemplated that unhealthy dietary habits might increase blood pressure. Table 10 presents the results of correlation between dietary habits and blood pressure (SBP and DBP).

Hypothesis 2.1 contemplated that high fat diets might increase blood pressure. No significant relationship was found between high fat diets and blood pressure of participants..

Hypothesis 2.2 contemplated that increased sodium consumption might increase blood pressure. The spearman rank correlation coefficient analysis demonstrated no significant relationship between sodium consumption and blood pressure.

Hypothesis 2.3 contemplated that low consumption of fruit might increase blood pressure. There was no significant relationship found between fruit consumption and blood pressure.

Hypothesis 2.4 contemplated that low consumption of vegetables might increase blood pressure. As predicted, the spearman rank correlation coefficient analysis demonstrated a significant negative (inverse) linear relationship between vegetable consumption and DBP ($r = - 0.185$, $p < 0.05$), but no significant relationship between vegetable consumption and SBP.

Age and hypertension

As predicted, the spearman rank correlation coefficient analysis demonstrated a significant positive (direct) linear relationship between age and SBP ($r = 0.224$, $p < 0.01$). However, no significant relationship was found between age and DBP.

Age and BMI

There was a statistically significant negative linear relationship between age and the BMI of participants ($r = - 0.407$, $p < 0.01$).

Income and BMI

As predicted, a statistically significant positive linear relationship was found between income and the BMI of participants ($r = 0.287$, $p < 0.01$).

Table 10 Correlation coefficient of SBP and DBP with physical activity, dietary habits, age and BMI

	Blood pressure (mmHg) Correlation coefficient (ρ)	
	SBP	**DBP**
Physical activity		
Type of physical activity	- .096	.141
Frequency of physical activity	- .020	.150
Duration of physical activity	- .066	.004
Dietary habits		
Fatty diet (days/week)	- .083	.080
Fatty diet (times/day)	- .111	.053
Fruit (days/week)	- .109	.004
Fruit (times/day)	- .112	- .106
Vegetables (days/week)	- .104	- .066
Vegetables (times/day)	- .054	- .185 *
Salty food (days/week)	- .098	- .099
Salty food (times/day)	- .132	- .081
Addition of salt to cooked food	- .091	- .058
Addition of fat to cooked food	- .007	- .131
Age	.224**	- .148
BMI	- .044	.099

* P-value < 0.05

** P-value < 0.01

CHAPTER V
DISCUSSION

The increased prevalence of hypertension is a major health problem in developing countries, including Thailand. This study was conducted using 153 hypertensive patients aged forty five years and above at Phutthamonthon District Hospital using a structured questionnaire and self reported technique, and with the help of well trained Thai research assistants. The purpose of this study was to ascertain the extent and nature of physical activity of hypertensive patients and their dietary habits. This chapter presents a discussion of the research results

Socio-demographic factors, co-morbidity, BMI, physical activity, dietary habits and alcohol consumption were regarded as independent variables, and blood pressure (SBP and DBP) as dependent variables.

Socio-demographic factors (characteristics)

The mean age of the participants was 63.5 years with 68.6 % aged between 55 and 74 years. This finding is consistent with previous research findings. Previous studies have shown that there is a positive relationship between age and hypertension. There is an increase in systolic and diastolic blood pressure with age. Although increased blood pressure is not a routine part of ageing, it tends to rise in elderly people. Ageing is an important risk factor of hypertension [6, 19, 29].

Overall there were more female patients than males involved in this study. 81 % of the total participants were aged fifty five years and above. This finding from the current study is consistent with previous research findings. Previous studies have shown that the prevalence of hypertension in women is lower than men before the age of 45 years. After that, there is an inversion in the prevalence of hypertension in

relation to gender. Men are generally at higher risk than women before menopause, but, after menopause, women are at higher risk than women [6, 18, 23].

A high number of female participants were housewives by occupation. The majority of participants attained primary education and reported low monthly income (less than 5000 baht per month). Of the total 153 participants, 100 reported no history of hypertension in their family members.

The findings relating to their education and income are consistent with the findings from developed countries at the post transitional stage of epidemiological and economic change, where hypertension is more pronounced among lower socioeconomic and less educated groups [11].

However this cross-sectional study was conducted in a community in an early stage of economic and epidemiological transition. Longitudinal observations from developed countries have suggested a direct relationship between upper socioeconomic groups and hypertension in societies that are in an early stage of transition. This pattern reverses in the later stages of transition where the burden of hypertension or chronic diseases shifts to lower socioeconomic and less educated groups [5, 11]. In this regard the finding from the current study is in contrast to the previous research findings.

Hypertension and co-morbidity

The majority of participants were found to have had their hypertension diagnosed by a medical person at either a hospital or health centre, and were taking oral antihypertensive drugs regularly in order to control their blood pressure under regular supervision of health personnel.

Since health care facilities are satisfactory in Thailand and the universal coverage policy might influence providing free medical care, the patients were found utilizing services at hospitals or health centre rather than self medication. It might be

the principal cause for the diagnosis of almost all of them by medical person at the hospital and regular intake of oral anti hypertensive drugs.

Co-morbidities such as, diabetes mellitus, high cholesterol levels (hypercholesterolemia), and heart disease were found along with hypertension in the majority of patients involved in this research. This is consistent with previous research. Previous studies have found a higher prevalence of hypertension in diabetic patients than in non-diabetic patients. Its prevalence was 1.5 to 2 times higher in diabetics than in non-diabetics [26, 27, 40]. Similarly, several studies have shown that there is an association between high cholesterol level and hypertension [11, 21]

Obesity and overweight were defined using the BMI. The mean BMI of participants involved in this study was 25.9 kg/ square meter (overweight) ranging from 15.92 to 45.83 kg/ square meter. There were more overweight and obese participants than underweight and normal participants. 35.95 % of participants were overweight and 18.3 % were obese. 41.83 % of participants had normal weight. With regard to demographic and socioeconomic changes, there have been significant lifestyle changes. It has influenced the dietary habits of people and increased the physical inactivity, which are the major causes of obesity and overweight.

Although there was a significant negative linear relationship between BMI and age, no significant relationship was found between BMI and hypertension.

Previous studies have shown a significant relationship between BMI and hypertension [6, 11, 23, 38, 44, 45]. This finding is not consistent with the previous research findings. The lack of relationship between BMI and hypertension might be partly due to the fact that some participants might have reduced their weight after being diagnosed with hypertension or after becoming obese. Moreover, only BMI was used to define obesity in this study. Android obesity, which might be more relevant for linking hypertension was not considered [7]. Waist hip ratio (WHR) is used to define android obesity.

Co-morbidities such as diabetes mellitus, high cholesterol levels (hypercholesterolemia), and heart disease were found to be associated with each other, but no significant relationship was found with blood pressure (SBP and DBP).

Physical activity

More than half (54.2 %) of the participants led sedentary lifestyles. Although they reported high frequency and longer duration of physical activity, it was not sufficient to burn the calories required for controlling blood pressure and weight. At least thirty minutes per day of regular moderate intensive physical exercise is recommended. This leads to burning 150 kcal of energy in adults. Even a mild level of exercise for 30 minutes per day at least three to five times per week can be effective. Previous research has shown that a mean reduction of 6.4 mmHg of SBP and 6.9 mmHg of DBP is achieved by regular exercise. Sedentary and unfit normotensive individuals have a 20 -50 % higher risk of developing hypertension than active and fit people [6, 11, 44, 46].

The majority of patients reported that they were diagnosed by medical persons and were taking oral anti hypertensive drugs with regular follow up visits to the hospital. It can therefore be assumed that they might have increased the frequency and duration of physical activity after being diagnosed with hypertension, following the advice of their doctors. Moreover, because a high number of participants were housewives or farmers by occupation, they were involved in domestic activities. Previous studies have shown that there is an inverse relationship between physical activity and hypertension [6, 45].

However, this research found no significant relationship between physical activity and hypertension. This finding is not consistent with previous research findings. A lack of relationship between physical activity and hypertension might be partly due to the fact that some participants might have altered their physical activity patterns after being diagnosed with hypertension.

Previous studies have shown that increased consumption of energy is an important factor for weight control, which eventually becomes beneficial in controlling blood pressure. It can be achieved by regular exercise, which burns more calories [31].

Participants were classified into different categories according to their physical activity or type of work. Frequency of work was reported in the form of days per week, and duration of work in the form of hours or minutes per day. Physical activity was not calculated in terms of calories burnt due to their activities. It was very difficult to establish the cut-off point in order to classify the individuals according to their calories burnt. It was even more difficult to calculate the burnt calories due to their physical activities.

Dietary habits

Unhealthy diet is a principal modifiable risk factor of hypertension. Foods rich in calories and fat are risk factors of cardiovascular diseases. Diets low in saturated fat, trans-fat and cholesterol decrease the risk of cardiovascular disease by decreasing LDL cholesterol. The Multi Center Intersalt study has shown that there is a positive association between BP and salt intake. Increased salt intake can cause a significant increase in mean blood pressure [3,6, 32, 39, 48, 49].

There was a statistically significant negative linear relationship between vegetable consumption and DBP. Increased consumption of vegetables can cause a decline in DBP. This finding is consistent with previous research findings. Previous studies have shown an inverse relationship between vegetable consumption and hypertension. A diet rich in fruits, vegetables, low-fat dairy products, fibre and minerals produces a potent antihypertensive effect [39].

However this study found no significant relationship between dietary habits and hypertension, except vegetable consumption and DBP. The majority of participants involved in the study were found to have unhealthy dietary habits in terms

of the addition of salt and fat to cooked food. At the same time, the number of patients consuming fruits and vegetables was also high. This finding suggests that although the patients seem to be aware of their dietary habits, they are unable to practise them in their daily lives.

The lack of relationship between dietary habits and hypertension might be partly due to the fact that some patients might have changed their dietary habits after being diagnosed with hypertension in accordance with medical advice. This finding from the current study was not consistent with the previous research findings. This inconsistent finding might be due to imperfect measurement of dietary habits of the participants involved in the study. Information relating to dietary habits was collected in the form of a diet history during the previous month, and frequency of food consumption, rather than the total energy intake. This might be an important limitation of this research.

More participants consumed fruit and vegetables than fatty and salty food. The reason might be their awareness regarding dietary habits following advice from health personnel. However, a majority reported the adding salt and fats to cooked food. Participants were asked about their dietary habits in terms of types of food and frequency of consumption.

WHO and AHA have recommended fatty diets (cholesterol < 300 mg, trans fat < 1 % of total k cal, saturated fat < 7 % of total k cal), sodium consumption not more than 2300 mg per day, and fruit and vegetable, 400 to800 grams per day for heart or hypertensive patients. However the participants' consumption of fat, salt, fruit and vegetables was not calculated in terms of amount or quantity as recommended by WHO and AHA. It was therefore very difficult to establish a cut-off point to classify them according to amounts consumed. This causes difficulty in assessing the actual amount of food consumption. Moreover, the limited short duration of the current study was another important limitation.

Blood pressure

Although blood pressure was not found to be significantly associated with physical activity or dietary habits, the descriptive results revealed that sedentary lifestyle, unhealthy dietary habits and excess body weight were pronounced in participants. More than half of the participants had their DBP below 90 mmHg, and almost one third of participants had their SBP below 140 mmHg, which are the cutoff points to classify hypertensive and non hypertensive. These participants had their blood pressure under control. Blood pressure levels of hypertensive patients below the cutoff point might be due to their regular intakes of anti hypertensive drugs, following the advice of their doctors.

However some participants did not have their blood pressure under control. It indicates that only pharmacological treatment or use of drugs is not sufficient to reduce and control blood pressure. The lack of relationship might be partly due to the fact that some participants might not have modified their lifestyles. It emphasizes the need for the doctors to focus on blood pressure control through non pharmacological treatment (lifestyle measures) rather than pharmacological treatment alone.

Limitations and further research

There are several limitations to the current study.

A major limitation is the study design. A cross-sectional study design was used to conduct this research. However, this was only able to ascertain the extent and nature of physical activity of hypertensive patients, and their dietary habits, rather than assess the temporal relationship (cause and effect) between them. Case control or prospective cohort studies with better measurement of behavioral factors are needed to identify the temporal relationship between behavioral factors and hypertension.

Another limitation is that this study did not collect information relating to physical activity in terms of burnt calories. Instead, physical activity was assessed in

the form of frequency and duration of physical activity. It was, therefore, not possible to classify the participants according to calories burnt. Accurate information in this regard could not be obtained from the participants involved in the study.

A further limitation is that this research did not collect information in terms of total energy intake or amount of food consumed. Instead, these were assessed in terms of diet history and frequency of food consumption which did not provide accurate information about the amount of food consumption or total energy intake.

A final limitation concerns use of the BMI. In this study, BMI was used to define obesity and overweight. Other measures, particularly android obesity, which might have been more relevant for linking obesity and hypertension were not considered.

CHAPTER VI
CONCLUSION AND RECOMMENDATION

Conclusion:

A hospital based cross-sectional study was conducted of hypertensive patients aged 45 years and above in Phutthamonthon district, Nakorn Pathom province, Thailand. Data was collected at Phutthamonthon District Hospital from 8 January to 28 January, 2009, with the help of Thai research assistants. The study sample comprised 153 individuals.

The study aimed to ascertain the extent and nature of physical activity of hypertensive patients and their dietary habits. Its objective was to examine the relationship of specific behavioral factors with hypertension.

Physical activity (sedentary, mild, moderate, hard or strenuous), dietary habits (fatty food, fruit, vegetables and salty food), alcohol consumption, socio-demographic factors (age, gender, occupation, education, income, family history), co-morbidities (diabetes mellitus, high cholesterol level, heart disease), and BMI (obesity, overweight, normal, underweight) were regarded as independent variables. Blood pressure (SBP and DBP) were regarded as dependent variables.

The majority of participants involved in this study led a relatively inactive or sedentary lifestyle, and consumed salt and fat either in the form of salty and fatty food or by adding salt and fat to cooked food. At the same time, a large number of participants also consumed fruit and vegetables. Overweight and obese participants also outnumbered normal and underweight participants.

With regard to the research hypotheses, a statistically significant negative (inverse) relationship was found between vegetable consumption and diastolic blood pressure (DBP). There no significant relationship of other types of food consumption such as fatty food, fruit, and salty food was demonstrated with hypertension. Similarly, no significant relationship was found between physical activity and hypertension.

However, there was a significant positive linear relationship between age and hypertension (SBP). BMI also had a statistically significant negative linear relationship with age and a significant positive linear relationship with income, but not with hypertension.

It can therefore be concluded that lifestyle related risk factors such as excess body weight, low levels of physical activity, and consumption of unhealthy diets were evident in hypertensive patients in Phutthamonthon district. The nature and extent of physical activity of hypertensive patients and their dietary habits were not effective and satisfactory. A high percentage of participants were found to lead sedentary and physically inactive lifestyles and consume fat rich diets. The majority of participants reported adding salt and fat to cooked food.

Although this study found an inverse relationship between vegetable consumption and diastolic blood pressure, no significant relationship was found between physical activity or other dietary habits such as consumption of fat, salt or fruit, and hypertension. It has highlighted their extent, nature and patterns. It emphasizes the need of further research in order to explore the relationship between behavioral factors and hypertension.

Recommendation:

Based on the findings from this study, the following recommendations can be made in order to reduce the burden of hypertension, prevent its consequences and complications, and to keep the blood pressure of hypertensive patients under control.

These recommendations will be helpful and useful both for health personnel and also the general population.

Physical inactivity is one of the major modifiable risk factors of hypertension. Physical exercise has been shown to be effective in reducing and controlling blood pressure in hypertensive as well as normotensive (non hypertensive) individuals. Since the majority of hypertensive patients involved in the study were found to lead sedentary lifestyles, they need to be encouraged and stimulated to change or modify their lifestyles. Programmes and campaigns relating to physical exercise should be promoted in both communities and clinical practice.

Unhealthy diet is a principal modifiable risk factor of hypertension. Excess consumption of salt and fat contributes to the development of hypertension. Reducing intakes of food rich in salt and fat has been found effective in controlling and reducing blood pressure in hypertensive patients as well as in the general population. Consumption of diets rich in fruit and vegetables has been proven effective in promoting good health and preventing disease, and produces a potent antihypertensive effect. Programmes encouraging healthy dietary habits should be promoted at community level, as well as in clinical practice. Moreover the food industry should also be encouraged to manufacture food products with low fat and salt contents.

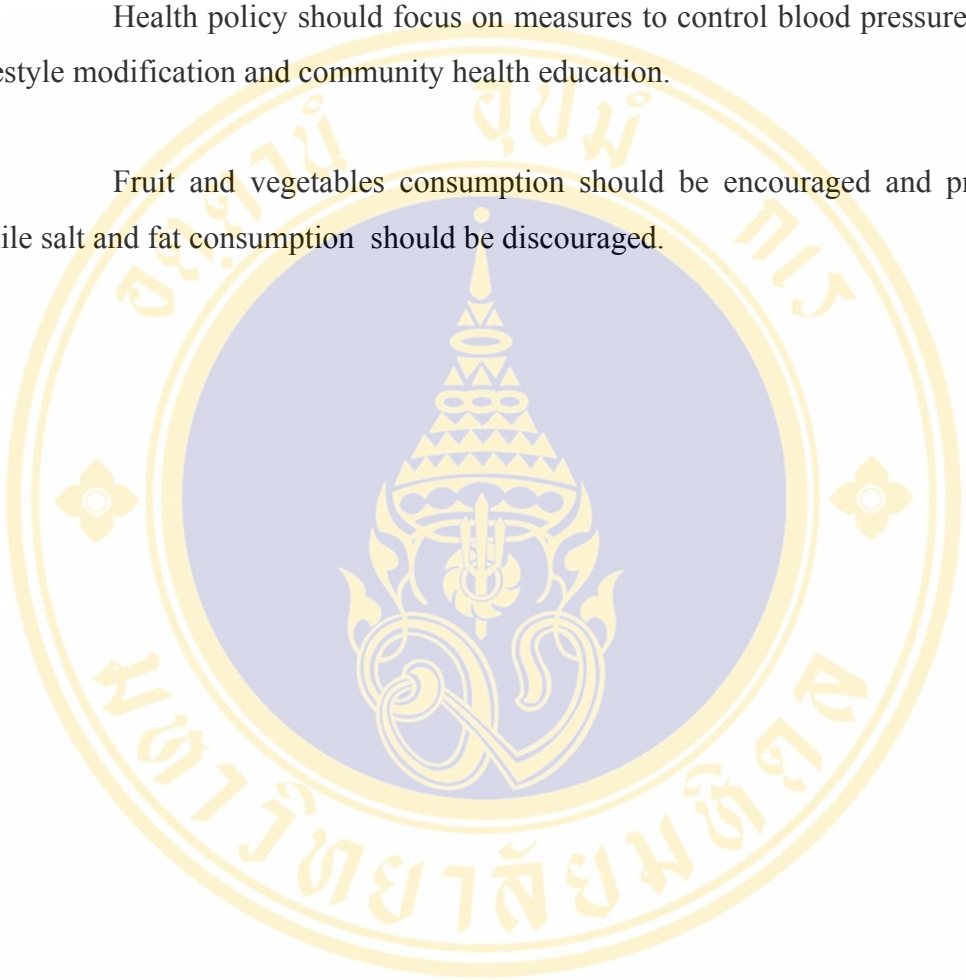
Obesity and overweight are important risk factors contributing to the development of hypertension. A high number of hypertensive patients were found to be overweight or obese. Reduction of weight is a very effective measure in controlling blood pressure. Both hypertensive and non hypertensive individuals in the community should be encouraged and counseled to reduce their weight. Weight reduction should be promoted and facilitated at both community level and in clinical practice.

Blood pressure screening programmes for early detection and effective management of hypertensive patients should be organized in order to prevent later complications associated with hypertension.

Health education and counseling programmes for both patients and the public should be developed in order to increase awareness regarding causes, consequences, prevention and control of hypertension.

Health policy should focus on measures to control blood pressure through lifestyle modification and community health education.

Fruit and vegetables consumption should be encouraged and promoted, while salt and fat consumption should be discouraged.



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APPENDIX

APPENDIX
QUESTIONNAIRES

Physical Activity and Dietary Habit among Hypertensive patients in Phutthamonthon District, Nakorn Pathom Province, Thailand

What this Questionnaire is about

By modifying the previously validated standardized questionnaire, this present questionnaire has been developed. It is aimed to collect the data regarding socio-demographic characteristics, hypertension and co-morbidity, physical activity and dietary habit in order to find out the relation of hypertension with physical activity and dietary habit pattern. Moreover researcher would like to know the type or level of physical activity and pattern of dietary habit more frequent among hypertensive patients.

If you have any concern about the question or study, please do not hesitate to ask the researcher or research assistant.

The questionnaire is completely confidential. It will only be seen by researcher and not even by any of the staffs, who are looking after you.

Questionnaires

Weight ..... kg

Height .....cm

BP ---------- mmHg

Part I: Socio-demographic

1.1 How old are you?

……years

1.2 What is your gender?

□ Male

□ Female

1.3 What is your occupation?

□ Government officer

□ Student

□ Farmer

□ Business owner

□ Private sector

□ Housewife

□ Others …….

1.4 What is your educational background?

□ Illiterate (no education)

□ Primary (1-6 years of schooling)

□ Secondary (7-12 years of schooling)

□ College and higher degree

□ Others (specify) ……..

1.5 Does anyone in your family have hypertension?

□ Father/ Mother

□ Sibling

□ Children

□ None

□ Don't know

1.6 How much is your monthly income?

□ < 5000 baht

□ 5000-9999 baht

□≥ 10,000 baht

Part II: Hypertension and co-morbidity

2.1 Were you diagnosed as hypertensive by a medical person?

□ Yes

□ No

2.2 When were you first diagnosed with hypertension?

2.3 Have you ever been diagnosed with diseases as follows?

Diseases	Yes	No
Diabetes mellitus		
High cholesterol level		
Heart disease		
Others		

2.4 Do you take oral antihypertensive medicines?

□ Yes

□ No

Part III: Your physical activity during the past month

3.1 Which type of physical activities do you do? (Please select just one answer, the best fit you.)

How often do you do the following physical activities?

How long do you perform your activities?

S.N	Type of physical activity	Frequency Days per week	Duration Hours/minutes	Never
3.1.1	Sedentary- walking/ job involving desk work/ domestic activities/ reading/ watching television/ computer work			
3.1.2	Mild level of physical activity- home maintenance activities/ gardening/Feeding cattle or livestock/washing clothes by hand/			
3.1.3	Moderate level of physical activity- carrying firewood/ aerobic exercise/ Swimming/ sports			
3.1.4	Hard or strenous level of physical activity- agricultural work in field/ Carpentry/ pulling rickshaw/ weight lifting			

Part IV: Your dietary habit during the past month

4.1 Which type of food you prefer? (You can choose more than one answer.)

How often do you eat the following foods?

S.N	Types of food	Frequency Days per week	Frequency Times per day	Never
4.1.1	Fat diet: Animal fats- ghee, butter, cheese, eggs, fat of meat and fish Vegetable fats - groundnuts, mustard, sesame Other sources - cereals, pulses, nuts,			
4.1.2	Fruits: Apple, orange, banana, mango, papaya, Grapefruit, melon, pear, lemon			
4.1.3	Vegetables: Dark green leafy vegetables such as Spinach, lettuce, basil, mint Broccoli, cauliflower, cabbage, carrots, Onion, garlic, tomato, sweet potato, peas, Pumpkin, green beans, peppers			
4.1.4	Salty food: salted fish, salted egg, salted meat, instant noodles, spicy food, pickle, canned fish or meat			

4.2 Do you add salt to cooked food?

□ Yes

□ No

4.3 Do you add fat to cooked food?

□ Yes

□ No

4.4 Do you drink alcohol?

□No (no further question)

□Yes (please specify)……

4.4.1 Type of alcohol you drink:

□Hard liquor

□ Beer

□Others (please specify) ……

4.4.2 How frequent do you drink?

…… days per week

4.4.3 How much do you drink?

…… glass per day

Thank you very much

BIOGRAPHY

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