Original Research

HYPERTENSION AND ITS NUTRITIONAL ASSOCIATED FACTORS IN ADULTS IN TWO COASTAL COMMUNES, NGHE AN PROVINCE, 2020

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ABSTRACT

Aims: To identify the hypertension status and its nutritional associated factors in adults in two coastal communes of Nghe An province.

Methods: A cross-sectional study was conducted on 1170 adults aged 40-69 years in Nghi Thinh and Nghi Thai communes, Nghi Loc district, Nghe An province. General information, blood pressure, anthropometry, salt intake behavior, alcohol consumption frequency and disease history were collected. The hypertensive prevalence was adjusted for age-sex structure of population. Multilogistic regression analysis was applied to test several models for the association of hypertension to socio–economic conditions, body mass index and waist circumference, high salt intake behavior, and frequency of alcohol consumption.

Results: The age- and sex-adjusted prevalence (95%CI) of hypertension status was 46.3 (42.6–50.0), 11.3 (9.12–14.0), 18.1 (15.1–21.5), 7.97 (6.11–10.3), 16.3 % (13.7–19.3), respectively, in normal, hight-normal, grade 1 hypertension, grade 2 hypertension, and previous diagnosed with current use of antihypertensive drugs. There were still 61.5% of hypertensive subjects without knowing the condition. The independent associated factors of hypertension were age, sex, obese status, vegetable and fruit intake/day (<5 units/day), high salt intake behavior, alcohol consumption (> 1 time/week), previously diagnosed dyslipidemia and family members with hypertension.

Conclusions: The study indicates the high hypertension prevalence in the coastal communes. The most important associated factors for hypertension should be given a great attention in controlling hypertension in the population.

Keywords: *hypertension, nutritional factors, 40-69 years, coastal communes*

I. INTRODUCTION

Hypertension is one of the eight leading causes of death in the world. It is also a major risk factor for heart failure, atrial fibrillation, chronic kidney disease, peripheral vascular disease, impaired cognitive function, etc. The estimated number of deaths caused by hypertension annually are 9.4 million and it will be about 1.56 billion by 2025 worldwide [1]. In Vietnam, the prevalence of hypertension has been increasing sharply: 11.2% in 1992 [2], 16.3% in 2001 [3], 18.3% in 2005 [4], 25.1% between 2003 and 2008 [5]. Although the prevalence of knowing, being treated and controlling for hypertension has been increasing, it was estimated that among people with hypertension in Vietnam, half of them did not know about their disease status.

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Among people with hypertension, two-thirds were treated and only one-third had measures to control their hypertension. The risk of hypertension is higher in older people. Currently, Vietnam is one of the countries with the fastest population aging in the world. As the proportion of elderly people increases, the prevalence of hypertension also increases, leading to an increase in the demand for health care, putting pressure on the health and social security system. Therefore, paying attention to health, preventing and treating hypertension from an early age will contribute to reducing the burden of disease in old age and reducing the prevalence of hypertension in the community.

Hypertension is considered a "silent killer" because 90% of hypertension is unexplained and the disease progresses silently without typical clinical symptoms. The signs of hypertension are often non-specific and the patient usually does not see any difference from normal until its specific signs appear, hypertension has been latent in most patients for a long time before being diagnosed by a doctor. Risk factors that cause an increase in the prevalence of hypertension such as an unhealthy diet (diet with salty foods, lacking of vegetables, etc.), lack of physical activity and being overweight or obese have been identified. These are modifiable factors. Therefore, early detection of hypertension and disease prevention by building a healthy lifestyle and having an appropriate diet are essential. However, we are only focusing on detecting and treating hypertension with the use of drugs, prevention of hypertension and attention on the nutritional issues in hypertension have not yet been paid.

Nghi Loc is a coastal district, located in the southeast of Nghe An province. Over the years, socio-economic conditions as well as infrastructure of Nghi Loc have been significantly improved, which is an area with high economic growth in Nghe An province. Rapid economic growth has greatly affected the lifestyle, eating habits and activities of the population, thereby affecting the prevalence of non-communicable diseases. Therefore, the study aimed at identifying the hypertension status and its nutritional associated factors in people aged 40-69 years in 2 coastal communes in Nghe An province.

II. METHODS

2.1. Study design and population

A cross-sectional study was designed to investigate hypertension status and its nutritional associated factors in adults aged 40-69 years in coastal communes of Nghi Loc district, Nghe An province between September and December 2020. Nghi Thinh and Nghi Thai were two coastal communes, bearing all the characteristics of the coastal of Nghi Loc district as well as of Nghe An province. The study was approved by the Ethics Council and the Scientific Council of the National Institute of Nutrition on September 17, 2020 (Decision 1651/QD-VDD) and by the local authorities.

2.3. Sample size and sampling method

The formula to estimate a proportion in a population was used.

$$n = \frac{Z^2_{(1-\alpha/2)}\, p\,(1 - p)}{d^2}$$

Using $Z_{(1-\alpha/2)}$ =1.96 with 95% confidence, the estimated rate of each indicator with the largest sample size p = 0.5 and the error d = 0.05, the calculated sample size was 384. As the sample was stratified into 3 age groups 40-49, 50-59 and 60-69 years of age, the minimum sample size for the survey was 1,152 subjects.

Sampling method was used as follows:

- Step 1: Select 2 communes Nghi Thai and Nghi Thinh, Nghi Loc district, Nghe An province;
- Step 2: Make a list of all people from 40 to 69 years old, who were currently living in 2 communes, divide them into 3 groups according to their age: groups of 40-49, 50-59 and 60-69 year-old people;
- Step 3: From the established list, for each age group of a commune, randomly select 200 subjects.

Inclusion criteria: Adults from 40 to 69 years old, living in the study areas, able to provide complete information, agree to participate and accept to comply with the requirements of the study.

Exclusion criteria: People with deformities affecting body shape such as hunchback, birth defects, dumbness, deafness, confusion, mental disorders, and pregnant women.

As a result, a total of 1,170 habitants met both inclusive and exclusive criteria were recruited in the study.

2.4. Data collection

The following data collection methods were performed on all study participants.

Direct interview was used to collect general information with a pre-designed questionnaire, including: age, occupation, education level, economic conditions, personal and family history of hypertension diabetes and dyslipidemia.

Weight, height and waist were measured to assess subject's anthropometric status: HealthOMeter 349KLX digital scale with 0.1 kg accuracy was used to measure the subjects' weight. UNICEF three-piece wooden ruler with an accuracy of 0.1 cm was used to measure their height. Waist circumference (WC) was measured with a soft, non-elastic tape measure with an accuracy of 0.1 cm.

Body mass index (BMI) was classified according to BMI cut-off (kg/m^2) recommended for the Asia-Pacific region: chronic energy deficiency (CED) (<18.5), normal (18.5–22.9), overweight (23–24.9), obesity (> 25) [6]. Subjects were considered to be abdominal obese when they had WC ≥ 90 cm in men and ≥ 80 cm in women [7]. The combination between BMI and WC groups led to groups: normal BMI and WC, overweight only, obesity only, abdominal obesity only, overweight + abdominal obesity, obesity + abdominal obesity)

Blood pressure (BP) was measured according to the instructions of the Ministry of Health [8] using an OMRON model. Systolic/diastolic blood pressures were used to classify hypertensive status: normal BP (< 130/85 mmHg), high-normal BP (130–139/85–89 mmHg), grade 1 hypertension (140–159/90–99 mmHg), and grade 2 hypertension (≥160/100 mmHg). Hypertension was defined as systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥

90mmHg or taking antihypertensive medication [9]. The normal control group included subjects with normal BP as the high-normal BP can be classified as prehypertension with high risk of developing hypertension.

Direct interview was conducted on semi-quantitative food consumption frequency and hypertension risk factors by pre-designed questionnaires. The questionnaires consisted of three parts:

(1) Salt consumption: the habit of using salt in cooking, of eating salty foods and processed salty foods. High salt intake behaviors (total scores=3): frequency of dipping or adding salty seasoning when eating, frequency of adding salty seasoning when preparing food, and frequency of eating processed salty foods. Each behavior was classified into two levels: "often" and "sometimes/rarely/never". The response of "often" scored 1 point and "sometimes/rarely/never" scored 0.

(2) Vegetable and fruit intake: number of days per *week* with vegetable or fruit consumption, amount of vegetable or fruit consumed per day. According to World Health Organization (WHO) recommendations, people should eat at least 400g of green vegetables and fruits per day, equivalent to 5 units of fruits and vegetables [10] (1 unit = 80g edible part of fruits or vegetables).

(3) Frequency of alcohol consumption including wine, beer and alcoholic beverages was recorded and classified in two groups: > 1 time/week and ≤ 1 time/week.

2.4. Data analysis

The distribution of continuous variables was checked before statistical analysis.

Data were weighted, taken into account the study design, the probability of sampling, and none–response rate. The estimated prevalences of normal BP, high-normal BP, grade 1 hypertension, grade 2 hypertension, and previously diagnosed hypertension with current use antihypertensive drugs were computed for the coastal communes of whole population aged 40–69 years together with subgroups according to age group and gender.

Multivariable logistic regression analysis with backward stepwise procedure was used to test several models for the associations of hypertension to the potential associated factors including: (i) socio–economic condition: age, gender, residence, occupation, income level, education level, (ii) family history of hypertension, previously diagnosed dislipidemia and diabetes; (iii) BMI and waist circumference; (iv) high salt intake behavior; and (v) alcohol consumption.

Data was cleaned before data entry with Epidata 3.1 software. Data were performed using SPSS version 20 (SPSS, Chicago, USA) and Stata version 16 (Stata Corporation, College Station,TX, USA). All of statistical tests were two-tailed and $p < 0.05$ was considered as significant.

III. RESULTS

Table 1. *Demographic characteristics of participants*

Characteristics	Total (*n*=1170)	Nghi Thinh (*n*=570)	Nghi Thai (*n*=600)	*p*-value by χ^2 test
Gender				
Men	283 (24.2)	157 (27.5)	126 (21.0)	0.009
Women	887 (75.8)	413 (72.5)	474 (79.0)	
Age group				
40-49 y	384 (32.8)	174 (30.5)	210 (35.0)	
50-59 y	398 (34.0)	204 (35.8)	194 (32.3)	0.235
60-69 y	388(33.2)	192 (33.7)	196 (32.7)	
Education level				
Illiterate	24 (2.1)	15 (2.6)	9 (1.5)	
Primary & Junior high school	854 (73.0)	372 (65.3)	482 (80.3)	<0.001
High school	292 (25.0)	183 (32.1)	109 (18.2)	
Occupation				
Farmer	889 (76.0)	445 (78.1)	444 (74.0)	
Factory worker	24 (2.1)	15 (2.6)	9 (1.5)	
Trader, service giver	87 (7.4)	26 (4.6)	61 (10.2)	0.001
Freelance worker	51 (4.4)	21 (3.7)	30 (5.0)	
Retired	46 (3.9)	30 (5.3)	16 (2.7)	
Others	73 (6.2)	33 (5.8)	40 (6.7)	
Income level				
Low and average	1014 (86.7)	514 (90.2)	500 (83.3)	
Poor/near poor	67 (5.7)	23 (4.0)	44 (7.3)	0.003
Well-off	89 (7.6)	33 (5.8)	56 (9.3)	

Table 1 shows the demographic characteristics of the study participants. In general, there was significant difference between two communes in socio-economic status (age, education level, occupation, and income level). The major part of the participants was in groups with education of primary & junior high school, farmer, and low and average income.

The crude prevalence of hypertension status in 2 coastal communes is shown in Table 2. Table 3 shows the age- and sex-adjusted prevalence of hypertension status in two communes. The adjusted prevalence (95%CI) of hypertension was 42.4 (38.7–46.2) % in total communes, and significantly higher in men [52.2 (45.4–59)%] compared to women [32.5 (29.5–35.6%)] ($p< 0.0001$). The age- and sex-adjusted prevalence of blood pressure was 46.3, 11.3, 18.1, 7.97, and 16.3 %, respectively, in normal, high-normal, grade 1 hypertension, grade 2 hypertension, and previous diagnosed with current use of antihypertensive drugs. The rate of newly diagnosed hypertension was 26.1 (22.7–29.8) %. There were still 61.5% of hypertension subjects without knowing the condition. The hypertension prevalences in 50–59 (52.3%) and 60–69 (52.4%) year groups were significantly higher compared to 40–49 year group (28%).

Table 2. *Crude prevalence of hypertension status in two coastal communes*

	n	Previously undiagnosed blood pressures				Current use of anti-hypertensive drugs
		Normal blood pressure	High-Normal blood pressure	Grade 1 hyper-tension	Grade 2 hyper-tension	
Men						
40–49 y	75	38 (50.7)	5 (6.7)	16 (21.3)	9 (12.0)	7 (9.3)
50–59 y	87	22 (25.3)	9 (10.3)	21 (24.1)	12 (13.8)	23 (26.4)
60–69 y	121	44 (36.4)	17 (14.0)	23 (19.0)	12 (9.9)	25 (20.7)
40–69 y	283	104 (36.7)	31 (11.0)	60 (21.2)	33 (11.7)	55 (19.4)
Women						
40–49 y	309	229 (74.1)	32 (10.4)	22 (7.1)	5 (1.6)	21 (6.8)
50–59 y	311	153 (49.2)	43 (13.8)	48 (15.4)	20 (6.4)	47 (15.1)
60–69 y	267	98 (36.7)	28 (10.5)	44 (16.5)	21 (7.9)	76 (28.5)
40–69 y	887	480 (54.1)	103 (11.6)	114 (12.9)	46 (5.2)	144 (16.2)
Total						
40–49 y	384	267 (69.5)	37 (9.6)	38 (9.9)	14 (3.6)	28 (7.3)
50–59 y	398	175 (44.0)	52 (13.1)	69 (17.3)	32 (8.0)	70 (17.6)
60–69 y	388	142 (36.6)	45 (11.6)	67 (17.3)	33 (8.5)	101 (26.0)
40–69 y	1170	584 (49.9)	134 (11.5)	174 (14.9)	79 (6.8)	199 (17.0)

Table 3. *Age-* and sex-*adjusted prevalence of hypertension in two coastal communes*

	Previously undiagnosed blood pressures				Current use of antihypertensive drugs
	Normal blood pressure	High-Normal blood pressure	Grade 1 hyper-tension	Grade 2 hyper-tension	
Men					
40–49 y	51.0 (38.8–63.1)	9.0 (3.70–20.3)	23.0 (14.1–35.3)	8.7 (4.30–16.8)	8.30 (3.70–17.5)
50–59 y	23.0 (15.0–33.6)	10.5 (5.3–19.9)	25.2 (16.5–36.4)	12.7 (7.0–22.1)	28.6 (19.3–40.1)
60–69 y	34.3 (26.1–43.5)	14.0 (8.7–21.8)	21.0 (14.2–29.9)	11.1 (6.3–18.8)	19.6 (13.3–28.0)
40–69 y	37.1 (30.7–43.9)	10.7 (7.1–15.8)	23.3 (17.9–29.8)	10.7 (7.4–15.3)	18.2 (13.6–23.9)
Women					
40–49 y	73.6 (68.3–78.2)	10.5 (7.5–14.5)	7.30 (4.9– 10.9)	1.70 (0.7–4.0)	6.90 (4.50–10.3)
50–59 y	47.8 (42.2–53.6)	14.2 (10.6–18.8)	16.1 (12.2–20.8)	7.2 (4.7–11.0)	14.7 (11.1–19.2)
60–69 y	35.7 (30.1–41.8)	11.1 (7.70–15.7)	17.4 (13.1–22.7)	8.2 (5.40–12.4)	27.5 (22.4–33.3)
40–69 y	55.5 (52.3–58.8)	11.8 (9.92–14.4)	12.8 (10.7–15.2)	5.2 (3.89–6.93)	14.5 (12.4–16.9)
Total					
40–49 y	62.2 (55.2–68.8)	9.76 (6.26–14.9)	15.2 (10.4–21.8)	5.2 (2.87–9.32)	7.56 (4.68–12.0)
50–59 y	35.4 (29.8–41.3)	12.3 (8.81–17.0)	20.6 (15.7–26.7)	10 (6.63–14.8)	21.7 (16.5–27.9)
60–69 y	35.0 (29.9–40.4)	12.5 (9.21–16.9)	19.2 (15.0–24.3)	9.7 (6.67–13.8)	23.6 (19.3–28.5)
40–69 y	46.3 (42.6–50.0)	11.3 (9.12–14.0)	18.1 (15.1–21.5)	8.0 (6.11–10.3)	16.3 (13.7–19.3)

Table 4. *Independent factors associated with hypertension in two coastal communes*

Independent factors	OR (95%CI)	*p*-value
Gender (men vs. women)	1.86 (1.22–2.82)	0.004
Age (year)	1.09 (1.07–1.11)	<0.001
Nutritional status		
Normal BMI and WC	1.0 (reference)	
Overweight only	1.07 (0.56–2.06)	0.837
Obesity only	7.38 (2.12–25.7)	0.002
Chronic energy deficiency	0.61 (0.35–1.06)	0.079
Abdominal obesity+Normal BMI	1.10 (0.72–1.70)	0.656
Abdominal obesity+Overweight	1.75 (1.13–2.71)	0.012
Abdominal obesity+Obesity	2.05 (1.21–3.48)	0.008
Vegetable and fruit intake/day (<5 units/day)	1.63 (1.13–2.37)	0.010
Scores of high salt intake behavior	1.22 (1.07–1.39)	0.003
Alcohol consumption (> 1 time/week)	2.89 (1.57–5.31)	0.001
History of dyslipidemia	2.59 (1.36–4.93)	0.004
Family members with hypertension	5.22 (3.48–7.84)	<0.001

p-value by multivariable logistic regression adjusted for socio-economic status (residence, education level, occupation and income level) and physical activity. BMI, body mass index; WC, waist circumstance.

Table 4 shows that the significantly associated factors of hypertension were age, sex, obese status, vegetable and fruit intake/day (<5 units/day), high salt intake behavior, alcohol consumption (> 1 time/week), previously diagnosed dyslipidemia and family members with hypertension after adjusted socio-economic status (residence, education level, occupation and income level) and physical activity. The associated factors remained statistically significant when adding the variables of frequency of food consumption.

IV. DISCUSSION

4.1. Hypertension status

In the study, the adjusted prevalence of hypertension was 42.4 % in the coastal population aged 40–69 years in Nghe An province, 2020. This prevalence was lower than that (44.8%) in the same age group in Thua Thien Hue Province in 2015 [11] and higher than that (38.7%) in a rural population aged 40 and over in a commune of Tu Ky district, Hai Duong province in 2021 [12]. In 50–69 age group, the hypertension prevalence of this study (52.2%) was higher than that in the STEPS survey (40.2%) in 2015 [13]. The difference in socio-economic status and sex-age structure of populations could explain for the difference among studies.

In the present study, the similar adjusted hypertension prevalences (52%) in 50–59 and 60–69 year groups were higher compared to 40–49 year group (28%). The prevalence of hypertension in each age group of the study was higher than that of the study in a Northern mountainous commune of Thai Nguyen province in 2012 (40–49: 26.3%; 50–59: 35.2%; 60–69: 48.4%) [14] and in two rural communes in Hanam province belonging to the Red River Delta Region of the Northern Vietnam in 2016 (40–49: 10.8%; 50–59: 24.5% and 60–69: 42.7%) [15]. The results of the study further demonstrated the close association between age and the prevalence of hypertension. As the age increases, the blood vessel wall becomes aging and harden, reducing their elasticity, so the pressure in the blood vessels will increase leading the higher blood pressure in the elderly in compare with that of young people. Besides, we can see an increase in the prevalence of hypertension in the community in general and in each age group in particular. Hypertension is gradually rejuvenating, which increases the risk of disease and leads to the possibility of severe disease progression and disease symptoms.

That the hypertension prevalence was much higher in men (52.2%) compared to women (32.5%) was consistently found in the present study and others in Vietnam, for instance, in Hai Duong province (men: 46.1%, women: 34.4%) [12], in Cham people in the South-Central Coast (men: 34.4%, women: 30.3%) [16]. The trend of sex difference in hypertension prevalence was observed in a study in Thua Thien Hue (men: 31.4%, women: 39.2%, $p > 0.05$) [17]. The study in Bangladesh reported that the hypertension prevalence was lower (37.4%) in men compared to women (62.6%) [18]. Men often have a higher blood pressure than that of women for most of their life, due to differences in body hormones and genes in sex chromosomes [19]. Other than that, risk factors such as smoking and drinking alcohol are more common in men than in women. However, after the age of 60, women were more likely to have hypertension and less likely to maintain hypertension control than men of the same age range [20].

4.2. Nutritional associated factors of hypertension

The study showed that family history of hypertension was a associated factor for hypertension (OR=5.22, p <0.001), consistent with some studies. According to the study of Masahiko Tozawa, the higher number of family member with hypertension, the higher risk of being hypertension. If there was one family member with hypertension, he had 2.74 times higher risk of hypertension, two members was 4.62 and three members was 6.04 [21].

Salty eating is one of the risk factors for hypertension, cardiovascular disease, kidney failure and a number of other diseases. According to the WHO salt consumption survey in 2012, Vietnamese person consumed 9.4g of salt per day in average, much higher than the WHO recommendation of 5g/day [22]. The results showed that hypertention associated with high salt intake behaviors: frequency of dipping or adding salty seasoning when eating, frequency of adding salty seasoning when preparing food, and frequency of eating processed salty foods. This finding suggests the key solution in

preventing hypertension. The National Strategy for Prevention and Control of Noncommunicable Diseases aims to reduce the average salt consumption per capita by 30% by 2025, equivalence to less than 7 grams/day. Therefore, it is necessary to continue to have strong interventions and more effective communication to achieve the set goals.

The study has confirmed the WHO recommendation of eating at least 5 unit per day of vegetable and fruit intake to reduce the hypertension risk. In recent years, the Government of Vietnam has implemented many activities to improve public health, especially in nutrition. People with hypertension were aware of their disease and recommended to eat more fruits and vegetables but their practice was not improved. More effective communication on consuming fruits and vegetables also needed.

In the study, subjects with a history of dyslipidemia were more likely to have hypertension (OR= 2.59, *p*= 0.004). The finding highlights the important role of dyslipidemia in the pathogenesis of hypertension. Endothelial damage caused by dislipidemia results to the loss of physiological vasomotor activity that may become manifested as increased blood pressure [23, 24]. Individuals with a history of dyslipidemia need a specific attention in dietary counselling to lower serum cholesterols.

This is a cross-sectional study on the community, so it was not possible to establish a cause-and-effect relationship between the factors. Some information in the study was self-provided by the subjects, such as the diagnosis of diabetes and dyslipidemia. So it is necessary to conduct more intervention studies to monitor and evaluate more accurately effects of these factors.

V. CONCLUSION

The study highlighted an alarmingly high prevalence of hypertension in the coastal communes of Nghi Loc district, Nghe An province. The most important factors associated to hypertension included age, sex, obese status, vegetable and fruit intake/day (<5 units/day), high salt intake behaviors, alcohol consumption (> 1 time/week), previously diagnosed dyslipidemia and family members with hypertension.

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