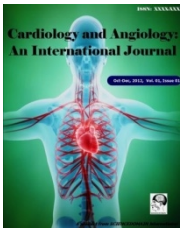

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Prevalence and Effects of Various Risk Factors Influencing the Blood Pressure Values

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Authors' contributions

All authors contributed equally in designing the study, collecting the data, performing the statistical analysis, managed the literature searches, and finally read and approved the final submitted manuscript.

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ABSTRACT

Aim: Hypertension is major cardiovascular risk factor contributing to all cause mortality. The present study was aimed to determine the impact of socio-demographic variables and risk factors on the blood pressures (BP) of the subjects.
Place and Duration of the Study: A cross sectional study was conducted at Ex-Servicemen Contributory Health Scheme (ECHS) Polyclinic, Sultanpur Lodhi, Kapurthala, India from June to Oct, 2013.
Methodology: All retired defense personnel and their family members (N= 351) who attended polyclinic during study period were recruited to assess physical activity, body mass index, dietary habits, alcohol, family history, sleep, stress, over the counter (OTC) medications, employment status, and education as determinants of BP. The results were analyzed by Chi Square test with statistically significance of P value <0.05.
Results: The frequency of high BP as per JNC VII guidelines was observed as 47.90% with higher range in females (51.19%) than males (48.80%). The frequency significantly increased with age >50years (88.08%; P<0.001), unemployment status (76.19%; P<0.05) and low education levels (37.50%; P<0.05). An association of high BP with inadequate sleep (35.11%; P<0.05), sedentary lifestyle (63.69%), alcohol (26.78%), positive family history (36.30%), stress (20.83%), non-vegetarian dietary habits (44.64%), increased BMI (67.26%; P<0.05) and OTC medications misuse (15.47%) was found. Half of the subjects

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were diagnosed with high BP for more than five years (49.40%), two-third had controlled (67.26%) and compliant (69.64%) status, and more than two-third had awareness about their diagnosis of high BP (83.60%). The uncontrolled status, non-compliance towards treatment, and low awareness level regarding high blood pressure values was found among 32.73%, 30.35% and 08.19% of subjects, respectively.

Conclusion: This rising frequency of high BP and its associated factors must be monitored, treated and controlled by appropriate preventive and therapeutic approaches including lifestyle modifications, Dietary Approach to Stop Hypertension, weight loss and maintenance, physical activity, stress management and pharmacotherapy.

Keywords: Hypertension; age; sleep; sedentary lifestyle; body mass index; stress management.

1. INTRODUCTION

Hypertension (HTN) is a major cardiovascular risk factor which contributes to all cause mortality globally [1]. The Joint National Committee VII (JNC VII) defines normal blood pressure (BP) as a systolic blood pressure (SBP) <120mmHg and diastolic blood pressure (DBP) <80mmHg. The gray area between SBP of 120-139mmHg or DBP of 80-89mmHg is defined as "pre-hypertension". HTN is defined as a physician office SBP ≥140mmHg or DBP ≥90mmHg [2]. A SBP<120mmHg is considered ideal, with each 10mmHg increase in BP being accompanied by 10% greater risk of cardiovascular events and mortality [3]. The Framingham Heart Study has estimated a residual lifetime risk of 90% for developing HTN among middle-aged and elderly persons [4]. The National Health and Nutrition Examination Survey (NHANES) 2007–10 has shown 81.5% with high BP are aware of it, 74.9% are under current treatment, 52.5% have it controlled, and 47.5% do not have it controlled [5].

The prevalence of HTN has increased to >25% of the adult population which accounts currently >1.5-billion individuals worldwide [6,7]. HTN has accounted for 9.4million deaths worldwide, and 7% of disability adjusted life years in 2010 [8]. However, the Global Burden of Chronic Disease Risk Factors Study has reported a decline of the mean SBP in high and middle income countries with an increase in low-middle and low-income countries [7]. HTN is the leading non communicable disease attributing to nearly 10% of all deaths in India [9]. Its prevalence has risen dramatically over the past three decades from 5% to 20-40% in urban and 12-17% in rural areas [10,11], and has been anticipated to nearly double from 118 million in 2000 to 213 million by 2025 [11]. It is estimated that 16% of ischemic heart disease, 21% of peripheral vascular disease, 24% of acute myocardial infarctions and 29% of strokes are attributable to the underlying HTN [12].

An increasing prevalence of high BP is the result of population aging and environmental changes [6]. Increased acculturation and changing lifestyle with sedentary living, stress, alcohol, and surplus availability of energy dense salt enriched food have lead to abdominal and generalized obesity; and subsequently contributed to high BP [13]. About 2-5% of patients have an underlying renal or adrenal disease; however, no clear single identifiable cause is found in the remainder 95% cases which labelled as an "essential or primary hypertension" [14]. The derangement of physiological mechanisms arises from the complex and interrelated genetic, environmental, metabolic, vascular, and endothelial pathological factors: an increased sympathetic nervous system activity on exposure or response to psychosocial stress; an overproduction of sodium-retaining hormones and vasoconstrictors; high dietary sodium intake; an inadequate dietary intake of potassium and calcium;

increased or inappropriate rennin, angiotensin II and aldosterone secretion; deficiencies of vasodilators, such as prostacyclin, nitric oxide and the natriuretic peptides; altered kallikrein–kinin system that affects vascular tone and renal salt handling; abnormalities of resistance vessels including the renal microvasculature; diabetes mellitus; insulin resistance; obesity; increased vascular growth factors activity; alterations in adrenergic receptors influencing heart rate, cardiac inotropic properties, and vascular tone and altered cellular ion transport [15].

A meta-analysis of 61 studies involving more than a million patients with HTN and 12.7 million years of follow up has observed that reducing BP will further decrease cardiovascular events [16]. Each difference of 20mmHg SBP or 10mmHg DBP at the ages of 40-69years was associated with more than a two-fold difference in the stroke death rate, and two-fold differences in the death rates from coronary heart disease and other vascular causes. There is, therefore, a need to lower BP by both non-pharmacological and pharmacological approaches in all the age groups [17]. A number of well evidenced pharmaceutical agents by large randomized clinical trials are available which includes thiazide diuretics for the most cases in stage I (SBP 140–159 or DBP 90–99mmHg) with the possible consideration of other drugs having different mechanism of actions; and the two drug combination (usually thiazide type diuretic and Angiotensin converting enzyme inhibitor (ACEI), or Angiotensin receptor blocker (ARB), or Beta Blockers (BB), or Calcium channel blocker (CCB)) for the stage II (SBP ≥160 or DBP ≥100mmHg) [13]. Hence, there is a need to create awareness among high risk individuals regarding healthy lifestyles. In this regard, the current study aims to assess the range of BP values among retired defence personnel and factors influencing the BP values.

2. MATERIALS AND METHODS

A cross-sectional survey was designed to study the socio-demographic and the risk factors affecting the BP values among the retired defence personnel and their family members residing in and surrounding the areas of Tehsil Sultanpur Lodhi, District Kapurthala, Punjab (India). Ex-Servicemen Contributory Health Scheme (ECHS) Polyclinic is primary care centre which provide free at-the-point-of-access primary services of physician consultations, blood investigations, X-ray facilities, pharmacy, and follow up care to their registered patients. This free health scheme helps to improve adherence rate of patients to visit polyclinic. All types of acute and chronic diseases were treated by polyclinic, and as per need critical patients were being referred to higher empanelled centres. A multi-parameter and pre-tested data collection forms were designed to record the clinical history and physical examination by an interview personally taken by physician. The results were analyzed by Chi Square test. The level of significance was defined with P value <0.05.

2.1 Ethical Approval

An Institutional ethical committee approval was obtained prior to the start of study and an informed verbal consent was taken from all the recruited subjects who attended polyclinic from June, 2013 to Oct, 2013. The study didn't involve any invasive procedures in the form of taking blood samples for investigations and/or minor or major surgeries; hence, no written consent was taken from the recruited subjects.

2.2 Assessment of High Blood Pressure

It was defined as a SBP ≥140mmHg or DBP ≥90mmHg or a previous diagnosis with being on anti-hypertensive therapy. BP measurements were done as per JNC VII guidelines [2] in the right arm with the subject seated and rested for 5 minutes using a standard mercury sphygmomanometer and a suitable calibrated cuff. Two readings were taken 5 minutes apart; if differed by >5mmHg, measurements were repeated until two concordant BP readings were obtained and their average was taken as final reading. Elevated BP readings were confirmed in a contra-lateral arm. The clinical details of high BP including duration, awareness, controlled status, patient compliance/adherence and type of treatment were elaborated. Level of awareness was defined on the basis of knowledge about the diagnosis of high BP, regular medication intake, and non-pharmacological measures to reduce BP. Subjects who were on anti-hypertensive therapy but recorded with normal and high BP were categorized with "Controlled" and "Uncontrolled" status, respectively.

2.3 Socio-demographic Variables

Age, education, socio-economic status and occupation were evaluated. Education level was classified into four categories: no/little formal, primary, secondary and graduation. Income adequacy was defined into lower, middle and upper on the basis of retired ranks of ex-servicemen including their household income and assets.

2.4 Risk Factors of HTN

2.4.1 Body Mass Index (BMI)

BMI was calculated as weight per square meter (kg/m^2) and classified into underweight (<18.50 kg/m^2), normal (18.50-24.99 kg/m^2), overweight (25.00–29.99 kg/m^2), and obesity (≥30.00 kg/m^2) [18]. Weight was determined on a pre-checked calibrated scale with each subject standing at the centre of the weighing scale in light clothing without socks and shoes. Height was determined using a wall mounted, non extendable measuring tape with subjects standing in an erect barefoot position, arms by side, and feet together.

2.4.2 Physical activity

The recommendations by the American College of Sports Medicine and the American Heart Association (AHA) of doing 30 minutes moderate-intensity physical activity (e.g. brisk walking) on 5 or more days of the week or 20 minutes vigorous-intensity physical activity (e.g. jogging and running) on 3 or more days of the week were considered [19].

2.4.3 Alcohol

Men intake is limited to <2 drinks per day; and for women and lighter weight persons, it is limited to <1 drink per day (1 drink = 1/2oz or 15ml ethanol (e.g., 12oz beer, 5oz wine, 1.5oz 80-proof whiskey)) [2].Subjects were asked about their average frequency and amount of alcoholic beverages intake during the year before an interview. Subjects who presently use alcoholic beverages and/or exceed their limits were categorised under "Current" group; and those who had never or left their habit of heavy alcohol consumption were counted under "Ex/Never" group.

2.4.4 Smoking

Current smokers were defined as participants who had smoked ≥100 cigarettes during their lifetime and were still smoking. Ex-smokers were subjects those had smoked ≥100 cigarettes during their lifetime but had stopped successfully. Participants who had smoked <100 cigarettes during their lifetime were classified as never had smoked.

2.4.5 Family history

It is considered positive if a first-degree male relative (e.g. father, brother) and female relative has cardiovascular disease (e.g., heart attack, high BP, stroke) before the age of 55 or 65 years respectively [2].

2.4.6 Sleep

Sleep adequacy evaluated on the basis of the self reporting of sleep duration (7 to 8 hours); difficulty in initiating and maintaining sleep; and early awakenings.

2.4.7 Stress

Factors affecting BP through significant stress include white coat hypertension, job strain, financial issues, and family distress were considered through self reporting by the subjects.

2.4.8 Over-the-counter (OTC) medications

It includes the list of readily available medications misused by subjects without proper consultation and prescription of registered physician that can affect their BP readings, e.g., decongestants, Oral Contraceptives Pills (OCP), Non Steroidal Anti Inflammatory Medications (NSAIDs), appetite suppressants, etc.

3. RESULTS

All patients (N=351) were divided into two groups on the basis of the BP readings: subjects with high BP (hypertensive; N=168) and normal BP (normotensive; N=183). The frequency of high BP was 47.90% as per JNC VII guidelines in the current study. Out of the 168 hypertensive subjects, the study reported two newly diagnosed cases with rest of them already having high BP. Table 1 show a frequency of high BP rises as age advances with statistically significant higher prevalence among the subjects >50 years old (88.08%; P<0.001).

The frequency of high BP was 48.80% and 51.19% among male and female subjects, respectively. Individuals with no/little, primary, secondary and graduation had 37.50%, 29.76%, 29.16% and 03.57% of high BP; and 25.13%, 27.86%, 41.53% and 05.46% of them had a normal BP for the same education categories, respectively. It shows a statistically significant inverse relation of education with BP values (P<0.05). There was no statistical significant difference between the frequency of high and normal BP among both middle and upper social class subjects; however, the trend of high BP was higher among the former (63.09%) as compared to the latter group (36.90%). Similarly, individuals who stay at home (76.19%; P<0.05) had a statistically higher frequency of high BP than employed subjects (23.80%; P<0.05).

Table 1. Comparisons of the socio-demographic variables in all the study subjects (N=351)

Category	Normal Blood Pressure (183)		High Blood Pressure (168)		*P* value
	Percentage (%)	Number of subjects	Percentage (%)	Number of subjects	
Age (years)					
20-35	07.10	13	00	00	35.54
36-50	32.78	60	11.90	20	(<0.001)
51-65	36.61	67	42.85	72	
>65	23.49	43	45.23	76	
Gender					
Male	50.81	93	48.80	82	0.16
Female	49.18	90	51.19	86	
Education					
No/Little	25.13	46	37.50	63	8.88
Primary	27.86	51	29.76	50	(<0.05)
Secondary	41.53	76	29.16	49	
Graduation	05.46	10	03.57	06	
Socio economic status					
Middle	63.38	116	63.09	106	0.01
Upper	36.61	67	36.90	62	
Occupation					
Retired	66.12	121	76.19	128	4.33
Employed	33.87	62	23.80	40	(<0.05)

Table 2. depicts 06.54%, 36.30%, 33.92% and 23.21% of the subjects who had high BP were in <18.50 kg/m^2, 18.50-24.99kg/m^2, 25.00-29.99kg/m^2 and >30.00kg/m^2 BMI ranges; and those with a normal BP had 04.37%, 49.18%, 32.78% and 13.66% for the same BMI groups, respectively. This shows some association between BP and BMI (*P*<0.05). Furthermore, subjects with a positive family history had been more frequently diagnosed with high BP (36.30%) than normotension (28.41%).

26.78% of the subjects who were under the effects of the alcoholic beverages had a predisposition to an increased BP; whereas 19.12% of them had a normal BP. High BP was diagnosed among 1.78% of smokers. However, a low smoking prevalence in the study population didn't help to give an accurate analysis on its relation with BP values. Sedentary lifestyle contributes to high BP (63.69%), while active lifestyle helped to maintain normal BP levels (38.25%). Taking dietary habits into consideration, vegetarian and non-vegetarian diet favours normal (63.93%) and high BP (44.64%) among the study subjects, respectively.

A statistically significant high (35.11%; *P*<0.05) and normal BP (75.40%; *P*<0.05) was noticed among subjects who take an inadequate and adequate amount of sleep, respectively. High BP (60.71%) was more frequent in subjects who take a daytime nap as compared to their counterparts (54.09%). The subjects under high stress levels were more frequently diagnosed with high BP (20.83%) than those who were under in-significant stress levels (16.93%). Similarly, the patients who misuse OTC medications reported a higher frequency of high BP (15.47%) as compared to the other group (10.92%). Fig. 1. further reveals the graphical frequency of the cardiovascular risk factors in subjects with high BP.

Table 2. Comparison of the risk factors affecting BP values in all the study subjects (N=351)

Category	Normal Blood Pressure(183)		High Blood Pressure(168)		*P* value
	Percentage (%)	Number of subjects	Percentage (%)	Number of subjects	
Body mass index (kg/m^2)					
<18.50	04.37	08	06.54	11	8.52
18.50-24.99	49.18	90	36.30	61	(<0.05)
25.00-29.99	32.78	60	33.92	57	
>30.00	13.66	25	23.21	39	
Family history					
Positive	28.41	52	36.30	61	2.52
Negative	71.58	131	63.69	107	
Alcohol					
Never/Ex	80.88	148	77.22	123	2.97
Current	19.12	35	26.78	45	
Physical activity					
Adequate	38.25	70	36.30	61	0.16
In adequate	61.74	113	63.69	107	
Dietary habits					
Vegetarian	63.93	117	55.35	93	2.26
Nonvegetarian	36.06	66	44.64	75	
Sound sleep					
Yes	75.40	138	64.88	109	4.68
No	24.59	45	35.11	59	(<0.05)
Day time NAP					
Yes	54.09	99	60.71	102	1.58
No	45.90	84	39.28	66	
Stress levels					
Significant	16.93	31	20.83	35	0.89
Insignificant	83.06	152	79.16	133	
OTC medications					
Yes	10.92	20	15.47	26	1.60
No	89.07	163	84.52	142	

Table 3. reflect that 04.76%, 45.83% and 49.40% of patients had a history of high BP for <1 year, 1-5 years and >5 years, respectively. Majority of the patients reported a controlled status (67.26% versus 32.73%). ACEIs, ARBs, BBs, CCBs and Diuretics were taken by 40.47%, 29.76%, 39.88%, 32.14% and 31.54% of the study subjects, respectively. 43.45% of the studied subjects take one (43.45%) and two (43.45%) antihypertensive medications each, respectively; whereas 13.09% of subjects take ≥3 medications for the high BP values. The high and low level of awareness regarding the diagnosis of high BP was seen among 83.60% and 08.19% of subjects, respectively. Moreover, 69.64% and 30.35% of patients were compliant and non-compliant towards their treatment, respectively. This shows that half of subjects were diagnosed with high BP for more than five years (49.40%), two-third had controlled (67.26%) and compliant (69.64%) status, and more than two-third had awareness (83.60%) about their diagnosis of high BP.

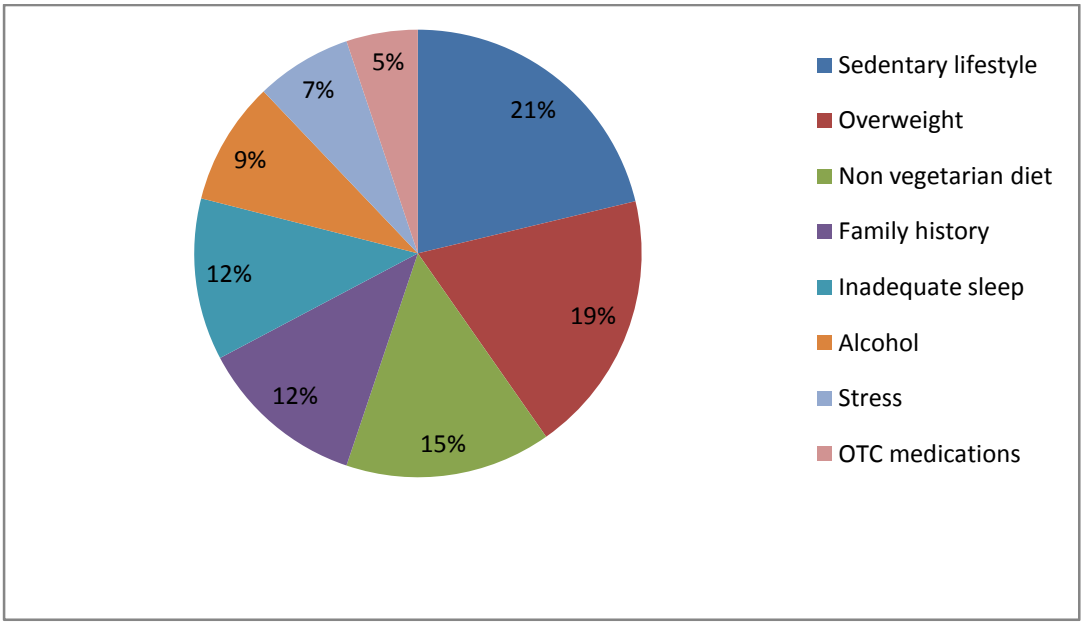

Fig. 1. Graphical presentation of risk factors in hypertensive subjects (N=168)

Table 3. Clinical characteristics of subjects with high blood pressure (N=168)

Category	Percentage (%)	Number of subjects
Duration (years)		
<1	04.76	08
1-5	45.83	77
>5	49.40	83
Level of awareness		
High	83.60	153
Low	08.19	15
Compliance		
Regular	69.64	117
Irregular	30.35	51
Status		
Controlled	67.26	113
Un-controlled	32.73	55
Medications		
ACEIs	40.47	68
ARBs	29.76	50
BBs	39.88	67
CCBs	32.14	54
Diuretics	31.54	53
Number of medications		
1	43.45	73
2	43.45	73
≥3	13.09	22

(ACEI: Angiotensin converting enzyme inhibitor, ARB: Angiotensin receptor blocker, BB: Beta Blockers, CCB: Calcium channel blocker)

4. DISCUSSION

The WHO has named HTN as the 'Silent Killer' [20]. Its clinical course is generally being asymptomatic with an underlying physiological decline in the form of 'Target Organ' damage resulting in ventricular hypertrophy, heart failure and accelerated atherosclerosis, cerebrovascular disease and stroke, renal failure and retinopathy. The AHA has described the seven metrics for an ideal cardiovascular health; being a non smoker, being physically active, having a normal BP (<120/80 mm Hg), normal blood glucose (HbA1C<5.7%), normal total cholesterol (<200 mg/dl), normal weight (BMI<25.00kg/m^2), and eating a healthy diet [21]. BP is an important component of this metric being studied in the current study.

The frequency of high BP as per JNC VII guidelines was 47.90% in the present study. The Screening India's Twin Epidemic (SITE) study [22] conducted in 2010 has reported 46% prevalence of HTN which resembles to the present findings. Conversely, another survey by Bansal et al [23] performed in 2010 has estimated 32.30% of prevalence of HTN among their subjects. This high frequency might be contributed to the white-coat effect especially when the measurements are taken by a physician instead of a nurse as in the current study [24]. Moreover, readings obtained in the clinic are often reported higher than those taken at home [25].

A statistically significant higher frequency of high BP among subjects older than 50 years in the current study (Table 1.) has been found similar to Sarafidis et al [26]. Age probably represent an accumulation of environmental influences and genetically programmed senescence in the body physiological systems [27]. A higher frequency of high BP in females than males in the current study has been consistence to other studies [28,29]. However, Bansal et al. [23] and Sarafidis et al. [26] have shown the contrary findings in their work. Hormonal factors, postmenopausal weight gain, and a different risk profile might account for the higher frequency of high BP in women than men [28].

A statistically significant relation of low education level with high BP (67.26%; P<.05) had been noticed in the current study. Similarly, Kautzky-Willer et al. [30] has shown the risk increased with decreasing education level for anthropometric measures and lifestyle factors in both sexes. Conversely, Tedesco et al. [31] has found the most hypertensive have reached higher standards of education and worked at sedentary jobs. A statistically significant trend of an increased frequency of high BP in subjects who stays at home than employed subjects has been supported by Kumar et al [32]. A higher frequency of high BP was diagnosed among middle than the upper social status subjects in the present study. This trend might be contributed to an awareness of HTN prevention and control, and better accessibility and adherence to the medical treatment among higher socioeconomic status groups; and probably prolonged working hours and higher job strain among the lower social strata groups [33]. However, Momin et al. [34] has noticed the contrary finding of an association of HTN with a higher socioeconomic class.

A statistically significant positive relation between BP and BMI ranges has been observed in the present study (Table 2). Similarly, Fould et al. [35] demonstrated a higher relative risks for HTN among individuals with an increased waist circumference or BMI in all the four studied ethnic groups (aboriginal, whites, East Asian, and South Asian). The NHANES [36] has shown a linear relationship between a rise in BMI and systolic, diastolic, and pulse pressures in the American population. However, the significant frequency of high BP among normal weight subjects in the current study was found approximately similar to the prevalence shown by Khan et al. [37] among their non obese subjects. This rise in BP

among normal BMI subjects might be due to a genetic origin or be a consequence of body-composition abnormalities. Further, genome-wide linkage scan study [38] done in non obese African American families have identified the significant evidence for a linkage of HTN to the chromosome 2q suggesting the presence of genes influencing the susceptibility to adiposity-independent hypertension.

The current study found an association between a high BP and positive family history. Similarly, Van der Sande et al. [39] has shown the subjects with a family history of HTN has a higher rate of DBP, BMI, higher cholesterol levels, uric acid concentrations and obesity; whereas, Taizan et al. [40] has reported a family history of HTN has only an additive impact on the age-associated increase in the HTN risk and thus suggested family history doesn't independently affect an increasing prevalence of HTN with age. The frequency of high BP was high among current alcoholic as compared to their counterparts in the present study. Furthermore, Ruidavets et al. [41] has correlated socioeconomic status and lifestyle behaviours with the type, quantity, and pattern of drinking. However, heavier drinkers or problem drinkers are far less likely to disclose their habits or participate in surveys than others; and further, past or present alcohol consumption and drinking patterns are difficult to quantify and often goes under reported [42].

Sedentary lifestyle had predisposed the present study subjects to high BP. Furthermore, Huai et al. [43] has shown an inverse dose–response association between the recreational levels physical activity and HTN risk; however, reported no significant association between occupational physical activity and HTN. Rossi et al. [44] observed a regular physical activity is beneficial for reducing mortality in patients with high BP. The current study had reported predisposition of non vegetarian diet to a high BP; and of vegetarian diet to a normal BP, respectively. Similarly, the Adventist health study-2 [45] observed vegetarians, especially vegans, do have a lower SBP and DBP and less HTN than omnivores which might be partly due to the lower body mass among vegan. Further, Melby et al. [46] has noticed vegetarian had significantly a lower concentrations of serum total cholesterol (STC), Low density lipoprotein- cholesterol (LDL-C), triglycerides, STC/HDL-C ratio, and LDL-C/HDL-C ratio than non vegetarians independent of waist-hip ratio differences. Thus, a vegetarian diet is associated with lower cardiovascular disease risk factors than an omnivorous diet.

Sleep inadequacy had lead to a statistically significant higher frequency of high BP than normal BP. Similarly, Gottlieb et al. [47] has recommended usual sleep duration above or below the median of 7-8hours per night is associated with an increased prevalence of HTN, particularly at the extreme of <6hours per night. A prolonged sleep loss or sleep quality alterations might act as a neurobiological and physiological stressor leading to an inappropriate arousal ("hyper-arousal") due to an over-activation of stress system functions; that impair brain functions, and contribute to allostatic load, compromising stress resilience and somatic health [48]. Moreover, Tochikubo et al. [49] have suggested a lack of sleep may increase sympathetic nervous system activity on the following day, leading to an increased BP reading.

A positive association of stress with high BP had been observed in the current study. Russell et al [50] has observed stress related to family life, anxiety, and depression results in an increased risk for HTN. The current study noticed a positive association between OTC medication misuse and BP. Similarly, Aljadhey et al. [51] has reported an incident use of NSAIDs, particularly ibuprofen, is associated with a small increase in SBP among hypertensive patients when compared to acetaminophen. Another study by Bavry et al. [52] has noticed chronic self-reported use of NSAIDs was associated with an increased risk of

adverse events in hypertensive patients with coronary artery disease. Similarly, American College of Obstetricians and Gynaecologists has proposed the use of OCPs including newer agents increases SBP by 8mmHg and DBP by 6mmHg; and recommended progestin-only contraceptives and the levonorgestrel-releasing intrauterine system (Mirena) as appropriate options among hypertensive women [53].

Table 3. revealed 83.60% awareness rate among the studied subjects which is found similar to Rossum et al. (80%) [54]. However, Gupta et al. [55] have shown a contrary finding of low awareness (55.3%) among their study subjects. High awareness level in the present study could be contributed to a regular interval medical check-ups being conducted on the subjects during their serving employment years; and facility of a free medical services provided by the defence government to all the registered retired personnel along with their family members. The compliance towards treatment modalities and controlled BP readings were found among 69.64% and 67.26% of subjects, respectively. However, the prevalence of medication non-adherence varies tremendously depending on the population studied and the specific medications assessed. For example, Vrijens et al. [56] found that about half of all the patients prescribed with antihypertensive medications stopped taking them within 1 year of the initial prescription, and further noticed patients omitted ≈10% of the scheduled doses of medications on any day. Contrarily, Bramley et al. [57] found that ≈75% of patients on monotherapy for HTN were highly adherence and defined a medication possession ratio of 80% to 100%. Various factors prevent the adherence towards medications; like, patients commonly perceive that their BP improved when symptoms abated or when they were not stressed, and assume that no further treatment was needed; disliked treatment and its side effects; feared addiction; unable to find time to take the drugs or to see the doctor; have insufficient money to pay for treatment; the cost of appointments and healthy food; a lack of health insurance; and forgetfulness and use of alterative medicines (traditional compounds, herbal supplements) [58].

This rising frequency of high BP prompts the need to increase the public awareness about prevention, early diagnosis of HTN, and effortful adequate control with treatment. A lifestyle modification should be encouraged at each physician's office visit including Dietary approach to Stop Hypertension (DASH), weight loss and normal BMI maintenance, daily minimum of 30 minutes of moderate-intensity physical activity for most of the days of the week, moderate alcohol consumption, tobacco cessation, and stress management [59]. The health system should be strengthened to undertake the overall prevention and care for HTN under National Non-Communicable Diseases control programmes [60].

Limitations of the present study include biases introduced because of sampling which limit generalizability of the study, non representation of the whole Indian population, undetected measurement errors, and cross sectional design. We did not study the specific dietary determinants of high BP, such as intake of salt (sodium), vitamin D, potassium, calcium, and fats. However, the current study findings provide baseline information for conducting large scale community based surveys in different job settings or social groups.

5. CONCLUSION

This rising frequency of high BP and its associated factors must be monitored, treated and controlled by appropriate preventive and therapeutic approaches including lifestyle modifications, Dietary Approach to Stop Hypertension (DASH), weight loss and maintenance, physical activity, stress management and pharmacotherapy. HTN simulates iceberg phenomenon of diseases; where, a still considerable proportion of persons do not

have awareness about high BP or importance of having well controlled blood pressure levels. This requires a stringent public health effort for effectively combating the burden of HTN in the population.

CONSENT

All authors declare that an informed verbal consent was taken from all the recruited subjects.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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