Factors Affecting Hypertension in Trang Province of Southern Thailand

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A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of
Master of Science in Research Methodology
Prince of Songkla University
2016

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Academic Year	2015

ABSTRACT

Hypertension is increasing public health concerns because of its high frequency and concomitant risks of cardiovascular and kidney diseases. This study aims to determine the prevalence of hypertension and some risk factors among 1,795 adults aged 35 years and older in Trang province of southern Thailand. This study used secondary data from a cross-sectional study conducted by health professionals between December 2009 and March 2010. The data collection was carried out using structured questionnaire. Statistics used were percentage, chi-squared test, odds ratios (OR), 95% confidence intervals of OR, and logistic regression. The model with treatment contrasts provided adjusted odds ratios and their confidence intervals. The model with sum contrasts provided adjusted percent and their confidence intervals.

After adjusting for the effect of other factors, significant factors affecting hypertension were being male, age greater than 55 years old, body mass index greater than 25 kg/m^2, using some kind of medicine, exercise at least 3 days a week, and not eating sweet taste.

These findings are useful for health education and health promotion program development in order to prevent hypertension among Thai people.

ชื่อวิทยานิพนธ์ ปัจจัยเสี่ยงต่อการเกิดโรคความดันโลหิตสูงของประชากรในจังหวัดตรัง

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ปีการศึกษา 2558

บทคัดย่อ

โรคความดันโลหิตสูงเป็นปัญหาด้านสาธารณสุขที่สำคัญ เนื่องจากมีความเสี่ยงในการเป็นโรคหัวใจ และโรคไต การศึกษาในครั้งนี้มีวัตถุประสงค์เพื่อศึกษาความชุกและปัจจัยเสี่ยงต่อการเกิดโรคความดันโลหิตสูงของประชากรที่มีอายุ 35 ปีขึ้นไป จำนวน 1,795 คน ในจังหวัดตรัง ข้อมูลได้มาจากการศึกษาของสำนักงานควบคุมและป้องกันโรคที่ 12 ที่เก็บข้อมูลระหว่างเดือนธันวาคม พ.ศ. 2552 ถึงเดือนมีนาคม พ.ศ. 2553 ด้วยการสัมภาษณ์และใช้แบบสอบถามที่ประกอบด้วยตัวแปร ด้านประชากรและลักษณะทางสังคม ปัจจัยด้านสุขภาพ พฤติกรรมส่วนบุคคล และพฤติกรรมการบริโภค วัดความดันโลหิต น้ำหนัก และส่วนสูง วิเคราะห์ข้อมูลโดยใช้ ร้อยละ การทดสอบไคสแควร์ อัตราส่วน odds และการถดถอยแบบลอจิสติกอย่างง่ายเพื่อหาความสัมพันธ์ระหว่างการเกิดความดันโลหิตสูงกับตัวแปรอิสระทีละตัว และสร้างโมเดลการถดถอยแบบลอจิสติกเพื่อหาปัจจัยเสี่ยงที่มีความสัมพันธ์กับการเกิดโรคความดันโลหิตสูง สร้างโมเดลโดยใช้ทรีตเมต์คอนทราสต์เพื่อหา adjusted odds ratios และสร้างโมเดลโดยใช้ weighted sum contrasts เพื่อหา adjusted percentages ของการเกิดโรคความดันโลหิตสูง

ผลการศึกษาพบว่าเพศชายมีความเสี่ยงต่อโรคความดันโลหิตสูง นอกจากนี้อายุที่เพิ่มขึ้นโดยเฉพาะประชากรที่มีอายุ 55 ปีขึ้นไป มีความเสี่ยงมากกว่าประชากรที่มีอายุต่ำกว่า ดัชนีมวลกายที่มากกว่า 25 kg/m^2 การใช้ยาประจำตัว การออกกำลังกายอย่างน้อย 3 ครั้งต่อสัปดาห์ และการไม่บริโภคของหวาน

ผลการศึกษาในครั้งนี้ทำให้ทราบถึงสาเหตุของโรคความดันสูงซึ่งภัยเงียบของคนส่วนใหญ่ อันจะมีประโยชน์ต่อการเฝ้าระวังและป้องกันการเกิดโรคความดันโลหิตสูงได้อย่างเหมาะสม

Acknowledgements

I would first like to thank my supervisor, Asst. Prof. Dr. Phattrawan Tongkumchum for her great guidance, valuable discussions and constructive suggestion to improve this thesis. I would express my thanks to my co-supervisor, Asst. Prof. Dr. Apiradee Lim for her guidance and comments. I am grateful to Asst. Prof. Dr. Chamnein Choonpradub and the staff of the Department of Mathematics and Computer Science for their help and support.

I also would like to thank Dr. Nantaporn Klinjun for providing me the data using in this thesis.

Last of all, I would like to thank my family for all their encouragement and support and to all others who directly or indirectly contributed to the success of the study.

Benchamas chunpradab

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Chapter 1

Introduction

1.1 Background and rationale

One of the world's highly concerned public health is hypertension, or high blood pressure (Lopez *et al.*, 2006; Berrios *et al.*, 1997). It was reported that more than 45% of deaths due to heart disease and 51% of deaths due to stroke are related to hypertension (Chockalingam *et al.*, 2006). Hypertension increases the risk of stroke, renal failure, heart failure and heart attack (Bani, 2011; Belletti *et al.*, 2010). The risk of hypertension can be avoided by early precautions, which are considerably less costly and safer for patients than medications like dialysis and cardiac bypass surgery for heart and renal failure. The risk of stroke and the risk of myocardial infarction can be reduced by 40% and 15%, respectively, by treating hypertension (WHO, 2003).

In 2008, roughly two-fifths of adults aged 25 and above was diagnosed with hypertension. It was revealed that the amount of people with hypertension increased from 600 million in 1980 to one billion adults in 2008 (WHO, 2013). The number of adults (20 years and older) with hypertension was forecasted to reach a total of 1.56 billions in 2025 (Kearney *et al.*, 2005).

The prevalence of hypertension varies by regions around the world. For adults aged 25 and above, the highest age-standardized prevalence of hypertension is found in Africa at 46%, while the lowest prevalence is found in America at 35%. In South-East Asia Region, approximately 38% is found as shown in Figure 1.1. Overall, a lower

prevalence of hypertension is found in high-income countries than in other groups of countries.

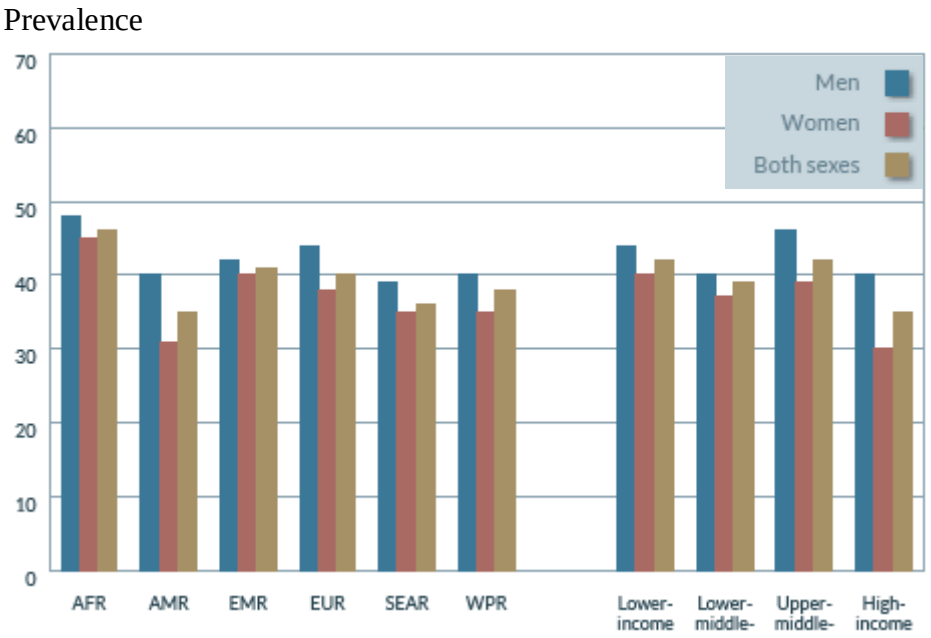

Figure 1.1 Age-standardized prevalence of hypertension by WHO regions

AFR: African regions AMR: Regions of the America

EMR: Eastern Mediterranean Region EUR : European Region

SEAR : South-East Asia Region WPR : Western Pacific Region

Source: WHO, 2013

The estimation of age-standardized prevalence of hypertension in Thailand was 34.2% (37.0% in men and 31.6% in women) (Krishnan *et al.*, 2013). Other study in Thailand reported prevalence of hypertension ranges from 22.1-32.5% in the group of 40-69 years (Puavilai *et al.*, 2011).

Association between hypertension and various factors has been reported, including unhealthy life style, anthropometric indices, demographic and socioeconomic factors (Ibrahim and Damasceno, 2012; Tee *et al.*, 2010; Duangtep *et al.*, 2010). However, inconsistent results were found in different studies (Doumas *et al.*, 2013; Puavilai

et al., 2011). The prevalence of hypertension in terms of blood pressure (BP) of 160/95 mm Hg or over was found to be 2.12% in the age group of 15-80 years at Chaiyo district in Arngthong Province (Kachacheewa *et al.*, 1978), 17.3% with the age of 30 years and older in Klong-Toey Slum in Bangkok (Sithi-Amorn *et al.*, 1989), and 29.8% in the age group of 40-69 years from Ban Paew district in Samutsakorn Province in 2000 (Puavilai *et al.*, 2000). Therefore, it was hypothesized if the prevalence was high in Trang Province and whether it was related to socio-demographic factors, health related factors, life style behaviors and dietary habits.

1.2 Objectives

The objectives of this study were 1) to estimate the prevalence for hypertension and 2) to investigate the association between hypertension and socio-demographic factors, health related factors, life style behaviors and dietary habits among adults in Trang province of southern Thailand.

1.3 Expected advantages

The expected advantages of this study were 1) provide a better understanding hypertension situation in Trang province and 2) provide a useful information on risk factors of hypertension for health authorities to set up an intervention plan to reduce hypertension rates.

1.4 Definition of hypertension

Blood is moving in blood vessels from the heart to other parts of the body. The heart pumps blood into the vessels as it beats. Blood pressure is generated by the collision

of blood against the walls of blood vessels as it is carried by the heart. Hypertension is defined as a condition in which blood pressure is constantly raised by the blood vessels (WHO, 2013).

The unit of blood pressure is millimeters of mercury (mm Hg) and is measured into two figures in the form that one is above the other. The upper number is systolic blood pressure or the highest pressure in blood vessels, occurring when the heart beats. The lower number is diastolic blood pressure or the lowest pressure in the blood vessels, happening when the heart muscle is relaxing.

Commonly the Seventh Report of the Joint National Committee (JNC 7) on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure was used to diagnose hypertension (Chobanian *et al.*, 2003, Martin, 2008), and Thai Hypertension Society, Thai Guidelines on The Treatment of hypertension updated in 2012. The patients, who were prescribed with anti-hypertensive medications, were described that their current blood pressure reading was hypertensive and irrespective.

According to JNC 7, normal systolic blood pressure (SBP) is less than 120 mm Hg and diastolic blood pressure (DBP) is less 80 mm Hg. Normal level of both systolic and diastolic blood pressures are essential for the heart, brain and kidneys to perform efficiently, and for having overall good health and well-being. Prehypertension was defined as SBP of 120-139 mm Hg or a DBP of 80-89 mm Hg. Stage I hypertension was defined as SBP of 140-159 mm Hg or DBP of 90-99 mm Hg. Stage II hypertension was defined as SBP $\geq$160 mm Hg or DBP $\geq$100 mm Hg (Chobanian *et al.*, 2003, Martin, 2008).

1.5 Literature reviews

Prevalence of hypertension

Hypertension has been one of the risk factor for health. Studies from several countries pay attention on hypertension.

The reported prevalence of hypertension varies. Kearney *et al.* (2005) have analyzed the global burden of hypertension and noted that 26.4% of the adult population in 2000 had hypertension. It means that 972 million adults were living with hypertension and one-third of these (333 million adults) were from economically developed countries, while two-thirds (639 million adults) were living in economically developing countries.

A review of surveys on hypertension in North America and Europe published since 1990 reported that the countries with highest prevalence of hypertension was Germany (55%), Finland (49%), Spain (47%), England (42%), Sweden (38%) and Italy (38%), respectively, while the United State and Canada showed half of that rate found in Germany (28% and 27%, respectively). The prevalence of hypertension for the European average was 42.2% compared with 27.6% in North America (Wolf-Maier *et al.*, 2003). The National Health and Nutrition Examination Survey of the US resident adults presented that hypertension was 31.3% in 1999 to 2000 (Fields *et al.*, 2004).

The age and sex adjusted prevalence of hypertension of Japanese lived in Hawaii, Los Angeles and Hiroshima was 42.6%, 37.2% and 29.7% (Imazu *et al.*, 1996). The prevalence of hypertension in Korea reported by the Nationwide Korea Health and Nutrition Survey in 1998 was 33.7% (Jo *et al.*, 2001). The prevalence in Saudi Arabia

in 2011 was 11.8% (Bani, 2011). The prevalence of hypertension in Brazil in 2004 and 2005 was 25.2% (Cipullo *et al.*, 2010).

Singh *et al.* (2000) reported that the prevalence of hypertension in Asia was found to be 15-35% for blood pressure higher than 140/90 mm Hg. In the study conducted in Thailand, the prevalence of hypertension was reported to be 22.1% for the age group of 40-69 years, up to 32.5% for the group of not knowing their blood pressure, and 17.3% for the age of 30 years and above in Klong-Toey Slum, Bangkok (Sitthi-amorn, 1989), while it was about 2.12% among the group of age 15-80 years in Chaiyo District, Angthong Province (Kachacheewa, 1978).

Regions

The reported prevalence of hypertension varies across regions. Most of the worldwide problem of hypertension was found in developing countries, in which 80% of the world populations were living. By 2025, almost 75% of people with hypertension will be living in those countries (lbrahim and Damasceno, 2012).

Kearney *et al.* (2005) reported global burden of hypertension and they found, in men, the highest prevalence was in the Latin America and the Caribbean (Mexico, Paraguay and Venezuela), whereas for women the highest estimated prevalence was in the former socialist economies (Slovakia). It was also found that the calculated prevalence for those regions are two-time higher that the rates of the regions with the lowest prevalence. Furthermore, it was predicted that prevalence of hypertension in the world would be increase by 9% in men and 13% in women in 2025.

The World Health Report 2002 identified hypertension as the third ranked factor for disability-adjusted life years. Nearly one-quarter of adults world's population live with hypertension. Most were unaware that they had hypertension, while those who were aware and on treatment, most did not have controlled blood pressure. One of the important elements in the hypertension control is early diagnosis. This report lead to the issue of factors related to hypertension.

Risk factors of hypertension

Socio-demographic factors

Nearly two-thirds of hypertensives live in low- and middle-income countries, resulting in a huge economic burden (Chockalingam *et al.*, 2006). Several studies of the incidence of hypertension have examined factors affecting the development of elevated blood pressure.

Age

Age is a common risk factor for hypertension (Puavilai *et al.*, 2011; Cipullo *et al.*, 2010; Yadav *et al.*, 2008). A positive association between hypertension and age has been reported in several studies. André *et al.* (1982) examined the effects of age on the 5-year incidence of hypertension among adults in a city in France. The recent English trend in systolic blood pressure and its relationship with age has been reported. There was a large difference in systolic blood pressure between age groups (Kumar and Dalton, 2013).

Gender

The associations between gender and prevalence of hypertension were different from region to region. Kearney (2005) found that there were four regions with higher prevalence in men and four regions with higher prevalence in women The greatest difference was in Latin America and Caribbean.

For older adults of 65 years and above, the rates of having hypertension were significantly higher in men than in women at the NHANES 1999–2004 survey (McDonald *et al*., 2009).

It was shown that, in Canada, the prevalence of hypertension was higher in older (60 years) women than in men (Robitaille *et al*., 2012). Similar findings were observed in a recent large population study in developing countries (India, China, and Latin America) (Prince *et al*., 2011). It is not known for the current situation if the gender discrepancy in hypertension is still evident.

Education level

Low education level was reported as one of the important modifiable risk factors for hypertension (Bani, 2011, Cipullo *et al*., 2010). High level of education was related to low hypertension.

Health related factors

Obesity (Yadav *et al.*, 2008) and family history of hypertension (Duangtep *et al.*, 2010; Sitthi-Amorn *et al.*, 1989) is an increasing risk of hypertension.

The hypertension increases with a family history of hypertension (Puavilai *et al.*, 2011; Cipullo *et al.*, 2010; Yadav *et al.*, 2008), body measures (Yadav *et al.*, 2008), and body mass index (BMI) (Madhukumar *et al.*, 2012; Puavilai *et al.*, 2011; Cipullo *et al.*, 2010). Overweight (body mass index 25 kg/m^2) has been seen in epidemiologic studies to be an important risk factor for higher blood pressure, and there seems to be a linear relation between body weight and blood pressure (Doll *et al.*, 2002). In the US from 1999 to 2000, the quantity of persons with hypertension increase with healthier lifestyles and BP control better associated with medical care quality improvement (Fields *et al*., 2004). Developing countries, they do not have national guidelines for diagnosis and treatment of hypertension. Therefore the drugs are commonly out stock and probably could not control patients' blood pressure (Ibrahim and Damasceno, 2012).

Life style behaviors

Hypertension is mainly related to environmental factors and lifestyle behaviours rather than to genetically defined as racial differences (Ibrahim and Damasceno, 2012) and it is also supported by the finding from the study of Japanese adults in Hawaii, Los Angeles and Hiroshima (Imazu *et al.*, 1996). The prevalence of hypertension, mean values of total cholesterol and triglyceride were higher for Japanese adults in Hawaii and Los Angeles than in Hiroshima.

Unhealthy life styles such as smoking and dietary habit (Duangtep *et al*., 2010; Sitthi-Amorn *et al*., 1989) have been found to be associated with hypertension. Sedentary lifestyle (Yadav *et al*., 2008), drinking alcohol, smoking and salt intake (Madhukumar *et al.*, 2012) were also association with hypertension.

A comparatively higher prevalence was found among males, people whose diets were non-vegetarian, people with high saturated fat intake, and people who did not engage in physical exercise (Chandwani *et al.*, 2010).

A study among suspected high-risk group in Ban Paew district of Samuthsakorn Province reported that hypertension did not increase with smoking and eating salty food. Eating sour taste was also reported as a negative risk for hypertension (Puavilai *et al.*, 2011). The higher hypertension burden from 1999 to 2000 may also reflect an increased number of persons with hypertension who live longer as a result of healthier lifestyles (Fields *et al.*, 2004).

Dietary habits

The connection between sodium consumptions and hypertension were investigated in many studies (Appel *et al*., 2001; Roberts, 2001; Sacks *et al*., 2001; Hooper *et al*., 2002; Molina *et al*., 2003; Cappuccio *et al*., 2006; Conlin, 2007; Erdem *et al*., 2010). Furthermore, a key reason for undesirable consequences for aldosterone on the heart, related to ventricular hypertrophy in hypertension was a high level of salt in food (du Cailar *et al*., 2010).

The amount of absolute systolic blood pressure was discovered to reduced clinically significantly by reducing the level of salt consumptions (2–4.6 g per day). This result was revealed by the studies conducted with meta-analyses of randomly controlled trials for examining long-term effects of salt reduction in people with and without hypertension (He and MacGregor, 2004; Hooper *et al*., 2004). Moreover, it was found that excess sodium intake in diet has been related to heart and non-cardiovascular

diseases (Antonios and MacGregor, 1996; He *et al*., 2000; Cook *et al*., 2007; He and MacGregor, 2010).

It was found that, in a day, the amount of sodium of 3400-5000 mg was consumed by many populations in the world regardless of any clinical condition (Molina *et al*., 2003; Khaw *et al*., 2004; Ajani *et al*., 2005; Corne´lio, 2008; Brown *et al*., 2009; Ferreira-Sae *et al*., 2009). The consumption was considerably higher than the present recommended level of 2400 mg (6 g of salt) or less for sodium intake per day for the general population and the daily amount of 1500 mg (4 g of salt) or less for people with hypertension (US Department of Health and Human Services & US Department of Agriculture, 2005; World Health Organization, 2006). However, the opposite result was found in the study in Ban Paew district of Samutsakorn Province, where the risk of having hypertension did not increase with eating salty food and eating sour taste was a negative risk for hypertension for potential high-risk studied group (Puavilai *et al.*, 2011).

It is generally perceived that hypertension becomes common among elderly. The trend for aging societies in the world is expected to cause the rise of cardiovascular deaths without exception of high income countries. Higher blood pressure levels and higher levels from cardiovascular deaths have been found in lower and middle income regions such as Southeast Asia, Eastern Europe, Latin America and Africa. This tendency is expected to be continued; therefore, immediate preventive plans are required to reduce these tendencies (Arima *et al*., 2011).

Statistical methods

Many studies used descriptive statistics and the chi-squared test for investigating associations between hypertension and a risk factors, for example age, gender, smoking and qat chewing, blood pressure measurement, anthropometric measures and dietary habits (Bani, 2011; Tee *et al.*, 2010).

Some studies thoroughly investigate hypertension and determinants using odds ratio and logistic regression model. Odds ratio is a common statistic used to investigate the strength of the association between hypertension outcome and its determinants (Tee *et al.*, 2010; Duangtep *et al.*, 2010).

1.6 Plan of thesis

This thesis contains five chapters. The introduction chapter discusses the background and rationale, objectives, expected advantages and literature reviews. Chapter 2 provides a description of the methodology and overviews the statistical methods for data analysis. Chapter 3 covers preliminary data analysis. Chapter 4 presents the results from statistical modeling, and confidence intervals. Chapter 5 presents the conclusions and discussion of the study.

Chapter 2

Methodology

This chapter describes methods used in this study including data sources, path diagram, variables and statistical methods. The graphical and statistical analyses were carried out using R program (R Development Core Team, 2011)

2.1 Data and variables

In this thesis, we used secondary data from a cross-sectional study conducted by health professionals between December 2009 and March 2010 in four districts (Huai Yot, Kantang, Na Yong, Ratsada) of Trang province (Figure 2.1).

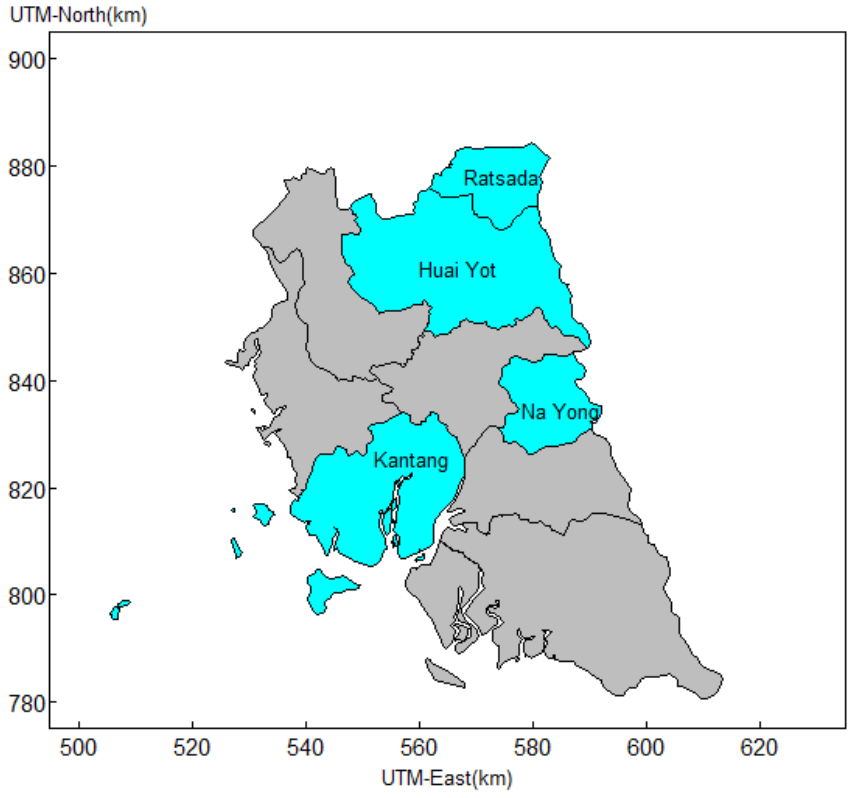

Figure 2.1 Map of Trang province

The study sample comprises 1,795 adults aged 35 years and above. The subjects were selected using multi-stages cluster sampling. The clusters are formed as nine groups of districts based on population size and four clusters were randomly selected from the nine clusters. The subjects from the four districts were interviewed using questionnaire.

The questionnaire items comprising socio-demographic factors, health related factors, health related behaviors, and dietary habits were filled in by a face-to-face interview. Blood pressure, body weight, height and waist were also measured.

Socio-demographic factors

The socio-demographic factors comprise gender, age, education, marital status, religion, occupation and income. Gender was classified as men and woman. Age was classified as 35-44, 45-54, 55-64, 65-74, and 75+. Education was classified as illiterate, primary school and secondary school. Marital status was classified as married, never married/divorced/separated and widowed. Religion was classified as non-Muslim and Muslim. Occupation was classified as unemployed/housewife, worker, employee/business/government and farmer. Income was classified as adequate without saving, adequate with saving and inadequate.

Health related factors

The health related factors comprise BMI, medical checkup, having disease, using medicine, and family history of hypertension. BMI was treated as a categorical variable with three levels (< 18.5 kg/m^2, 18.5-24.99 kg/m^2, and ≥ 25 kg/m^2). Medical checkup

was classified as none, irregularly, and regularly checkup. Having disease, using drug, and family history of hypertension were classified as yes, no and unknown.

Life style behaviors

The life style behaviors comprise smoking, alcohol, coffee, physical activity, and labor work. Smoking habits was classified as current smoker and non smoker. Alcohol and coffee drinking habits were classified as drinking, ever drinking, and never drinking. Physical activity and house work were classified as no activity, 1-3 days per week, and at least 3 day per week.

Dietary habits

The dietary habits comprise cooking oil, fried food consumption, salty food consumption, eating sweet taste, seafood consumption, and adding fish sauce. Cooking oil was classified as using vegetable and animal oil or vegetable oil only. Fried food consumption, salty food consumption habits, eating sweet taste, and seafood consumption were classified as yes or no. Adding fish sauce was classified as always, sometimes and never.

2.2 Path diagram

Path diagram

Figure 2.1 shows path diagram. The path diagram shows relationship between outcome and determinants.

The outcome is hypertension. It is defined based on an average of two measurements of systolic and diastolic blood pressure. Subjects with their average of systolic blood

pressure at least 140 mm Hg or diastolic blood pressure at least 90 mm Hg were classified as hypertension. All subjects currently self-reported on anti-hypertensive medications, or having written prescriptions of anti-hypertensive drugs were also classified as hypertensive, irrespective of their current blood pressure reading.

The determinants are socio-demographic factors, health related factors, life style behaviors, dietary habits.

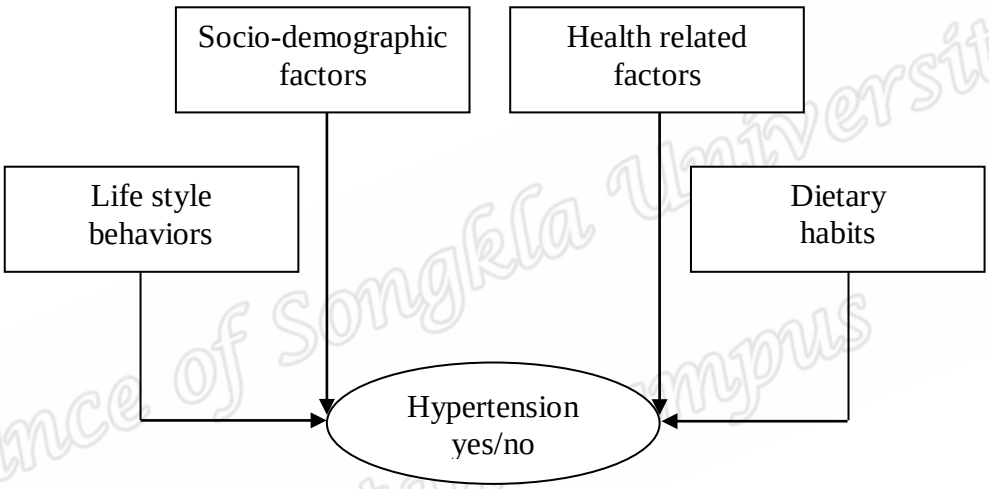

Figure 2.2 Path diagram

2.3 Statistical methods

Data were analyzed and presented with frequency and percentage using graphical methods. The chi-squared test was used for preliminary testing associations between the hypertension outcome and the determinants. Logistic regression was fitted to the data.

Chi-squared test and odds ratio

Pearson's Chi-squared test and 95% confidence intervals for odds ratio were used to assess the association between the determinant variables and the outcome of this study. The formulas of contingency tables (McNeil, 1996) are as follows (X is the determinant of interest, Y is hypertension)

A. 2×2 table

In this case X is the binary determinant and Y is the binary outcome. The odds ratio is a measure of the strength of an association between two binary variables (McNeil, 1996). To illustrate the definition of the odds ratio, assuming the variables takes values 1 and 0. A two-by-two table is constructed as follows.

		Y = 1	Y = 0
X	1	*a*	*b*
	0	*c*	*d*

n = *a* + *b* + *c* + *d*

where *n* is the sample size, and *a*, *b*, *c* and *d* are cell counts.

The estimate the odds ratio is

$$OR = ad/bc \qquad (2.1)$$

The method for testing the null hypothesis of no association between the determinant and the outcome is to use the z-statistics $z=\ln(OR)/SE$, where *SE* is the standard error of the natural logarithm of the odds ratio (McNeil, 1996). An asymptotic formula for this standard error is given by

$$\text{SE}(\ln \text{OR}) = \sqrt{\frac{1}{a}+\frac{1}{b}+\frac{1}{c}+\frac{1}{d}} \qquad (2.2)$$

A 95% confidence interval for the population odds ratio is thus

$$\text{OR} \times \exp(\pm 1.96 \times \text{SE}(\ln \text{OR}) \qquad (2.3)$$

The more conventional method of testing the null hypothesis is based on Pearson's chi-square statistic, defined as

$$\chi^2 = \frac{(ad-bc)^2 n}{(a+b)(c+d)(a+c)(b+d)} \qquad (2.4)$$

The p-value is the probability that a chi-squared distribution with 1 degree of freedom exceeds this statistic.

B. r×2 table

Some of the determinants are multi-categorical, having more than two levels. The non-stratified $r \times 2$ table was used to compare proportion of outcome of interest for each level. For example, *x* is age group and *y* is hypertension (1: yes, 0:no).

		Y	
		1	0
X	1	a_{11}	a_{12}
	2	a_{21}	a_{22}
	…	..	..
	r	a_{r1}	a_{r2}

The estimate of odds ratio (OR) is

$$OR_{ij} = \frac{a_{ij}d_{ij}}{b_{ij}c_{ij}} \tag{2.5}$$

where $b_{ij} = \sum_{j=1}^{2} a_{ij} - a_{ij}, c_{ij} = \sum_{j=1}^{r} a_{ij} - a_{ij}, d_{ij} = n - a_{ij} - b_{ij} - c_{ij}, n = \sum_{j=1}^{r} \sum_{j=1}^{2} a_{ij}$

The standard error of logarithm of odds ratio is similar to a 2x2 table. General association is compose of r x c odds ratios, except (r-1) x (c-1) are independent.

this standard error is given by

$$SE(\ln OR_{ij}) = \sqrt{\frac{1}{a_{ij}} + \frac{1}{b_{ij}} + \frac{1}{c_{ij}} + \frac{1}{d_{ij}}} \tag{2.6}$$

A 95% confidence interval for the population odds ratio is thus

$$OR \times \exp(\pm 1.96 \times SE(\ln OR) \tag{2.7}$$

Pearson's Chi-squared test for independence in an $r \times c$ table is define as

$$\chi^2_{(r-1)\times(c-1)} = \sum_{j=1}^{r} \sum_{j=1}^{c} \frac{(a_{ij} - a_{ij})^2}{a_{ij}} \tag{2.8}$$

where $b_{ij} = \sum_{j=1}^{2} a_{ij} - a_{ij}, c_{ij} = \sum_{j=1}^{r} a_{ij} - a_{ij}, d_{ij} = n - a_{ij} - b_{ij} - c_{ij}, n = \sum_{j=1}^{r} \sum_{j=1}^{2} a_{ij}$

When the null hypothesis of the independence is true, this has a chi-squared distribution with (r-1) (c-1) degree of freedom. For a binary outcome, c = 2 (McNeil, 1998).

Simple logistic regression

Logistic regression with only one determinant is referred to as simple model. The simple model is formulated as

$$\ln (p_i/(1-p_i)) = \mu + \alpha_i \qquad (2.9)$$

where p_i is the probability of hypertension, μ is a constant, and α_i is the parameter of determinant of level *i*.

Multiple logistic regression

The simple model was compared with the full model (2.5), which includes an additive linear function of further determinant factors. The full model is formulated as

$$\ln (p_{ij\ldots k}/(1-p_{ij\ldots k})) = \mu + \alpha_i + \beta_j + \ldots + \gamma_k \qquad (2.10)$$

where $p_{ij\ldots k}$ is the probability of hypertension, μ is a constant, and α_i , β_j , and γ_k refer to determinant levels. This equation may be inverted to give an expression for the probability $p_{ij\ldots k}$ as

$$p_{ij\ldots k} = 1/(1+\exp(-(\mu + \alpha_i + \beta_j + \ldots + \gamma_k))) \qquad (2.11)$$

or

$$p_{ij\ldots k} = \exp(\mu + \alpha_i + \beta_j + \ldots + \gamma_k)/(1+\exp(\mu + \alpha_i + \beta_j + \ldots + \gamma_k)) \qquad (2.12)$$

The reduced model was fitted to the data based on treatment contrasts after omitting determinants with p- value greater than 0.05, using backward elimination process. The model with treatment and sum contrasts were fitted (Tongkumchum and McNeil,

2009). The model with treatment contrasts provided adjusted odds ratios and their confidence intervals. The model with sum contrasts provided adjusted percent and their confidence intervals.

Chapter 3

Preliminary Results

This chapter presents preliminary results comprising characteristics of study sample, association between hypertension, socio-demographic factors, health related factors, lifestyle behaviors, and dietary habits.

3.1 Characteristics of study sample

A total of 1,795 participants were included in this study. Definition of hypertension was based on three variables. They are self-reported as hypertension (diagnosed as hypertension), systolic blood pressure and diastolic blood pressure measurements. The cross tabulation between these variables are shown in Table 3.1. There are 316 (17.6%) participants live with hypertension, 325 (18.1%) participants were unaware that they had hypertension, 24 (1.3%) participants did not know that they had hypertension, 1,130 (63.0%) participants did not have hypertension.

Table 3.1 Number of cases due to diagnosed of hypertension, systolic blood pressure and diastolic blood pressure

Diastolic BP	Diagnosed as hypertension					
	yes		no		unknown	
	Systolic BP		Systolic BP		Systolic BP	
	≥140	<140	≥140	<140	≥140	<140
≥90	67	9	133	38	10	0
<90	83	157	154	1049	14	81
total	316		1374		105	

Table 3.2 shows characteristics of study sample by socio-demographic factors. Of 1,795 participants, 66.4% were females. Age ranges from 34 to 95 year with percent of participants in each age group are quite similar about 21.6-28.6% with the exception for the elderly aged 65-74 and 75+. Most of participants (74.9%) had primary school education, 81.2% had married, and 93.2% were non-Muslim.

More than half (53%) of the participants were farmers and 62.3% had enough income with saving.

Table 3.2 Socio-demographic characteristics of study sample

Factor	Number	Percent
Gender		
Male	604	33.6
Female	1191	66.4
Age		
35-44 year	490	27.3
45-54 year	514	28.6
55-64 year	388	21.6
65-74 year	256	14.3
75+	147	8.2
Education		
Illiterate	123	6.9
Primary school	1344	74.9
Secondary school	328	18.3
Marital status		
Married	1458	81.2
Never married/ divorced/separated	120	6.7
Widowed	217	12.1
Religion		
Non-Muslim	1673	93.2
Muslim	122	6.8
Occupation		
Unemployed/housewife	402	22.4
Worker	223	12.4
Employee/business/government	214	11.9
Farmer	956	53.3
Income		
Adequate without saving	338	18.8
Adequate with saving	1118	62.3
Inadequate	339	18.9

Table 3.3 shows numbers and percent of study sample by health related factors. About 40.6% of participants, their BMI were 25 kg/m^2 or above. Forty percent had medical checkup regularly. There were 74% living with non-disease or unknown, 64.4% of the participants reported that they did not use medicine, and 66.3% did not have family history of hypertension.

Table 3.3 Health related factors of study sample

Factor	Number	Percent
BMI		
< 18.5 kg/m^2	125	7.0
18.5-24.99 kg/m^2	941	52.4
>=25 kg/m^2	729	40.6
Medical checkup		
None	407	22.7
Irregularly	671	37.4
Regularly	717	39.9
Disease		
Yes	467	26.0
No and unknown	1328	74.0
Medicine		
Yes	639	35.6
No	1156	64.4
Family history of hypertension		
Yes	604	33.6
No and unknown	1191	66.3

Table 3.4 shows number and percent of study sample by life style behaviors. About 83.6% of participants were non-smoker, 72.2% never drink alcohol. There were 55.8% drink coffee, 44.2% reported that they exercised at least three days a week

whereas 39.4% of the participants reported that they did not exercise, and 78.3% did their house at least three days a week.

Table 3.4 Life style behaviors of study sample

Factor	Number	Percent
Smoking habits		
Current smoker	295	16.4
Non smoker	1500	83.6
Alcohol drinking habits		
Drinking	281	15.7
Ever drinking	128	7.1
Never drinking	1385	77.2
Coffee drinking habits		
Drinking	1002	55.8
Ever or never drinking	792	44.1
Physical activity		
No	708	39.4
<3 day per week	293	16.3
3+ day per week	794	44.2
House work		
No	123	6.9
<3 day per week	266	148
3+ day per week	1406	78.3

Table 3.5 shows dietary habits of sample. About fifty five percent reported that they had been used vegetable oil only, 92.4% had been eaten fried food, 77.3% of participants reported that they had salty food consumption habits and 68.9% had sweet taste habits.

Table 3.5 Dietary habits of study sample

Factor	Number	Percent
Cooking oil		
Vegetable oil and other	795	44.3
Vegetable oil only	1000	55.7
Fried food consumption habits		
Yes	1659	92.4
No	136	7.6
Salty food consumption habits		
Yes	1388	77.3
No	407	22.7
Eating sweet taste habits		
Yes	1237	68.9
No	558	31.1
Seafood consumption habits		
Yes	1321	73.6
No	474	26.4
Fish sauce		
Always	170	9.5
Sometimes	505	28.1
Never	1120	62.4

3.2 Association between hypertension and determinants

Table 3.6 shows bivariate analysis of hypertension and socio-demographic factors using chi-squared test. All of socio-demographic factors were associated with hypertension.

The percentage of hypertension was found to be higher in male than in female. The percentage of hypertension increases with age but it decreases with education level.

The occurrence of hypertension was highest among those being widows, followed by married. In terms of religion, the percentage of hypertension was found to be high among non-Muslim. The occurrence of hypertension was highest among those working in the unemployed or housewife. In terms of income, the percentage of hypertension was found to be highest among those having enough income.

Table 3.6 Hypertension and socio-demographic factors

Factor	Hypertension		p-value
	yes	no	
Gender			0.006
Male	251 (41.6)	353 (58.4)	
Female	414 (34.8)	777 (65.2)	
Age			<0.001
35-44 year	86 (17.6)	404 (82.4)	
45-54 year	156 (30.4)	358 (69.6)	
55-64 year	187 (48.2)	201 (51.8)	
65-74 year	134 (52.3)	122 (47.7)	
75+	102 (69.4)	45 (30.6)	
Education			<0.001
None	61 (49.6)	62 (50.4)	
Primary school	524 (39.0)	820 (61.0)	
Secondary school	80(24.3)	248(75.7)	
Marital status			<0.001
Married	510(40.0)	948(65.0)	
Never married/divorced/separated	42(35.0)	78(65.0)	
Widowed	113(52.0)	104(48.0)	
Religion			0.002
Non-Muslim	636(38.0)	1037(62.0)	
Muslim	29(23.7)	93(76.3)	
Occupation			<0.001
Unemployed/housewife	208(51.7)	194(48.3)	
Worker	72(32.2)	151(67.8)	
Employee/business/government	75(35.0)	139(65.0)	
Farmer	310(32.4)	646(67.6)	
Income			0.003
Adequate without saving	125(37.0)	213(63.0)	
Adequate with saving	441(39.4)	677(60.6)	
Inadequate	99(29.2)	240(70.8)	

Table 3.7 shows association between hypertension and health related factors. All of health related factors were associated with hypertension.

Having BMI 25 kg/m^2 and above had high proportion of hypertension. Subjects who had medical check-up regularly had high proportion of hypertension. Subjects with disease have high proportion of hypertension. Subjects with family history of hypertension have high proportion of hypertension.

Table 3.7 Hypertension and health related factors

Factor	Hypertension		p-value
	yes	no	
BMI			<0.001
< 18.5 kg/m^2	39(31.2)	86(68.8)	
18.5-24.99 kg/m^2	305(32.4)	636(67.6)	
>=25 kg/m^2	321(44.0)	408(6.0)	
Medical checkup			<0.001
None	119(29.2)	288(70.7)	
Irregularly	224(33.3)	447(66.4)	
Regularly	322(45.0)	395(55.0)	
Disease			<0.001
Yes	248(53.1)	219(46.9)	
No and unknown	417(31.4)	911(68.6)	
Medicine			<0.001
Yes	394(61.6)	245(38.3)	
No	271(23.4)	885(76.5)	
Family history of HT			<0.011
Yes	249(41.2)	355(58.8)	
No and unknown	416(34.9)	775(65.1)	

Table 3.8 shows association between hypertension and life style behaviors. All life style behaviors with the exception of smoking and coffee drinking were associated with hypertension.

Alcohol drinking participants had higher proportion of hypertension. High level of physical activity participants had high proportion of hypertension. High level of house work participants had low proportion of hypertension.

Table 3.8 Hypertension and life style behaviors

Factor	Hypertension		p-value
	yes	no	
Smoking habits			0.813
Current smoker	107(36.2)	188(63.8)	
Non smoker	558(37.2)	942(62.8)	
Alcohol drinking habits			0.004
Drinking	103(36.5)	179(63.5)	
Ever drinking	65(50.8)	63(49.2)	
Never drinking	497(35.8)	888(64.2)	
Coffee drinking habits			0.078
Drinking	353(35.2)	649(64.8)	
Ever or never drinking	312(39.4)	480(60.6)	
Physical activity			<0.001
No	230(32.5)	478(67.5)	
<3 day per week	97(33.1)	196(66.9)	
3+ day per week	338(42.6)	456(57.4)	
House work			0.002
No	63(51.2)	60(48.8)	
<3 day per week	100(37.5)	166(62.5)	
3+ day per week	502(35.7)	904(64.3)	

Table 3.9 shows association between hypertension and dietary habits factors. All dietary habits with the exception of cooking oil and salty food consumption were associated with hypertension.

The percentage of hypertension was found to be highest among participants who were not having fried food, sweet taste, seafood, and fish sauce.

Table 3.9 Hypertension and dietary habits

Factor	Hypertension		p-value
	yes	no	
Cooking oil			0.696
Vegetable oil and other	299(37.6)	496(62.4)	
Vegetable oil only	366(36.6)	634(63.4)	
Fried food consumption habits			<0.001
Yes	595(35.8)	1064(64.2)	
No	70(51.4)	66(48.6)	
Salty food consumption habits			0.051
Yes	497(35.8)	891(64.2)	
No	168(41.2)	239(58.8)	
Sweet taste consumption habits			<0.001
Yes	424(34.2)	813(65.8)	
No	241(43.1)	317(56.9)	
Seafood consumption habits			<0.001
Yes	431(32.6)	890(67.4)	
No	234(49.3)	240 (50.7)	
Fish sauce			<0.001
Always	56(32.9)	114(67.1)	
Sometimes	153(30.2)	352(69.8)	
Never	456(40.7)	664(59.3)	

3.3 Unadjusted odds ratio of hypertension and determinants

Figures 3.1 and 3.2 show unadjusted odds ratio from simple logistic regression between hypertension and each determinant of socio-demographic factors with the corresponding 95% confidence intervals. The natural logarithm of odds ratio was estimated from coefficient and its 95% confidence interval.

The graph shows that hypertension increase with age. Probability in group of age 45 and above had a greater risk of hypertension than young age group. Being widowed people were more likely to have hypertension.

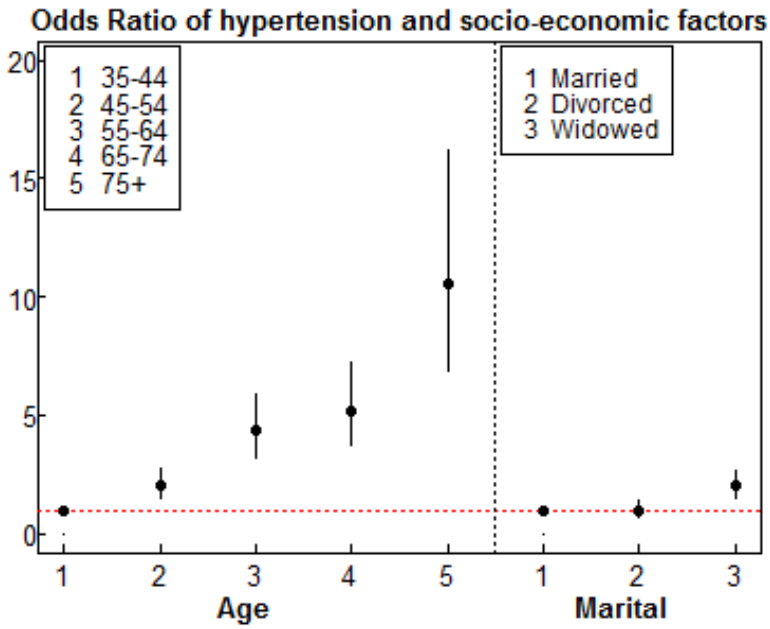

Figure 3.1 odds ratio of hypertension by age and marital status

Hypertension decreased with being female, higher education level, and being Muslim. For occupations, being unemployed were more likely to have hypertension. However, subjects having enough income were less likely to have hypertension.

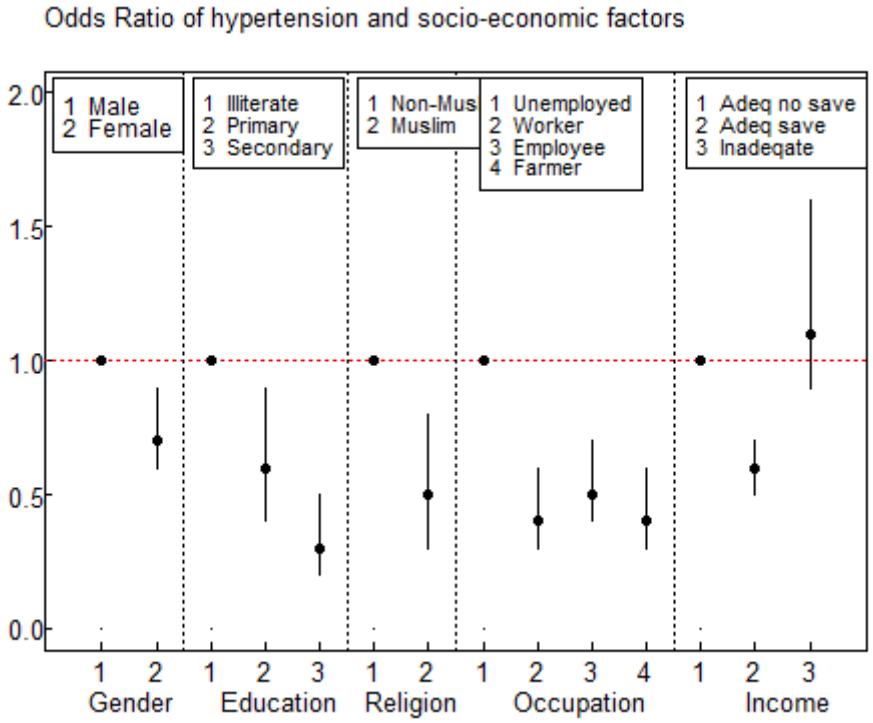

Figure 3.2 odds ratio of hypertension by socio-demographic factors

Figure 3.3 shows odds ratio of hypertension and health related factors. The variable of odds ratio of hypertension and health related factors include BMI, medical, disease, medicine and father history of family (FHT). BMI $\geq$ 25 kg/m^2 had a 1.7 times greater risk for hypertension than people whose BMI <18.5kg/m^2. People who exercise regularly were 1.8 times more likely to have risk of hypertension than people who did not exercise.

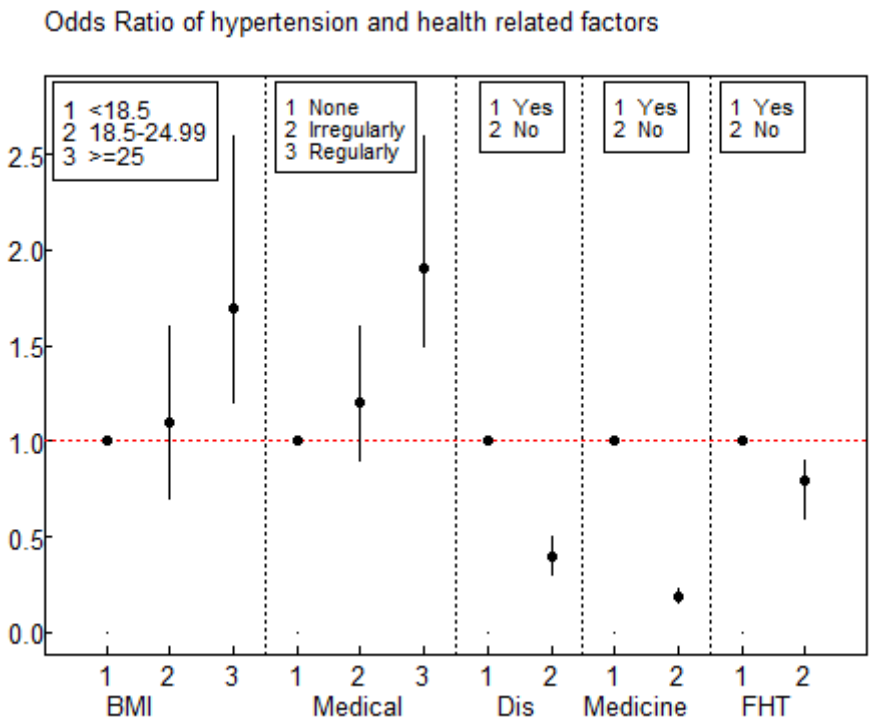

Figure 3.3 odds ratio of hypertension by health related factors

Figure 3.4 shows odds ratio of hypertension and life style behaviors. The odds ratio of hypertension and life style behavior factors include smoking, alcohol drinker, and coffee drinker, physical activity and doing house work. Subject being ever drink alcohol and exercise at least 3 days a week were more likely to have hypertension. However, subjects doing house work were less likely to have hypertension.

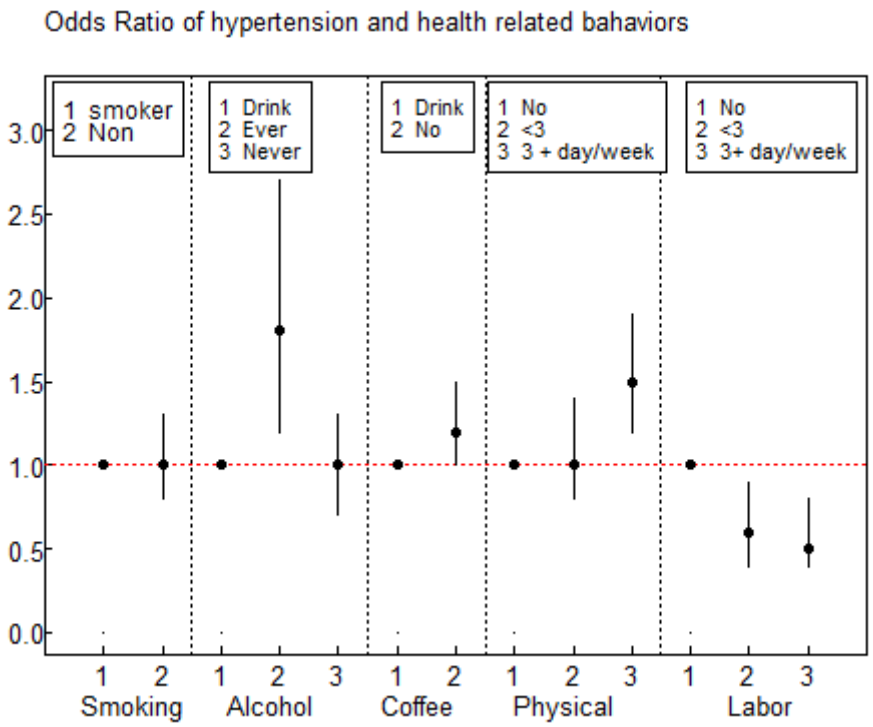

Figure 3.4 odds ratio of hypertension by life style behaviors

Figure 3.5 shows odds ratio of hypertension and dietary habits. Surprisingly for a group who were not eating fried food, not eating sweet taste, and not eating seafood were more likely to have hypertension.

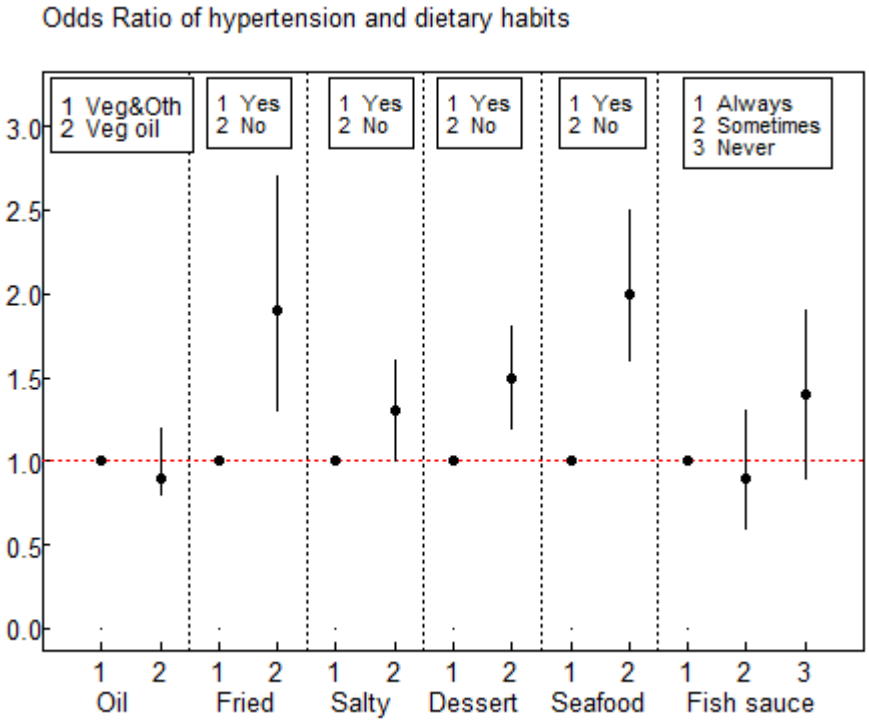

Figure 3.5 odds ratio of hypertension by dietary habits

Chapter 4

Model Results

This chapter presents results from logistic regression models. Among 1,795 participants, there were 665 (37%) who had hypertension. The determinants comprise socio-demographic factors, health related factors, life style behaviors and dietary habits among a group of adults in Trang province of southern Thailand.

4.1 Full model

The logistic regression model comprising all determinates was initially fitted to the data based on treatment contrasts. The results were presented in Table 4.1. Gender, age, education, BMI, taking medicine, and eating sweet taste were statistically significant in the full model.

Table 4.1 Results from full model

Factors		Estimate	SE	z value	p-value
Intercept		-0.821	0.522	-1.574	0.115
Gender	Male*				**0.004**
	Female	-0.526	0.183	-2.876	0.004
Age	35-44*				**<0.001**
	45-54	0.553	0.169	3.282	0.001
	55-64	1.174	0.182	6.444	0.000
	65-74	1.255	0.224	5.609	0.000
	75+	2.150	0.296	7.260	0.000
Education	None*				**0.048**
	Primary	-0.169	0.237	-0.713	0.476
	Secondary	-0.566	0.287	-1.971	0.049

Factors		Estimate	SE	z value	p-value
Marital status	Married*				**0.551**
	Never married+	0.262	0.238	1.099	0.272
	Widowed	0.030	0.192	0.156	0.876
Religion	Non-Muslim*				**0.595**
	Muslim	-0.134	0.253	-0.528	0.597
Occupation	Unemployed+*				**0.240**
	Worker	0.238	0.225	1.055	0.291
	Employee+	0.209	0.226	0.922	0.357
	Farmer	-0.072	0.169	-0.424	0.671
Income	Adeq no saving*				**0.088**
	Adeq+ saving	0.025	0.153	0.161	0.872
	Inadequate	-0.315	0.193	-1.633	0.103
BMI	< 18.5 kg/m^2*				**<0.001**
	18.5-24.99kg/m^2	0.627	0.244	2.568	0.010
	>=25 kg/m^2	1.417	0.256	5.529	<0.001
Medical checkup	None*				**0.144**
	Irregularly	0.157	0.158	0.988	0.323
	Regularly	0.309	0.160	1.932	0.053
Disease	Yes*				**0.190**
	No+ unknown	0.200	0.153	1.305	0.192
Medicine	Yes*				**<0.001**
	No	-1.491	0.142	-10.494	<0.001
Family history HT	Yes*				**0.200**
	No+ unknown	-0.158	0.123	-1.283	0.199
Smoking habits	Current smoker*				0.959
	Non smoker	-0.010	0.193	-0.051	0.959
Alcohol drinking	Drinking*				**0.310**
	Ever drinking	-0.225	0.256	-0.880	0.379
	Never drinking	-0.307	0.203	-1.511	0.131
Coffee drinking	Drinking*				**0.586**
	Ever+ never	-0.067	0.123	-0.544	0.587

Factors		Estimate	SE	z value	p-value
Physical activity	No*				**0.188**
	<3 day/week	0.027	0.174	0.157	0.875
	3+ day/ week	0.227	0.131	1.730	0.084
House work	No*				**0.421**
	<3 day/ week	-0.215	0.263	-0.818	0.413
	3+ day/ week	0.003	0.234	0.012	0.990
Cooking oil	Vegetable oil+*				**0.870**
	Vegetable oil	-0.020	0.119	-0.163	0.870
Fried food	Yes*				**0.495**
	No	0.151	0.221	0.683	0.495
Salty food	Yes*				**0.611**
	No	-0.074	0.145	-0.508	0.611
Sweet taste	Yes*				**0.001**
	No	0.434	0.130	3.329	0.001
Seafood	Yes*				**0.072**
	No	0.244	0.135	1.800	0.072
Fish sauce	Always*				**0.080**
	Sometimes	-0.376	0.219	-1.716	0.086
	Never	-0.104	0.205	-0.508	0.611

*reference group

4.2 Reduced model

The reduced model was fitted to the data based on treatment contrasts after omitting determinants with p-value greater than 0.05, using backward elimination process.

Table 4.2 shows model results. Gender, age, BMI, taking medicine, physical activity, and eating sweet taste were significant associated with hypertension.There was an increased risk of hypertension with being male, age greater than 55 years old, body

mass index greater than 25 kg/m^2, using some kinds of medicine, exercise at least 3 days a week, and not eating sweet taste.

Table 4.2 Results from reduced model

Factors		Coefficients	Standard Error	z value	p-value
Intercept		-1.438	0.293	-4.906	<0.001
Gender	Male*				**<0.001**
	Female	-0.547	0.122	-4.499	<0.001
Age	35-44 year*				**<0.001**
	45-54 year	0.635	0.163	3.891	<0.001
	55-64 year	1.291	0.169	7.620	<0.001
	65-74 year	1.423	0.193	7.381	<0.001
	75+	2.342	0.244	9.595	< 0.001
BMI	< 18.5 kg/m^{2*}				**<0.001**
	18.5-24.99 kg/m^2	0.613	0.238	2.571	0.010
	≥25 kg/m^2	1.376	0.249	5.536	<0.001
Medicine	Yes*				**<0.001**
	No	-1.401	0.116	-12.085	< 0.001
Physical	No*				**0.023**
	<3 day per week	0.056	0.169	0.332	0.740
	3+ day per week	0.325	0.124	2.629	0.009
Eating sweet	Yes*				**<0.001**
	No	0.474	0.120	3.937	<0.001

*Reference group

Table 4.3 shows adjusted odds ratios (aOR) from reduced model and unadjusted odds ratios(OR) from simple logistic regression modelfor each determinant with their corresponding 95% confidence intervals.

Table 4.3 Unadjusted and adjusted odds ratio

Factor	Unadjusted odds ratio		Adjusted odds ratio	
Gender				
Male*	1		1	
Female	0.749	(0.613, 0.916)	0.579	(0.456, 0.735)
Age				
35-44 year*	1		1	
45-54 year	2.047	(1.518,2.761)	1.886	(1.370, 2.597)
55-64 year	4.371	(3.217,5.937)	3.635	(2.608, 5.066)
65-74 year	5.160	(3.680, 7.236)	4.149	(2.843, 6.054)
75+	10.648	(6.989,16.223)	10.401	(6.446, 16.782)
BMI				
< 18.5 kg/m^{2*}	1		1	
18.5-24.9 kg/m^2	1.057	(0.707, 1.581)	1.846	(1.157, 2.946)
>=25 kg/m^2	1.735	(1.156, 2.603)	3.961	(2.433, 6.447)
Medicine				
Yes*	1		1	
No	0.190	(0.154, 0.235)	0.246	(0.196, 0.309)
Physical activity				
No*	1		1	
<3 day per week	1.029	(0.770, 1.374)	1.058	(0.759, 1.474)
3+ day per week	1.540	(1.247, 1.902)	1.384	(1.086, 1.764)
Eating sweet taste				
Yes*	1		1	
No	1.458	(1.188, 1.789)	1.607	(1.269, 2.034)

*Reference group

The model with sum contrasts was fitted to the data in order to provide confidence intervals for every category of risk factors. Figure 4.1 shows 95% confidence interval plot for adjusted percentage of hypertension by six determinants.

The graph shows the corresponding crude and adjusted percent with respect to the various levels of each of the determinants. The horizontal red line is the overall mean percent of hypertension (37.05%).The confidence intervals can be classified into three groups, lower, cross, and higher than overall percent.

The adjusted percent of hypertension was found to be higher among male, age above55 years, BMI 25 or above, taking medicine, exercise at least 3 days a week, and not eating sweet taste compared to overall percent.

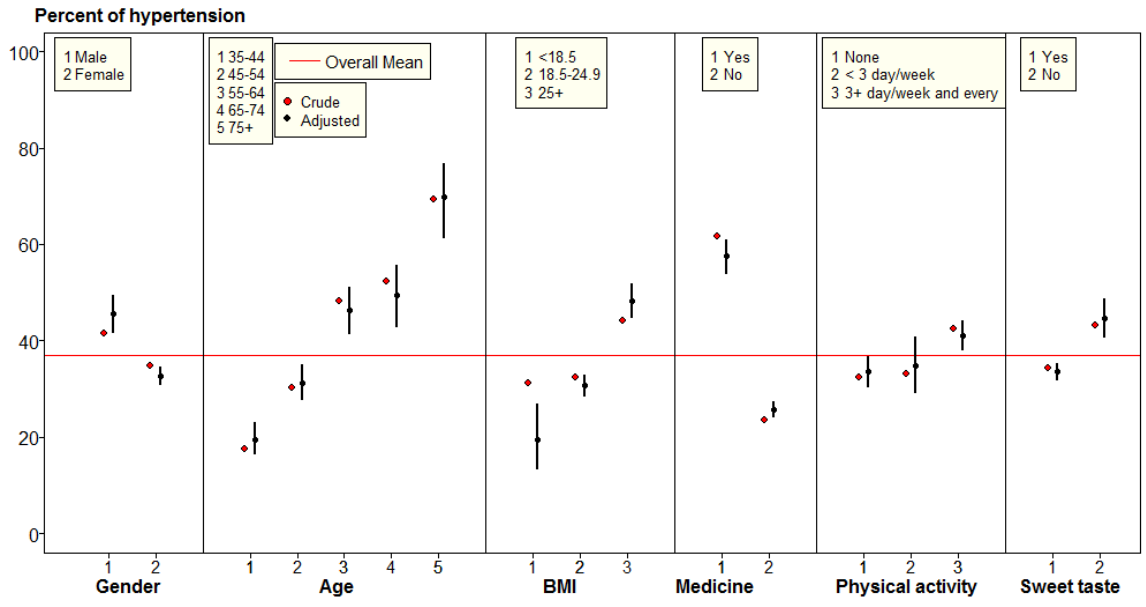

Figure 4.1 95% confidence intervals of adjusted percentage of hypertension

Chapter 5

Discussions and conclusions

This chapter covers discussions, conclusions, limitations of study and recommendations of the present study. It is concerns with factors affecting hypertension among adults aged 35 years and older in Trang province of southern Thailand. The determinants are socio-demographic factors, health related factors, lifestyle behaviors and dietary habits.

5.1 Discussions

In this study, on average the prevalence of hypertension was 37%. This rate exceeds those of many studies in Asia, Southeast Asia and Thailand. Singh *et al*. (2000) reported that the prevalence of hypertension among adults in Asia varied from 15-35%. Krishnan *et al*. (2013) reported that in Southeast Asia approximately 35% of the adult population has hypertension. Krishnan *et al*. (2013) also reported that prevalence of hypertension among Thai adults aged 25 years and older was 34.2%. Puavilai *et al*. (2011) reported that the prevalence among adults aged 40-69 years in Ban Paew district of Samuthsakorn province varied from 22.1 to 32.5%. The high prevalence found in our study possibly it included older age group than those studies.

Logistic regression was used to identify the strength of association between hypertension outcome and determinants. Socio-demographic factors (gender and age), health related factors (BMI and taking medicine), life style behaviors (physical activity) and dietary habits (eating sweet taste) were related to hypertension.

In this study, it was found that the prevalence of hypertension in men was significantly higher than in women. Hypertension was found to be higher in men than in women has also been reported from many parts of the world including India (Yadav *et al*., 2008), Iran (Janghorbani *et al*., 2008), Ban Paew District in Thailand (Puavilai *et al*., 2011), Saudi Arabia (Bani, 2011) and Myanmar (Krishnan *et al*., 2013). This could be possibly the increased prevalence of risk factors of hypertension in males. Although gender differences in hypertension have been reported in several studies opposite findings also exist. Some studies reported the prevalence was higher in women than in men (Arslantas *et al*., 2008; Al-Hamdan *et al*., 2011). It was also reported that there is no different among gender (Kearney *et al*., 2005; Cipullo *et al*., 2010). The impact of gender in hypertension remains poorly clarified.

The prevalence of hypertension gradually increased as age increased. Elderly people were more likely to develop hypertension than younger people (see, for example Hori *et al*., 2003; Khan *et al*. 2011; Bani, 2011). This could be possibly because of atherosclerotic change in blood vessels and the sedentary life style of the elderly (Madhukumar *et al*., 2012).

It is known that body mass index is a powerful predictor of hypertension. The present study has also revealed a higher prevalence of hypertension in the overweight and obese with BMI ≥25. Similar association has been reported by many studies (see, for example, Puavilai *et al*., 2011; Yadav *et al*., 2008; Tee *et al*., 2010)

Our results found that prevalence of hypertension increased with taking some kinds of medicine. This factors remain unclear because no specific of explanation about medicine in questionnaire. The medicine used could be anti-hypertension medication

or other medicine. However, among people using anti-hypertensive meditation their blood pressure were still high because they did not exercise and could not control their dietary consumptions mainly in men (Fields *et al*., 2004; Chinnakali *et al*., 2012; Falaschetti *et al*., 2014).

In developing countries, a potentially more important issue is that many of this medicine can be bought without prescription. It may increase the proportion of patients whose blood pressure is not correctly controlled (Ibrahim *et al*., 2012).

Our results found that prevalence of hypertension increased with exercise at least 3 days per week. It is contradict with other studies. This may be because exercise in our study did not provide detail about how often or how long about exercise. Physical activity was the healthy style related to prevent and reduce hypertension in another studies (Chockalingam *et al*., 2006; Leelacharas; 2009; Li *et al*., 2010; Khan *et al*., 2011; Ibrahim *et al*., 2013). Sedentary activity was associated with an increase in risk of pre-hypertension and hypertension in North Indian population (Yadav *et al*., 2008). Dynamic physical training such as aerobic dynamic and training program from three to five times per week during half an hour to one hour per session at an intensity of about 40–50% of exercise performance appears to be effective with regard to reduce blood pressure (Fagard, 2001). There was a report on increasing hypertension in the US in 1999 to 2000 although it reported on increasing healthier lifestyles among population (Fields *et al*., 2004).

Also in our study, it was found that prevalence of hypertension increased with not eating sweet taste, which is the healthy style and it could be related to prevent and reduce hypertension. It is difficult to give clear explanation.

5.2 Conclusions

Hypertension is an important chronic disease among adults in Trang province of southern Thailand. The high prevalence is significantly associated with being males, advancing age, excess body mass index, using medicine, exercise at least 3 day a week, and not eating sweet taste.

Undetected hypertension is still a main problem. An effective approach is needed to early detect the disease aiming at preventing rather than treatment. Reducing risk factors such as changing life style behaviours and dietary habits should start as earlier as possible. Emphasis should be targeting at elderly men with excess body mass index.

Although hypertension is a common disease increasing worldwide the magnitude of the problem and risk factors are not well understood. This study confirmed that hypertension was a problem in Trang province. Health professionals should have role in detecting new cases by regular enquiry about risk factors and measuring blood pressure. Strategies for intervention need to focus on the significant risks factors.

Interventions strategies should be translated into action. Health professionals should provide strategies to help hypertensive individuals improving their self-efficacy perception and breaking habits. Educating hypertensive individuals about their diet quality may contribute to prevention of hypertension. Intakes of vegetables, fruits, and difference varieties in dietary consumption are also important to consider. Educating hypertensive individuals about their anti-hypertensive medication may also contribute to reduce and control hypertension. Since overweight was found to be

related to hypertension physical activities may also be important. Dynamic exercise should be encouraged to hypertensive individuals.

5.3 Limitations of study

This study design using a cross-sectional study from subject in Huai Yot, Kantang, Na Yong, Ratsada districts of Trang Province. The subject may not be representative of the population of Trang Province. Moreover, health related factors, life style behaviors, and dietary habits were measured using questionnaire. The information may not be specific enough in amount of exercise and dietary consumptions.

5.4 Recommendations

A further study in the future should be designed as a case-control study in order to measure health related factors, life style behaviors, and dietary habits accurately among a smaller sample. Measurements on variables should be more accurate. For example taking medicine, it needed more specific information on type of medicine (anti-hypertensive medication or others) and frequency of use. Frequency of smoking, amount of cigarette, alcohol and coffee consumption, addition of seasoning should be measured.

To our knowledge a few studies of hypertension in Thailand were published and no representative study on Thai population. Therefore, further studies are needed to understand situation of hypertension in Thailand.

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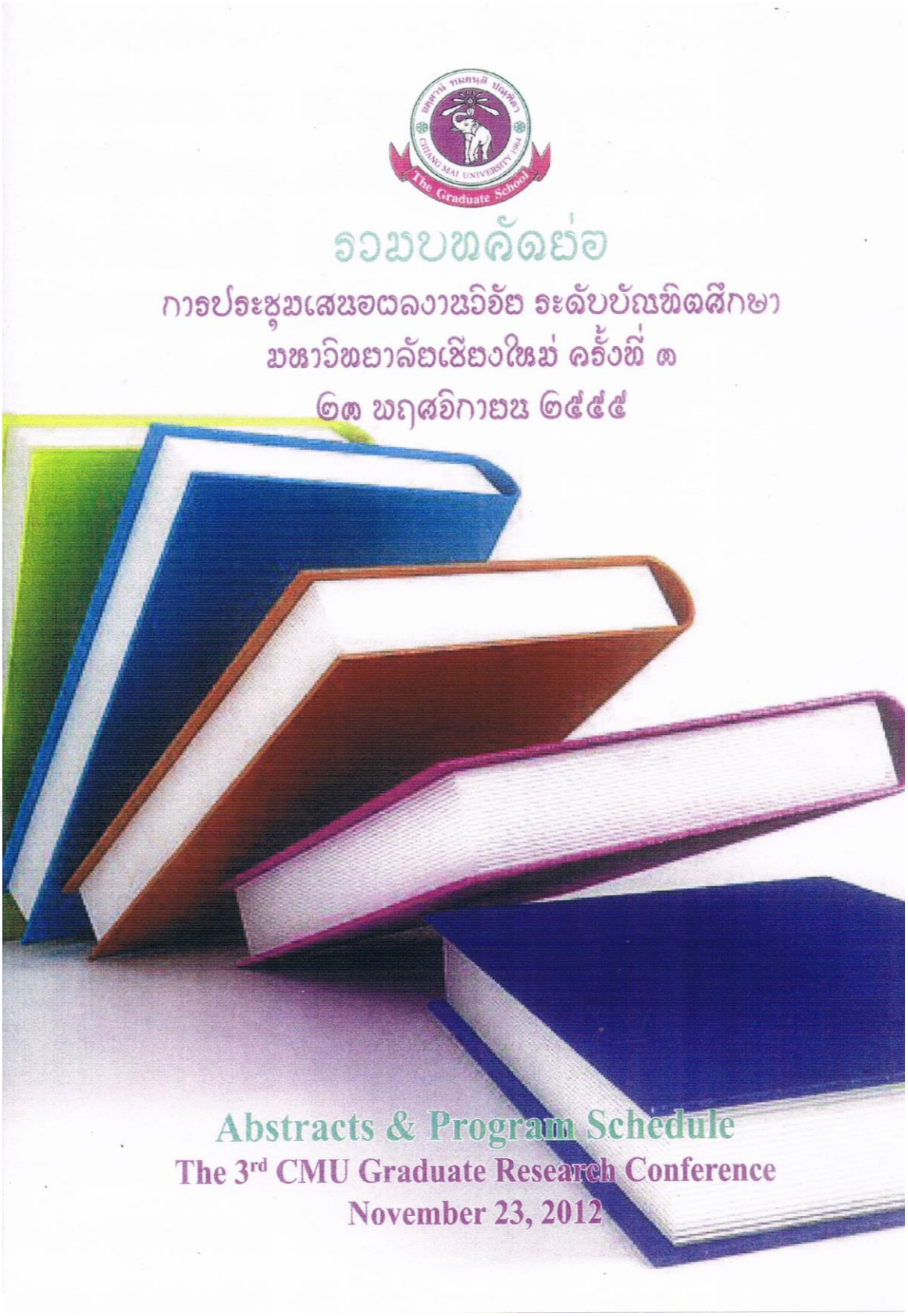
Appendix



รวมบทคัดย่อ

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Factors Affecting Hypertension in Trang Province

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Abstract

Our study aims to assess the knowledge of risk factors of hypertension among adults aged 35 years and above and to examine the association between hypertension and socio-demographic and behavior factors. We used data from the study conducted in districts of Trang province (Hoi yoat, Kantang, Na-yong and Ras-sa-da) by public health authorities of Trang province between December 2009 and March 2010. It was a cross-sectional study, which included a sample of 1,795 adults. Logistic regression will be used to construct the model of association between hypertension and determinants. Of these, 453 (25.2%) were defined as hypertension. The prevalence of hypertension increases with male gender, older age group, illiterate education, housewife occupation, high BMI and not regularly eating dessert.

Keywords: Hypertension, Logistic Regression, Risk Factor, Prevalence

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บัณฑิตวิทยาลัย มหาวิทยาลัยเชียงใหม่

ขอมอบเกียรติบัตรฉบับนี้ให้ไว้เพื่อแสดงว่า

เบญจมาศ ฉุ้นประดับ

มหาวิทยาลัยสงขลานครินทร์

ได้เข้าร่วมนำเสนอผลงานทางวิชาการ

ในการประชุมเสนอผลงานวิจัยระดับบัณฑิตศึกษา มหาวิทยาลัยเชียงใหม่ ครั้งที่ 3

วันที่ 23 พฤศจิกายน พ.ศ. 2555

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List of Publication and Proceedings

Chunpradab, B., Tongkhumchum, P. and Lim, A. Factor Affecting Hypertension in Trang Province. The 3rd CMU Graduate Research Conference. 23 November, 2012. Chiang Mai University, Thailand.