

ASSOCIATION BETWEEN AN UNHEALTHY LIFESTYLE AND OTHER FACTORS WITH HYPERTENSION AMONG HILL TRIBE POPULATIONS OF MAE FAH LUANG DISTRICT, CHIANG RAI PROVINCE, THAILAND

Yuwadee Duangtep¹, Kulaya Narksawat², Rawadee Chongsuwat²
and Peungchon Rojanavipart²

¹District Health Office, Mae Fah Luang, Chiang Rai; ²Faculty of Public Health, Mahidol University, Bangkok, Thailand

Abstract. An unhealthy lifestyle may lead to hypertension which can cause strokes and cardiovascular disease. The aim of this study was to identify the specific unhealthy lifestyle practices which could cause hypertension among hill tribe populations in Mae Fah Luang District of Chiang Rai Province, Thailand. In 2006, 196 patients with hypertension were selected from 2 district hospitals and 13 health centers as cases, and 196 normotensive subjects from a local neighborhood were chosen as controls. Trained health personnel collected data by interviewing subjects from both groups regarding unhealthy lifestyles and other factors. All participants had a physical examination at the time of interview. The results from multiple logistic regression analysis show the factors associated with hypertension among the hill tribe people studied were smoking (OR 2.48; 95%CI 1.43-4.30, $p = 0.001$), no or irregular exercise (OR 1.84; 95%CI 1.16-2.99, $p = 0.005$), being overweight (OR 2.96; 95%CI 1.69-5.18, $p < 0.002$), having obesity (OR 2.65, 95%CI 1.04-6.73, $p < 0.018$) and having a high frequency intake of fatty foods (OR 1.98, 95%CI 1.23-3.18, $p < 0.013$). The findings suggest the need for significant lifestyle changes in regards to smoking, eating habits and leisure time exercise programs. The adoption of such lifestyle changes would result in a reduced chance of being hypertensive, which could later reduce cardiovascular morbidity and mortality.

Key words: unhealthy lifestyle, hypertension, hill tribe population, Thailand

INTRODUCTION

The Mae Fah Luang District, Chiang Rai Province is located in northern Thailand. The area was named "Mae Fa Luang" by HRH Princess Mother Srinagarindra, who was more commonly

known to the hill tribe people of the area as "Mae Fa Luang" (lit. *Royal mother from the sky*). The hill tribe people's occupations include agricultural work and making handicrafts, which includes woven products. The total population of the district is 77,151; most of this population is made up of 6 or 7 different hill tribe racial groups who inhabit the district. Due to the mountainous terrain this district's population is semi-rural. The hill tribe people regularly commute between urban and rural areas.

Correspondence: Kulaya Narksawat, Department of Epidemiology, Faculty of Public Health, Mahidol University 420/1 Ratchawithi Road, Ratchathewi, Bangkok 10400, Thailand. E-mail: phkns@mahidol.ac.th

In 2004, the prevalence of hypertension (HTN) was about 39.1 cases per 1,000 people (Mae Fah Luang District Health Office, 2004). In 2005, 740 patients visited hypertension clinics at health centers in Mae Fah Luang District, including Mae Fah Luang Hospital and Mae Chan Hospitals of Chiang Rai Province (Mae Fah Luang District Health Office, 2005). Lifestyle factors are critical determinants of blood pressure along with genetic susceptibility (Beilin *et al*, 1999).

Life style is usually referred to as a set of habits or customs that are influenced, modified, encouraged, or constrained by a life long process of socialization. These habits and customs include the use of substances, such as alcohol, tobacco, tea and coffee, as well as dietary habits and exercise, all of which have important implications for health and are often the subject of epidemiological investigations (Last, 2001). A variety of factors have been shown to directly influence blood pressure levels at both the individual and population levels. Of these, the most important parameters are excess body fat, smoking, alcohol consumption, insufficient physical activity, dietary habits include excessive intake of salt, inadequate intake of potassium, and a complex variety of fruits, vegetables and saturated fats (Beilin *et al*, 1999; National Heart, Lung, and Blood Institute, 2010).

Overweight and obesity have been shown to be associated with blood pressure and serum lipid levels (Stamler, 1991; Lamon-Fava, 1996). Several lifestyle factors are associated with BMI, including smoking, physical activity at work, leisure-time activity, and alcohol consumption (Willsgaard *et al*, 2005). Cigarette smoking causes vasoconstriction. Smokers are more than 10 times more likely to develop peripheral vascular disease, including hyper-

tension (Fielding *et al*, 1998). The effect of alcohol on systolic blood pressure is independent of the effects of age, obesity, cigarette smoking and physical activity. Alcohol also ranks close to obesity as a potentially preventable cause of hypertension in the community, especially among the working population (Arkwright *et al*, 1982). Hypertension is strongly associated with other metabolic abnormalities, such as overweight, hyperuricemia, hyperglycemia, and hypercholesterolemia, that may be related to the pathogenesis of high blood pressure and compounds the risk of major clinical cardiovascular events in people with hypertension (Martino *et al*, 1990). Body mass index (BMI) and current cigarette smoking are major lifestyle risk factors for hypertension (Kivimaki *et al*, 2009). Modification of an unhealthy lifestyle is both a preventive measure and method of treatment for hypertension. A previous study showed that when an unhealthy lifestyle is modified hypertension can be reduced by 17%, coronary heart disease by 6%, and strokes and transient ischemic attacks can be reduced by 15% (Cook *et al*, 1995).

The primary aim of this population based case-control study was to identify unhealthy lifestyle factors associated HTN among this hill tribe population and to provide an effective health promotion program designed to reduce the incidence of hypertension.

MATERIALS AND METHODS

Study population

The study population was hill tribe people with ages at risk for hypertension: 34 to 60 years (National Heart, Lung, and Blood Institute, 2010). The study population was selected from those living in Mae Fah Luang District exposed to the local

lifestyle for at least 3 years. The sample size was calculated by the following formulas (Schlesselman, 1982):

$$n = \frac{Z_{\alpha/2}^2 \sqrt{2pq + Z_{\beta}^2 \sqrt{p_1q_1 + p_0q_0}}}{(p_1 + p_0)^2}, \text{ and } p_1 = \frac{p_0 \times OR}{[1 + p_0(OR - 1)]}$$

with the rate of poor physical activity set at 47% among the normotensive population and the odds ratio for physical inactivity at 1.80 (Sabri *et al*, 2004). The ratio of cases to controls was 1:1; the power was 80%, the level of significance was 5%, the minimum sample size was 184 for cases and 184 for controls. Cases were taken from all patients recently diagnosed with HTN from October 2005 to 30 September 2006, who attended 2 district hospitals: Mae Chan Hospital and Mae Fah Luang Hospital, or 13 health centers of the Mae Fah Luang District, Chiang Rai Province. The hospitals and health centers are accessible since they are centrally located. They are also representative of the resources available to this hill tribe population. Controls were selected from people not previously diagnosed with HTN in the previous 3 years. Controls were neighbors from the same village as the cases, and were matched by gender and age within 5 years. Blood pressure level among the control group participants was measured three times at five minute intervals using the Omron M1 manometer with the participant seated, after having rested for at least 15 minutes. Controls were selected only if their systolic and diastolic blood pressures were less than or equal to 140/90 mmHg (National Heart, Lung, and Blood Institute, 2010). Some were excluded because of pre-existing diabetes, renal disease, coronary heart disease, or stroke. The total study population was 392: 196 cases and 196 controls. This study was approved by the Ethics Committee of Mahidol University;

patients gave informed consent before participating in the study.

Questionnaire

A questionnaire was used to interview participants regarding their lifestyle. Questions addressed factors such as alcohol consumption, cigarette smoking, physical activity by occupation and leisure time exercise. A frequency of food intake questionnaire (FFQ) was used to measure the participant's weekly dietary habits, specifically in regards to fat, salt, and meat consumption. Type A behavior was measured using a questionnaire based on Framingham's Type A Behavior Pattern Scale (Perlman, 1984; Sykes, 1992). The standard Thai stress questionnaire was used for measuring mental health (Phattarayuttawat and Ngamthipwattana, 2000). Having a family member with HTN was also included in the questionnaire as a confounding variable.

Data collection

Among the control group, a home visit, by local nurses and health personnel trained to conduct basic physical examinations and interviews, was carried out. Blood pressure, weight and height were measured. Among cases, data were retrieved from medical records and interviews were held at the hypertension clinics of district hospitals and health centers. BMI was calculated for both cases and controls by weight in kilograms divided by height in meters squared. Participants were classified into thin, normal, overweight and obese status categories (BMI <18.5, 18.5-24.9, 25-29.9, >30 kg/m², respectively) (National Heart, Lung, and Blood Institute, 2010).

Statistical analysis

Multiple logistic regression analysis was used to assess the adjusted odds ratio with a 95% confidence interval. A *p*-value

Table 1
Characteristics of study population.

Variables	Cases No. (%)	Controls No. (%)	<i>p</i> -value ^a
Gender			
Male	78 (39.7%)	78 (39.7%)	0.63
Female	118 (60.3%)	118 (60.3%)	
Age (years)			
<40	13 (6.6%)	11 (5.6%)	0.98
40-59	116 (59.2%)	123 (62.7%)	
≥ 60	67 (34.2%)	62 (31.7%)	
Education			
Illiterate	191 (97.5%)	192 (97.9%)	0.73
Elementary	5 (2.5%)	4 (2.1%)	
Family monthly income (Baht)			
≤ 5,000	98 (50.0%)	85 (43.36%)	0.63
> 5,000	98 (50.0%)	111 (56.64%)	
Occupation			
Agriculture	86 (43.8%)	88 (44.8%)	0.3
No occupation and housewife	71 (34.2%)	67 (35.2%)	
Employee	22 (11.3%)	36 (18.3%)	
Merchant	21 (10.7%)	9 (4.67%)	

^aChi-square test

of < 0.05 was determined for statistical significance. The dependent variable was HTN (yes/no). The independent variables were smoking (never/ex and current), alcohol consumption (never/ex and current), level of physical activity at work (non sedentary/sedentary), exercise at leisure (usually/occasionally and never), BMI (thin and normal/overweight/obese) and frequency of food intake per week of fatty, salty foods and meat (high /low). The confounding factors of having a family member with hypertension (yes/no), age (years) and gender (male/female) were simultaneously taken into account during analysis.

RESULTS

Common characteristics of study participants were illiteracy (90%) and low in-

comes (>50% with a monthly income of <5,000 baht). Ages ranged from 40 to 60 years old with a mean age of 55.16±10.91 years old among cases and 54.66±10.08 years old among controls. Forty-three percent of cases and 44% of controls had agricultural work, while 34% of cases and 35% of controls had no occupation or were a housewife (Table 1). A higher prevalence of smoking, inadequate physical activity, having stress, overweight and obese were found among cases than controls (Table 2).

Having good model fitness (Hosmer and Lemeshow test: chi-square test = 7.27, *p*-value = 0.508), our findings showed the significant unhealthy factors associated with hypertension were smoking, no leisure time exercise, being overweight, obesity and consumption of fatty foods. Participants who were ex-smokers or current

Table 2
Life style factors of study population.

Variables	Cases No. (%)	Controls No. (%)	<i>p</i> -value ^a
Smoking status			
Never smoked	126 (64.3%)	157 (80.1%)	
Ex and current smoker	70 (35.7%)	39 (19.9%)	0.0004
Alcohol consumption			
Never drank	129 (65.8%)	139 (70.9%)	
Ex and current drinker	67 (34.2%)	57 (29.1%)	0.164
Physical activity at work			
Non sedentary	142 (72.4%)	156 (79.6%)	
Sedentary	54 (27.6%)	40 (20.4%)	0.062
Physical activity as leisure time exercise			
Usually	108 (55.1%)	142 (72.4%)	
Occasionally and never	88 (44.9%)	54 (27.6%)	<0.000
Type A behavioral			
Non type A	137 (69.8%)	157 (80.5%)	
Type A	59 (30.1%)	39 (19.5%)	0.013
Mental health			
Excellent and normal mental health	130 (66.3%)	153 (78.0%)	
Mildly stressed and stressful	66 (33.6%)	43 (21.9%)	0.006
Body Mass Index (kg/m ²)			
<18.5	10 (5.1%)	16 (8.2%)	
18.5-24.9	105 (53.8%)	139 (71.6%)	
25-29.9	62 (31.8%)	29 (14.9%)	<0.000
≥ 30	18 (9.2%)	10 (5.2%)	
Dietary habits by frequency of intake per week fatty foods			
Low	90 (45.9%)	124 (63.3%)	
High	106 (54.1%)	72 (36.7%)	<0.000
Salty foods			
Low	118 (60.2%)	126 (64.3%)	
High	78 (39.8%)	70 (35.7%)	0.233
Meat			
Low	128 (67.7%)	98 (50.3%)	
High	61 (32.3%)	97 (49.7%)	0.166

^aChi-square test

smokers were 2.48 times more likely to develop HTN than those who never smoked (OR 2.48; 95%CI 1.43-4.30). Participants who had never exercised or only exercised occasionally were 1.85 times more likely to develop HTN than those who exercised regularly (OR 1.85; 95%

CI 1.16-2.99). The overweight (BMI 25-29.9 kg/m²) and the obese participants (BMI ≥ 30 kg/m²) were 2.96 and 2.65 times more likely to develop HTN than those who were thin (BMI<18.5) or normal (BMI 18.5-24.9) (OR 2.65; 95%CI 1.69-5.18, OR 2.65; 95%CI 1.04-6.73, respectively). Participants

Table 3
Adjusted odds ratio (OR) with 95% CI of lifestyle factors and hypertension.

Lifestyle factors	Crude		Adjusted ^a		p-value
	OR	95%CI	OR	95%CI	
Smoking status					
Never smoked	1		1		
Ex-and current smoker	2.23	1.41-3.53	2.48	1.43-4.30	0.001 ^b
Alcohol consumption					
Never drank	1		1		
Ex-drinker and currently drinking	1.26	0.27-1.94	0.97	0.58-1.80	0.947
Physical activity by types of jobs					
Non-sedentary	1		1		
Sedentary	1.48	0.92-2.36	0.85	0.56-1.37	0.662
Physical activity by leisure time of exercise					
Usually	1		1		
Occasionally and never	2.14	1.40-3.26	1.85	1.16-2.99	0.009 ^b
Behavioral type A					
Non-type A	1		1		
Type A	1.73	1.08-2.76	1.54	0.91-2.66	0.104
Mental health					
Excellent and normal mental health	1		1		
Mildly stressed and stressful	1.8	1.05-2.83	1.38	0.88-2.36	0.132
Body Mass Index (kg/m ²)					
Thin and normal	1		1		
Overweight	2.88	1.74-4.76	2.96	1.69-5.18	<0.001 ^b
Obese	2.42	1.07-5.45	2.65	1.04-6.73	0.040 ^b
Dietary habits by frequency of intake per week fatty foods					
Low	1		1		
High	1.42	0.67-2.99	1.98	1.23-3.18	0.013 ^b
Salty foods					
Low	1		1		
High	0.59	0.32-1.06	1.07	0.66-1.71	0.808
Meat					
Low	1		1		
High	0.56	0.32-1.06	0.4	0.25-1.19	0.151

^aControlled for all variables in the table including having a family member with hypertension, age, and gender.

^bSignificant risk by *p*-value < 0.05.

who frequently consumed fatty foods were 1.82 times more likely to develop HTN than those who had low intake of fatty foods (OR 1.82; 95%CI 1.13-2.96). Other variables did not demonstrate significant effects (Table 3).

DISCUSSION

The principle findings from this population based case-control study are the epidemiological association between a set of unhealthy lifestyle factors and HTN

among the hill tribe population in Mae Fah Luang District, Chiang Rai Province, Thailand. The set of unhealthy lifestyle were smoking, lack of exercise and poor dietary habits. The hill tribe population in this area of Mae Fah Luang District is considered less developed than the low land population of Chiang Rai. The specific characteristics of this group of hill tribes people are the use of their own dialect of language, smoking hand made cigarettes and eating and drinking local foods and alcohols. A change in lifestyle has occurred during the last 5-7 years due to the influx of new foods from the Thai lowland and from China.

Our results indicate a high prevalence of overweight (BMI = 25-29.9 kg/m²) and obesity (BMI ≥ 30 kg/m²) representing 40.0% of cases and 39.1% of controls. Being overweight or obesity is the result of an energy imbalance between energy intake and energy expenditure arising from poor dietary habits and lack of physical exercise (WHO, 2003). A cohort study suggested for each unit increase in BMI (per kg/m²) there is a 12% increase in the risk of hypertension (Shuger *et al*, 2008).

In this study, physical activity was measured by the level of labor involved in ones job and the frequency of leisure time exercise. Their agricultural jobs with daily travel to and from work (perhaps to a farm), and walking up and down a hill, did not help much to counteract the energy intake, which suggests the necessity for more exercise. Our study also demonstrated the significant risk for hypertension among participants who exercised only occasionally or not at all. This evidence sufficiently exemplifies the cause and effect association among this study population. One needs to consider in cases 44.9% never or only occasionally exercised while in controls 27.6% never or only occasionally exercised.

Cigarette smoking and hypertension are independently associated with higher blood viscosity and higher plasma viscosity (Levenson *et al*, 1987). Our study showed that smoking is a major risk factor for hypertension. Twenty-three point four percent of cases and 16.3% of controls were current smokers. Our study confirms clustering of risk factors which are often associated with clustering of unhealthy lifestyle characteristics. These are most prominent in lower socio-economic groups and in developing countries which adopt a more sedentary lifestyle and Western diets (Beilin, 1999).

Recall bias is a major limitation in case-control studies and a greater attempt to recall unhealthy lifestyle factors is usually found in cases than controls. We were unable to include lipid profiles, which might be more reliable and more specific risk factors for hypertension to include in our analysis because such profiles were unavailable. Centrally distributed obesity and metabolic syndrome is often associated with elevated blood pressure (Zimmet *et al*, 2005). Further studies taking into account local chronic diseases risk factors and surveillance of waist circumferences may be more sensitive and more practical to assess for risk of HTN among this population. There is need for a follow-up study in order to establish a causal relationship to be undertaken after the implementation of health promotion programs.

A set of integrated health promotion programs for a primary prevention program of lifestyle modification should be implemented among this hill tribe group. There is a need for a "quit smoking" program and a program addressing diet counseling and leisure time exercise. The combination of an exercise program with a weight reduction program has been

proven to have extra benefit in reducing a participant's blood pressure (Reid *et al*, 1994). Overweight adults with established hypertension, calorie restriction and a concomitant weight loss of around 5 kg, are able to rapidly lower their blood pressure (Cox *et al*, 1996).

In conclusion, the principle findings of this case-control study identifies major unhealthy lifestyle factors associated with hypertension. These factors are overweight, obesity, insufficient leisure time exercise and smoking. The modification of life styles with integrated health promoting activities should emphasize healthy dietary habits in order to address the issue of weight gain. The introduction of a group exercise program at the end of a day of work would also yield benefits. A smoking cessation program must be a high priority for this study population.

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