



Research article

Hypertension in a mountainous province of Vietnam: prevalence and risk factors



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ABSTRACT

Background: Hypertension (HTN) significantly contributes to global disease burden, and its prevalence varies amongst different countries and regions. This work is aimed to characterize the hypertensive prevalence and identify risk factors for HTN among the residents in five locations (four communes and one town) of Moc Chau district (Son La province, Vietnam).

Methods: A cross-sectional study with a cross-sectional methodology was done in selected places from August 2018 to December 2018. We interviewed 197 participants aged equal to or more than 18 years old and measured their blood pressure (BP). Univariate and multivariate logistic regression were applied.

Results: The overall HTN prevalence of 30.0% was recorded. The differences of HTN prevalence rates were seen by several characters including age groups ($p < 0.001$), accompanying disease ($p < 0.001$) and alcohol drinking ($p < 0.05$). Factors independently associated with hypertension were age (ORs: 3.1 [1.1–9.1]; 6.1 [1.7–22.3]), much salty consumption (OR: 2.6 [1.1–6.6]), alcohol use (OR: 3.1 [1.2–8.1]), HTN familial history (OR: 4.2 [1.3–13.3]) and at least one suffering disease (OR: 5.2 [2.1–12.7]).

Conclusions: Thus, this study highlighted the high overall HTN prevalence in the Vietnam Northwestern region. Significant differences of HTN rate were observed among several characteristics such as age groups, accompanying disease and alcohol drinking. Age group, much salty consumption, alcohol use, hypertension familial history and at least one suffering disease were risk factors for HTN in study group.

1. Introduction

Hypertension (HTN), one of the most crucial risk factors for cardiovascular diseases (CVDs), results in increasing mortality rate [1].

Globally, in early 2014, approximately 22.0% of population aged 18 years or over suffered from HTN [2]. The situation of hypertension is increasing along with its enlarged epidemiology, which contributes to increase the global burden of overall disease [3]. Previous

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epidemiological researches have indicated that HTN is one of the most popular causes for CVDs in Southeast Asian countries [4] whose hypertensive figure is estimated as one-third of the adults experiencing high blood pressure (BP) each year [4]. Particularly, there are the significant variances in the hypertensive proportion in the Asia countries such as 29.6% in China (2014) [5], 31.4% in India (2014) [4], and 33.4% in Indonesia (2018) [6].

Vietnam is a low-middle income country where nationally representative sample reveals that 47.3% of the population (20.1 million) aged 25 years or older suffered from hypertension. A most recent study in two communes (Tuyen Quang province, Vietnam) located in the Northeastern mountainous region reported that the overall prevalence of HTN was 47.3% in the population over 18 years old [7], which was significantly higher compared to previous studies in Vietnam [8, 9]. Thus, it is needful to update the regular information on HTN in various areas belonging to northern mountainous region such as in Moc Chau - a mountainous district of Son La province in Northwestern region of Vietnam.

In Moc Chau district, currently, there has been no previous up-to-date epidemiological evidence in the incidence of hypertension as well as its surrounding issues. This study was conducted with expectation to contribute to fill this gap in specifically planning and implementing primary health care system. Our study hypothesis are high prevalence of hypertension, and several risk factors such as socioeconomic characteristics, nutrition status and health risk behaviors are positively associated with hypertension among people living in communes and town of Moc Chau district in Son La province.

2. Methods

2.1. Study design

To conduct this survey, the cross-sectional methodology was applied in five selected areas (four communes: Long Sap, Muong Sang, Chieng Son, Chieng Hac and one town - Nong Truong Moc Chau town) of Moc Chau District in Son La province between August 2018 and December 2018. All participants, known as the locals, aged 18 years and older and lived in study areas.

2.2. Sample size

The following sample size formula was used:

$$n = Z_{1-\frac{\alpha}{2}}^2 \frac{p(1-p)}{d^2}$$

Where:

n is the minimum sample size,

α is a level of statistical significance ($\alpha = 0.05$ with 95% confidence interval)

Z is the value from the standard distribution (then replace the table is that $Z_{1-\frac{\alpha}{2}}^2 = 1.96$ with $\alpha = 0.05$).

$p = 0.473$ which was recorded overall hypertension prevalence among Vietnam population (25 years and older) [10], $d = 0.1$ is the relative error of the study (appropriate with $p = 0.473$). Calculated minimum sample size was 190. However, we had 197 subjects participated in this research.

Sampling: A simple random sampling technique was employed to ensure the presentation of subjects met criteria. In the first step, we listed all the people aged 18 and older living in four communes and one town mentioned above. The second stage included selecting 197 objects from available list. In the third stage, all participants were invited to examine health and to participate in the research. Variables and indexes were collected in the final stage.

2.3. Measurement

The Japanes Alpk2 sphygmomanometer was used for BP measurement. We measured participants' BP on their right arms (three times for each participant) as previously [11, 12]. Briefly, the participants were recommended to take a rest of 15 min before the first measurement and to take a 30-second break between BP measurements. The subjects were informed no consumption of any caffeinated beverages or smoke, and no physical activities at least 30 min before the first measurement. After 3 times BP measurements, the systolic BP (SBP) and diastolic BP (DBP) values were calculated by add up 3 values (SBP or DBP), then divide the average and officially recorded. All participants were also measured body weight and height. We utilized Tanita weight scale for body weight and measuring tape for height.

2.4. Definitions

BP was classified according to the ESC/ESH 2013 guidelines [13]. The subjects, had SBP ≥ 140 mmHg and/or DBP ≥ 90 mmHg, took anti-hypertensive drugs daily or at least two times, were diagnosed with hypertension [13].

Body mass index (BMI) was determined as the weight of a person divided by the square of his/her height (kg/m^2) [14, 15, 16]. The following BMI classification suggested for Asia adults: underweight (<18.5), normal weight (18.5 to <23), overweight (23 to <25), and obesity (≥ 25) [17].

Accompanying disease was defined that the individuals have suffered from at least one disease including stroke, transient anaemia, diabetes mellitus, Parkinson, arthritis and cancer.

Family history of hypertension was defined that the individuals reported whether or not their parents or siblings of the same generation have existed hypertension. The individuals were considered as much salty consumption when they reported to consume more than 5 g (a teaspoon) of salt per day [18].

Alcohol use is recorded when subjects drink alcohol at least once per week in the previous year. We applied the International Physical Activity Questionnaire (IPAQ) to measure physical activities. The individuals were considered capable of physical activity if they reported participation in moderate-intensity physical activity and vigorous-intensity one for at least 60 min/day/week [19].

2.5. Data analysis

All data was entered to the software Epidata 3.1, and then was analyzed using software Stata 16.0. The descriptive method was used to describe the status of HTN by selected characteristics (such as percentage and 95% confidence interval). To study the risk factors for HTN, univariate and multivariable analysis with logistic regression were applied. The statistical significance was considered as $P < 0.05$.

2.6. Research ethics

All subjects received the adequate information of the research purposes. The participation agreement was voluntary for all residents. All participants' personal information was kept secretly and encrypted. All individuals were promptly advised and treated if they were diagnosed with high BP. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This study was proved by the institutional board of the Institute of Preventive Medicine and Public Health on 18th April 2018. Informed consent was obtained from all individual participants included in the study.

Table 1. Demographic of study subjects (n = 197).

Characteristic	n	%
Gender		
Male	97	49.2
Female	100	50.8
Age group		
18-34	49	24.9
35-54	104	52.8
≥55	44	22.3
Median (min-max)	44.8 (21–76)	
Ethnic group		
Kinh	61	31.0
Thai	115	58.4
Other ^a	21	10.6
Education		
Primary school or under	82	42.6
Secondary school	77	39.1
High school and higher	36	18.3
BMI (kg/m²)		
<18.5 (underweight)	8	4.0
18.5 to <23.0 (normal)	140	71.1
23.0 ≤ to <25.0 (overweight)	25	12.7
≥25 (obese)	24	12.2

^a Other ethnic groups include Nung, Mong, and Muong.

3. Results

The proportion of the genders was both about 50.0%. Most people aged 35–54 years (52.8%), 24.9% was in the 18–34-year-old group and 22.3% people was 55 years and above. The proportion of people belonging to Thai ethnic group was the highest, while the figures for Kinh and others were 31% and 10.7%, respectively. While the proportion of people with primary or less education was 42.1%, the figures for lower secondary and upper secondary and higher were 39.5% and 18.5% respectively. Most people were in the normal group of BMI (71.1%) (Table 1).

Table 2 presents the overall hypertension prevalence of 30.0%. The proportion of HTN was the highest among people aged ≥55 years old (52.3%), while these figures were lower in the 35–54 -year-old and 18–34 -year-old group (29.8% and 10.2% respectively). The HTN prevalence was higher among subjects suffering from accompanying diseases than among those with no accompanying diseases (44.3% and 20.3% respectively). This prevalence in the alcohol consumers (40.3%) was higher than for the another subgroup (25.3%). These differences were statistically significant ($p < 0.05$).

People in age groups of 35–54 year and ≥55 years had significantly higher odds of HTN than ones in the 18–34 -year-old group (OR: 3.1 and 6.1 respectively). The odds of hypertension was 5.2 times higher among subjects suffering from at least one accompanying diseases than among those without accompanying diseases. People reporting family history of hypertension had 4.2 (95%CI 1.3–13.3) times higher of HTN rate than those without hypertensive family history. The odds of hypertension among subjects consuming salty was 2.6 (1.1–6.6) times higher than those reporting no use. Current alcohol users were more likely to be hypertension compared to who without use (OR 3.1; 95%CI 1.2–8.1) (Table 3).

4. Discussion

In this study, we reported that the overall hypertension prevalence was 30.0%. This result was significantly higher than previous results in the Vietnam northern region such as 16.3% in the study of Pham GK et al (2001–2002) [19] and 23.3% in Duc AH's study (2013) [20]. However,

the figure for hypertension in the study of Nhon BV et al (47.3%) was higher than ours [7]. This could be due to the difference of the study location and sample. In our study, five selected study areas are low economic communes and town, existing difficult access to primary health services as well as inadequate medical equipment at local facilities. In particular, most respondents in this survey, belong to ethnic minority groups, exist false beliefs in their life style that may be a risk factor for disease' formation [21]. Nevertheless, our study was much lower overall hypertensive prevalence than the most recent study of Nhon BV in two communes of Chiem Hoa district where also located in the Northeast region of Vietnam. The reasonable explanation for this might be that most of the subjects in the Nhon BV's report were the elderly (aged 60 years and above), so lifestyles and long-term living regime affected their BP. A systematic review and meta-analysis of Lana M et al (2019) recently indicated that the overall Vietnamese hypertensive rate was 21.1. Compared to this updated result, the present figure was much higher. The pattern of our study was consistent with the survey result reported in Indonesia (2018) (33.4%) [6]. This could be due to, firstly, both the studies sampled in those aged 18 years and above in which the average age of two studies was similar (45 and 44.8 years old), as well as, secondly, the similar lifestyle characteristic amongst these Southeast Asia countries. The hypertensive prevalence of approximately 30% also found in the earlier reports from China (2014), India (2014) and the U.S. (2011–2014) [5,22,23]. In Vietnam, overall, poor accessibility of medical facilities combined with restricted handiness of adequate treatment was exhibited to be linked to hypertension. In addition, the population's lack of knowledge regarding hypertension, the link between physicians and patients, the adherence to medication, and health system characteristics were recommended to play a crucial role within the perspective of the population to the disease [24].

Processed foods and meals contain most consumed salt in Western developed countries, whereas in Vietnam, the salt consumption mainly concentrates among table salt or salty condiments at home, which accounts for 80% of the salt consumed [25]. Our study found that people who consumed excess salty were more likely to have hypertension, compared to those reported sufficient salt consumption. Many studies have provided similar evidence that consumption of excess salt was positively associated with high BP [26, 27]. Nevertheless, the Nhon BV's

Table 2. The hypertensive prevalence by selected characteristics (n = 197).

Selected characteristics	Hypertension % (95%CI)	p-value
Sex		0.987
Male	29.9 (21.5–39.9)	
Female	30.0 (21.7–39.8)	
Age groups		<0.001***
18–34	10.2 (4.2–22.9)	
35–54	29.8 (21.7–39.4)	
≥55	52.3 (31.2–67.0)	
Ethnic groups		0.844
Kinh	32.8 (22.0–45.8)	
Thai	28.7 (21.1–37.8)	
Other	28.6 (12.5–52.9)	
Education		0.312
Primary school or under	35.7 (26.0–46.7)	
Secondary school	26.0 (17.2–37.1)	
High school and higher	25.0 (13.1–42.4)	
BMI (kg/m ²)		0.298
<18.5 (underweight)	37.5 (8.7–79.2)	
18.5 to <23.0 (normal)	26.4 (19.7–34.4)	
23.0 ≤ to <25.0 (overweight)	44.0 (25.2–64.7)	
≥25 (obese)	33.3 (16.7–55.5)	
Accompanying diseases		<0.001***
No	20.3 (13.9–28.7)	
Yes	44.3 (33.6–55.6)	
Family history of hypertension		0.230
No	21.2 (10.0–39.4)	
Yes	31.7 (25.0–39.3)	
Salty consumption (≥5 g of salt per day)		0.212
No	22.9 (12.9–37.4)	
Yes	32.4 (25.3–40.5)	
Drinking alcohol		<0.05*
No	25.2 (18.5–33.3)	
Yes	40.3 (28.6–53.2)	
Physical activity		0.911
No	30.5 (19.9–43.7)	
Yes	29.7 (22.6–38.0)	
Total	30.0 (23.9–36.8)	

*, **, ***: significant at 0.05, 0.01 and 0.001 respectively.

study in Chiem Hoa district where located in this northern mountainous area reported that no significant association of hypertension and salt consumption was observed although the odds of having hypertension was 1.1 times higher among people having experienced salty diet than those in sufficient salt consumption ($p > 0.05$) [7]. The difference might be due to that the standard of salty consumption was not the same. The WHO has noted that “Reducing salt intake has been identified as one of the most cost-effective measures countries can take to improve population health outcomes. Key salt reduction measures will generate an extra year of healthy life for a cost that falls below the average annual income or gross domestic product per person”. Therefore, our study’s results will contribute to an important part towards managing the general living regime for the community in this country.

We recorded that having HTN was positively related to the use of alcohol. The result was in line with the findings by Todkar in India, Wei in China and Raja Ram Dhungana in Nepal [28, 29, 30]. However, there are several studies that found protective effects of alcohol consumption on hypertension [31, 32]. Some also failed to demonstrate any significant association between consumption of alcohol and hypertension [33, 34]. These differences in findings might have occurred because of difference

in amount and concentration of alcohol consumed. Sacco, Kannel and Ellison et al concluded that protective effect of alcohol in hypertension and other cardiovascular diseases was mainly detected among the moderate alcohol users (up to two standard drinks/day). The effect was opposite among ones consuming seven and more drinks/day. A meta-analysis of 15 randomized controlled trials observed a dose response relationship of alcohol reduction and on BP. This is supported by the current findings which demonstrated that the median number of standard drinks consumed was significantly higher among the hypertensive participants. Further research is required to explain the apparent bidirectional effects of alcohol intake on hypertension.

Family history was displayed as a non-modifiable risk factor for HTN. In this study, people who reported their existed family history of HTN had more likely to induce HTN than those without existing a hypertensive history one (OR: 4.2). Several available studies before in different countries have also indicated similar an increased risk (2–4 times higher) [35, 36, 37, 38, 39], which compared to who having no a family history of HTN. Most of the previous studies in Vietnam did not consider the constant factor of family history, so this significant relationship should be considered as one of the highlights in our research. This result plays

Table 3. Risk factors for hypertension: logistic multivariate regression (n = 197).

Selected factors	OR	95% CI
Gender		
Male	1	-
Female	1.2	0.5–3.0
Age group		
18–34	1	-
35–54	3.1*	1.1–9.1
≥55	6.1**	1.7–22.3
Ethnicity		
Kinh	1	-
Thai	0.7	0.3–1.8
Other	1.4	0.3–6.1
Education		
Primary or less	1	-
secondary school	0.7	0.3–1.6
school and higher	0.9	0.2–3.0
BMI (kg/m²)		
<18.5 (underweight)	1	-
18.5 to <23.0 (normal)	0.3	0.1–1.8
23.0 ≤ to <25.0 (overweight)	0.6	0.1–3.7
≥25 (obese)	0.4	0.1–2.7
Accompanying diseases		
No	1	-
Yes	5.2***	2.1–12.7
Family history of HTN		
No	1	-
Yes	4.2*	1.3–13.3
Salty eating		
No	1	-
Yes	2.6*	1.1–6.6
Drinking alcohol		
No	1	-
Yes	3.1*	1.2–8.1
Physical activity		
No	1	-
Yes	0.5	0.2–1.3

OR: Odds ratio; CI: confidence interval.

*, **, *** significant at 0.05, 0.01 and 0.001, respectively.

important premise to fill the gap in the link between family factors and BP in the Vietnam delta regions where accounts for a quarter of this country. Also in this study, we have discovered that the hypertensive prevalence was significantly higher in patients with at least one accompanying disease than those without. Presence of at least one attached disease significantly increased the risk for hypertension. This result are perfectly reasonable because reported diseases (stroke, transient anemia, diabetes mellitus, Parkinson, arthritis and cancer) in the present study have been proved to have the links with high blood pressure level.

We acknowledge the limitations that exist in current research. First, this cross-sectional study can not allow us to determine the relationship of cause and effect. Second, this study was the inability to asses other variables such as psychological stress and biochemical parameters, which may function as a confounding factor or an interacting variable in the assessment of association between other independent variables and hypertension. Third, several selected risk factors in this study were self-reported by all participants (diet, alcohol consumption, salt consumption, etc..), and no validation of the information was confirmed. Fourth, this study only measure PA on the right arm which in some case can lead to minor bias, especially with people had severe cardiovascular diseases.

5. Conclusions

This is the first study indicating the high overall prevalence of HTN in study locations in the Vietnam Northwestern region. We observed the differences of hypertension by several characters of age groups, accompanying disease and alcohol drinking. Age group, much salty consumption, alcohol use, hypertension familial history and at least one suffering disease were significantly risk factors for hypertension.

Declarations

Author contribution statement

K. Nam, N. Van, L. Hoang, D. Chu: conceived and designed the experiments; performed the experiments; analyzed and interpreted the data; contributed reagents, materials, analysis tools or data; wrote the paper.

T. Duc, T. Ha, V. Tuan, P. Dinh, H. Thu, P. Show, V. Nga, L. Minh: conceived and designed the experiments; analyzed and interpreted the data; contributed reagents, materials, analysis tools or data; wrote the paper.

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Competing interest statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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References

- [1] WHO, Global health risks, Mortality and burden of Disease Attributable to Selected Major Risks, World Health Organization, Geneva, Switzerland, 2009.
- [2] WHO, Cardiovascular Diseases (CVDs), 2017. Available from: <https://www.who.int/en/news-room/fact-sheets/detail/cardiovascular-diseases-cvds>.
- [3] S. Bromfield, P. Muntner, High blood pressure: the leading global burden of disease risk factor and the need for worldwide prevention programs, *Curr. Hypertens. Rep.* 15 (3) (2013) 134–136.
- [4] D. Neupane, et al., Prevalence of hypertension in member countries of South Asian Association for Regional Cooperation (SAARC): systematic review and meta-analysis, *Medicine* 93 (13) (2014).
- [5] J. Wang, et al., Prevalence, awareness, treatment, and control of hypertension in China: results from a national survey, *Am. J. Hypertens.* 27 (11) (2014) 1355–1361.
- [6] K. Peltzer, S. Pengpid, The prevalence and social determinants of hypertension among adults in Indonesia: a cross-sectional population-based national survey, *Int. J. Hypertens.* 2018 (2018), 9 pages.
- [7] N. Bui Van, et al., Prevalence and risk factors of hypertension in two communes in the Vietnam northern mountainous, 2017, *BioMed Res. Int.* 2018 (2018).
- [8] H. Van Minh, et al., Blood pressure in adult rural INDEPTH population in Asia, *Glob. Health Action* 2 (1) (2009) 2010.
- [9] P. Son, et al., Prevalence, awareness, treatment and control of hypertension in Vietnam—results from a national survey, *J. Hum. Hypertens.* 26 (4) (2012) 268.
- [10] N.L. Việt, Kết quả mới nhất điều tra tăng huyết áp toàn quốc năm 2015 – 2016, *Hội Tim mạch học quốc gia Việt Nam, Hà Nội*, 2016, p. 20.
- [11] N. Bui Van, et al., Prevalence and risk factors of hypertension in two communes in the Vietnam northern mountainous, 2017, *BioMed Res. Int.* 2018 (2018) 7.
- [12] N. Nguyen Duc, et al., Impact of body mass index and waist circumference on blood pressure: a cross-sectional survey in a population living in the Vietnam northern mountainous. *Diabetes & Metabolic Syndrome, Clinical Research & Reviews*, 2019.
- [13] G. Mancia, et al., ESH/ESC guidelines for the management of arterial hypertension: the task force for the management of arterial hypertension of the European society of hypertension (ESH) and of the European society of cardiology (ESC), *Eur. Heart J.* 34 (28) (2013) 2159–2219.
- [14] D.-T. Chu, et al., An update on physical health and economic consequences of overweight and obesity, *Diabetes Metab. Syndrome Clin. Res. Rev.* 12 (6) (2018) 1095–1100.
- [15] D.-T. Chu, et al., An update on obesity: mental consequences and psychological interventions. *Diabetes & Metabolic Syndrome, Clin. Res. Rev.* 13 (1) (2018) 155–160.
- [16] H. Nguyen Thi Hong, et al., Childhood obesity is a high-risk factor for hypertriglyceridemia: a case-control study in Vietnam, *Osong Public Health Res. Perspect.* 8 (2) (2017) 138–146.
- [17] S. Inoue, et al., The Asian - Pacific Perspective: Redefining Obesity and its Treatment, Health Communications Australia, New South Wales, 2000.
- [18] Organization, W.H., Guideline: Sodium Intake for Adults and Children, World Health Organization, 2012.
- [19] Wikipedia, Alcohol abuse, Available from: https://en.wikipedia.org/wiki/Alcohol_abuse.
- [20] Gia Khai Pham, et al., Frequency and related factors of hypertension in northern provinces of Vietnam 2001–2002, *J. VietNameese Cardiology* (2003) 33.
- [21] D.A. Ha, et al., Prevalence, awareness, treatment, and control of high blood pressure: a population-based survey in Thai Nguyen, Vietnam, *PLoS One* 8 (6) (2013), e66792.
- [22] S. Singhal, U. Beck, Ethnic Disadvantage in Vietnam: Evidence Using Panel Data, 2015. WIDER Working Paper.
- [23] H. Al-Thani, et al., Epidemiology of occupational injuries by nationality in Qatar: evidence for focused occupational safety programmes, *Injury* 46 (9) (2015) 1806–1813.
- [24] N.M.T. Ho Anh Hien, Vo Tam, Anselme Derese, Dirk Devroey, Prevalence, awareness, treatment, and control of hypertension and its risk factors in (central) Vietnam, *Int. J. Hypertens.* 2018 (2018).
- [25] C.A. Anderson, et al., Dietary sources of sodium in China, Japan, the United Kingdom, and the United States, women and men aged 40 to 59 years: the INTERMAP study, *J. Am. Diet Assoc.* 110 (5) (2010) 736–745.
- [26] N. Sasaki, The relationship of salt intake to hypertension in the Japanese, *Geriatrics* 19 (1964) 735–744.
- [27] I. Prior, et al., Sodium intake and blood pressure in two Polynesian populations, *N. Engl. J. Med.* 279 (10) (1968) 515–520.
- [28] S.S. Todkar, V.V. Gujarathi, V.S. Tapare, Period prevalence and sociodemographic factors of hypertension in rural Maharashtra: a cross-sectional study, *Indian J. Community Med.: Off. Pub Indian Assoc Prev. Soc. Med.* 34 (3) (2009) 183.
- [29] Q. Wei, et al., Prevalence of hypertension and associated risk factors in Dehui city of Jilin province in China, *J. Hum. Hypertens.* 29 (1) (2015) 64.
- [30] R.R. Dhungana, et al., Prevalence and associated factors of hypertension: a community-based cross-sectional study in municipalities of Kathmandu, Nepal, *Int. J. Hypertens.* 2016 (2016).
- [31] R.L. Sacco, et al., The protective effect of moderate alcohol consumption on ischemic stroke, *JAMA* 281 (1) (1999) 53–60.
- [32] W.B. Kannel, R.C. Ellison, Alcohol and coronary heart disease: the evidence for a protective effect, *Clin. Chim. Acta* 246 (1-2) (1996) 59–76.
- [33] C. Shanthirani, et al., Prevalence and risk factors of hypertension in a selected South Indian population—the Chennai Urban Population Study, *J. Assoc. Phys. India* 51 (2003) 20–27.
- [34] J. Chataut, R. Adhikari, N. Sinha, The prevalence of and risk factors for hypertension in adults living in central development region of Nepal, *Kathmandu Univ. Med. J.* 33 (1) (2011) 13–18.
- [35] P. Corvol, et al., Can the genetic factors influence the treatment of systemic hypertension? The case of the renin-angiotensin-aldosterone system, *Am. J. Cardiol.* 70 (12) (1992) 14d–20d.
- [36] R. Stamler, et al., Family (parental) history and prevalence of hypertension. Results of a nationwide screening program, *JAMA* 241 (1) (1979) 43–46.
- [37] R.R. Williams, et al., Genetic basis of familial dyslipidemia and hypertension: 15-year results from Utah, *Am. J. Hypertens.* 6 (11 Pt 2) (1993) 319s–327s.
- [38] K. Masuo, et al., Familial hypertension, insulin, sympathetic activity, and blood pressure elevation, *Hypertension* 32 (1) (1998) 96–100.
- [39] P. Ranasinghe, et al., The influence of family history of hypertension on disease prevalence and associated metabolic risk factors among Sri Lankan adults, *BMC Publ. Health* 15 (1) (2015) 576.