



## PREVALENCE OF DETERMINANTS OF HYPERTENSION IN HYPERTENSIVE CASES OF A PERIPHERAL BASE OF INDIAN AIR FORCE: AN OBSERVATIONAL STUDY

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**ABSTRACT** There is no known study on prevalence of determinants of hypertension in hypertensive cases in Indian armed forces in general and Indian Air Force in particular. Prevalence of determinants of hypertension in a cohort of Indian Air Force personnel is likely to behave differently because of the peculiarities of the job, health status, awareness and regular health screening however, there's no known study available to verify this possibility.

**Methodology:** The medical documents of all the known cases of hypertension present in the station by 31<sup>st</sup> Dec 14 were perused to find out various determinants of hypertension available in the standard form and descriptive statistical analysis was done to find out the trend.

**Results:** A total of 60 male cases of hypertension were present in the period of study. 33.33% of cases of hypertension was found to have associated cardiovascular and life style diseases viz HOCM (5%), IGT (2%), T2DM (65%) and TIA (5%). Mean age of hypertensive cases was  $47.5 \pm 5.6$  yrs, mean age at onset of hypertension was  $43 \pm 6.5$  yrs and mean military service at the onset of hypertension was  $22.2 \pm 6.6$  yrs. Only 6.7% of cases had family history of hypertension/DM/smoking. Only 13.3% cases were smoker and 5% of cases had admitted to consume alcohol. Lipid profile was deranged in 11.6% cases. Overweight cases of BMI > 25 Kg/m<sup>2</sup> were 40 %, Waist Circumference 94- 102cms were 21.6%. Truncal obesity (WHR>0.9) was found in 38.3% and BMI>30% in 1.6%.

**Discussion:** Cardiovascular risk factors prevalent in a society determine prevalence of the cardiovascular diseases including hypertension and hence it is expected that the prevalence of risk factors in hypertensive cases should be close to prevalence in the society if not high. Prevalence of smoking (13.3%), alcohol intake (5%) and family history of hypertension (6.7%) was much lesser than reported by Agrawal et al in rural community though he divided the cases as systolic and diastolic hypertension. BMI> 25 Kg/m<sup>2</sup> (40%) was lower than systolic hypertension but higher than diastolic hypertension cases reported by Agrawal et al. However, prevalence of Truncal obesity (WHR> 0.9) was higher (38.3%) than reported by Agrawal et al. There was no case of abdominal obesity (WC> 102 cms) in our study as compared to 34% in systolic and 32% in diastolic hypertension cases reported by Agrawal et al.

**Conclusion:** Prevalence of modifiable risk factors like smoking, alcohol intake and abdominal obesity was much lesser in hypertensive cases at the base however, prevalence of BMI> 25 Kg/m<sup>2</sup> and truncal obesity is comparable to hypertensive cases in rural population reported by Agrawal et al.

**KEYWORDS :** Hypertension, Air Force, Determinants, Risk factors, Prevalence.

### Introduction

Hypertension was estimated to be cause of death among approximately 13- 15% of the total death worldwide in 2001. It doubles the risk of cardiovascular diseases, including congestive heart failure (CHF), coronary heart disease (CHD), ischaemic and hemorrhagic stroke, renal failure and peripheral arterial disease. Frequently it is associated with additional cardiovascular disease risk factors.

Hypertension is prevalent in all population except for a small number of primitive, culturally isolated societies. The probability that a middle-aged or elderly individual will develop hypertension in his or her lifetime is 90%. The likelihood of hypertension increases with age. As per National Health and Nutrition Examination Survey (NHANES) in US, Age adjusted prevalence rate of hypertension (JNC 7 criteria) among adults was approximately 30% (2). Overall, 26.4% (95% CI 26.0-26.8%) of the adult population in 2000 had hypertension (26.6% of men [26.0-27.2%] and 26.1% of women [25.5-26.6%]), and 29.2% (28.8-29.7%) were projected to have this condition by 2025 (29.0% of men [28.6-29.4%] and 29.5% of women [29.1-29.9%]) (3). The prevalence rate of hypertension in a society varies with regional and racial variation due to environmental and genetic factors.

Indian Air Force (IAF) follows JNC 7 classification for diagnosing hypertension. Obesity and weight gain are strong and independent risk factors for hypertension. IAF closely monitors weight of all its personnel through annual medical examination. Overweight and obesity is defined based on four physical parameters viz 2 to 3 standard deviation (SD) from ideal body weight for age and sex as overweight and more than 3 SD as obese, BMI 25- 30 Kg/m<sup>2</sup> as overweight and more than 30 kg/m<sup>2</sup> as obese, Waist circumference (WC) of 94- 102 cms among males measured at the level of navel is considered overweight and WC > 102 cms as obese, waist-hip ratio (WHR) of 0.9-1 as overweight and more than 1 as obese. The highest value of any of

these parameters determines the grade of obesity (4). Waist circumference is measure of abdominal obesity and WHR is measure of Truncal obesity. Alcohol intake, psychosocial stress, low levels of physical activity and family history may contribute to hypertension. There is paucity of data over prevalence of these determinants of hypertension among hypertensive cases of Indian Air Force which is expected to be comparable if not high as compared to general population due to the psychosocial and job stress among 'airwarriors'.

This study was conducted with the aim of finding out the prevalence of these determinants among cases of hypertension in an operational airbase to know the extent and nature of the problem.

### Methodology

This study intends to find out the prevalence of determinants of hypertension in hypertensive cases of a peripheral Indian Air Force base. The determinants of hypertension viz family history of hypertension, smoking and drinking habit, deranged lipid profile, parameters for abdominal and Truncal obesity etc. Overweight is defined as weight between 20 to 30% of ideal body weight for age or waist circumference 94- 102 cms or BMI 25 to 30 Kg/m<sup>2</sup> or waist hip ratio (WHR) 0.9 to 1. Obesity is defined as weight more than 30% of ideal body weight for age or waist circumference more than 102 cms or BMI more than 30 Kg/m<sup>2</sup> or WHR more than 1. Any of the higher anthropometric parameter decides the category of overweight or obesity (4). Total Cholesterol of more than 200mg/ dl and Triglycerides more than 150 mg/ dl was considered as deranged lipid profile.

All cases of hypertension in IAF are reviewed monthly by authorised medical attendant (AMA) and three monthly to yearly by a medical specialist depending on the recommendation by medical board. All of these cases are examined on a standardised medical examination form containing host of data which could be utilised for this study. All the

medical documents of the cases of hypertension present in the airbase till 31<sup>st</sup> Dec 14 were perused by an experienced and trained medical assistant to gather data relevant to our study. Descriptive statistical analysis using Microsoft Excel © 2007 was done to analyse the data obtained.

**Results**

A total of 60 (4.5% of study population) cases of Essential hypertension were present in the base during the period of study. All cases were male. Out of these 60 cases, 20 cases were associated with other life style diseases also. Mean age of hypertensive cases were 47.5 ± 5.6 (36- 57) yrs. Mean age at onset of hypertension was 43 ± 6.5 (29- 56) yrs. Mean total service at the onset of hypertension was 22.2 ± 6.6 (10- 35) yrs. None of the cases were posted at high altitude when hypertension was diagnosed. A total of 16 cases (26.7%) were diagnosed at Sirsa (Haryana). Only 04 cases (6.7%) had family history of hypertension. 13.3 % of hypertensive cases were smoker and 5% of them consumed alcohol. 73.3% of cases were vegetarian. 11.7% cases had deranged lipid profile (Total Cholesterol > 200mg/ dl and or Triglyceride>150 mg/dl).

Prevalence of Overweight was 5.6% and obesity was 0.7% in this peripheral airbase. 37.8% of overweight airwarriors had hypertension. 46.4% of overweight hypertensive cases had associated lifestyle diseases. None of the hypertensive cases were overweight more than 30% of ideal body weight (IBW). 8% of cases were overweight more than 20% (but < 30%) of IBW. 38.3% cases had BMI 25- 30 Kg/m<sup>2</sup> and only one case had BMI> 30 Kg/m<sup>2</sup> (1.7%). None of the cases had abdominal obesity (Waist circumference>102cms). 2 cases (3.3%) had truncal obesity (WHR > 1) and 20 cases (33.3%) of overweight with truncal adiposity (WHR 0.9-1).

The 20 hypertensive cases associated with other life style diseases were hypertrophic obstructive cardiomyopathy (5%), Impaired Glucose Tolerance (20%), type 2 diabetes mellitus (65%), coronary artery disease (5%) and transient ischemic attack (5%).

| Cases                   | Deranged Lipid profile | OW <20 % | OW (20- 30%) | BMI (<20 kg/m <sup>2</sup> ) | BMI* (20-30 kg/m <sup>2</sup> ) | BMI (>30 kg/m <sup>2</sup> ) | WHR < 0.9 | WHR (0.9- 1) | WHR > 1 |
|-------------------------|------------------------|----------|--------------|------------------------------|---------------------------------|------------------------------|-----------|--------------|---------|
| Only Htn                | 5                      | 35       | 5            | 0                            | 40(16)*                         | 0                            | 26        | 13           | 1       |
| Htn with CVS disability | 2                      | 17       | 3            | 2                            | 17(07)*                         | 1                            |           |              |         |
| Total                   | 7                      | 52       | 8            | 2                            | 57                              | 1                            | 12        | 7            | 1       |

**Table 1:** Prevalence of determinants of hypertension among hypertensive cases. \*BMI 25- 30 Kg/m<sup>2</sup>.

40 cases were hypertensive cases without any associated cardiovascular disability (Table 1). Mean age of this group was 48 ± 5 yrs (36- 57 yrs). Mean total service at onset was 22.9 ± 7 yrs. Mean age at onset was 43.7 ± 6.8 yrs (29- 56 yrs). A total of 09 cases were diagnosed at Sirsa. There was no family history of hypertension among this group. 15 % of cases were smoker and 3% of them consumed alcohol. 77.5% of the cases were vegetarian. All the cases were with BMI 20- 30 kg/ m<sup>2</sup>. Mean BMI of this group was 24.62 ± 2 kg/ m<sup>2</sup> (29.43 – 22.01 kg/m<sup>2</sup>) (Table 2 and 3). 16 cases in this group had BMI in overweight range (>25 Kg/m<sup>2</sup>) and none in obesity range (>30 Kg/m<sup>2</sup>). 12.5% cases had deranged Lipid profile.

| Cases                   | Total case | Mean age | Mean total Service | Mean age at onset | Diagnosed at Sirsa | Veg | Non-Veg |
|-------------------------|------------|----------|--------------------|-------------------|--------------------|-----|---------|
| Only Htn                | 40         | 48       | 22.9               | 43.7              | 9                  | 31  | 9       |
| Htn with CVS disability | 20         | 46       | 20.8               | 41.7              | 7                  | 13  | 7       |

**Table 2: Personal characteristics of two groups of hypertension**

Mean age of the cases of hypertension with CVS disability (Table 2) was 46 ± 6 yrs (36- 56 yrs). Mean age at the onset of hypertension 41.7 ± 5.7 yrs. Mean total service at onset of hypertension was 20.8 ± 5.7 yrs. 35% of the cases were diagnosed at Sirsa (Haryana). 20% of these

cases had history of hypertension among this group. 10% of cases were smoker and the same number consumed alcohol as well. 65 % of the cases were vegetarian in this group (Table 2 and 3). 10% of cases in this group had deranged Lipid profile. Hypertension preceded among 45 % of cases (09 out of 20) of hypertensive cases with CVS co-morbidity and possibly these comorbidities are due to hypertension. 40 % of these cases (08 out of 12) they were diagnosed simultaneously along with other CVS comorbidities and hence, may or may not be due to hypertension. In three cases (15%), hypertension was diagnosed after the co-morbidity and hence may not be the complication of hypertension. Cause- effect analysis was not done as this is beyond the scope of present study.

Family history of hypertension was statistically significantly higher (p<0.04) among the cases of hypertension with CVS disability. Rest all studied variables were not significantly different between the two groups.

| Characetristics              | 30- 39 yrs | 40- 49 yrs | 50- 59 yrs |
|------------------------------|------------|------------|------------|
| Total no of Cases            | 07         | 24         | 29         |
| Mean total Service           | 14         | 18.33      | 27.38      |
| Mean age at Onset            | 34.86      | 39.46      | 47.97      |
| Diag at Sirsa                | 03         | 03         | 10         |
| Veg                          | 05         | 19         | 20         |
| Non- veg                     | 02         | 05         | 09         |
| Family history               | 00         | 02         | 02         |
| Smoking                      | 01         | 02         | 05         |
| Drinking                     | 01         | 01         | 01         |
| Lipid Profile                | 02         | 02         | 03         |
| Wt <20%                      | 06         | 23         | 23         |
| Wt 20%- 30%                  | 01         | 01         | 06         |
| Wt > 30%                     | 00         | 00         | 00         |
| BMI< 25 Kg/m <sup>2</sup>    | 06         | 13         | 18         |
| BMI 25- 30 Kg/m <sup>2</sup> | 01         | 11         | 11         |
| BMI> 30 Kg/m <sup>2</sup>    | 01         | 00         | 00         |
| WC< 94 cms                   | 06         | 21         | 20         |
| WC 94- 102 cms               | 01         | 03         | 09         |
| WC> 102 cms                  | 00         | 00         | 00         |
| WHR< 0.9                     | 06         | 14         | 18         |
| WHR 0.9-1                    | 00         | 10         | 10         |
| WHR>1                        | 01         | 00         | 01         |
| HOCM                         | 00         | 01         | 00         |
| IGT                          | 02         | 00         | 02         |
| Diabetes Mellites            | 02         | 06         | 05         |
| CAD                          | 00         | 01         | 00         |
| TIA                          | 00         | 01         | 00         |

**Table 3: Age- wise distribution of determinants of hypertension**

Table 3 shows age wise distribution of the determinants of hypertension among Airforce hypertensive personnel. The deranged determinants of hypertension are more frequently seen in the age group of 40 and above. Physical parameters were largely within normal range among most of the hypertensive cases in the age group of 30- 39 yrs. Family history of hypertension was nil in this group. 4 out of 7 had IGT and DM. This suggest strong genetic predisposition for hypertension as all other modifiable risk factors are minimal in this age group. There are only two Truncal obesity cases (WHR >0.1), only one case of obese body mass index (BMI> 30 Kg/m<sup>2</sup>) and nil case of abdominal obesity (WC> 102cms). Truncal obesity case is equally distributed among the extremes of age groups and obese BMI is seen in younger age group (<40 yrs). Overweight cases are distributed equally in the two age groups after 40 yrs. It shows tendency to gain weight after the age of 40yrs in this cohort. Obesity cases are distributed in extremes of the age group of the study population. The two obese cases are seen in 30-39 yrs and 50- 59 yrs age group each.

**Discussion**

Essential hypertension is diagnosed when there is no obvious cause for hypertension. It is hypothesised that essential hypertension is multifactorial in nature and 95% of all hypertensive cases fall in this group. Secondary hypertension and Pregnancy induced hypertension are increasingly recognised as an independent entity. Though there is no strict definition of hypertension but JNC 7 classification defines hypertension for clinical purpose as blood pressure of ≥ 140/ 90 mm of Hg. Increase in prevalence of hypertension in India is a cause of concern which may be reflected in the recruited armed forces

personnel. Studies have shown prevalence of hypertension in the region of this airbase as 10.99% (Jaipur) and 14.08% (Ludhiana) (6).

A total of 60 cases of hypertension were present in the peripheral airbase during the period of study. The prevalence of hypertension among uniformed personnel of this airbase (also known as airwarriors) is 4.5% which is far below average among civil population which ranges from 10.99% to 36.4% (3, 6). The prevalence of hypertension in this peripheral base of IAF is far lower than in this region and Brazilian Air Force where it was reported to be 22% (6, 7). This is possibly because of high level of fitness and continuous monitoring of health of airwarriors by IAF. This is reflected in the very low prevalence of overweight (5.6%) and obesity (0.7%) cases in this airbase.

As expected number of cases of hypertension rose with age (Table 3). Majority of hypertensive cases (66.7%) are not associated with any lifestyle diseases. This is possibly because of regular follow-up and stringent control of blood pressure among this cohort of hypertensive airwarriors. Mean age, mean age at onset of hypertension and mean total service at onset of hypertension is comparable in the both group of hypertensive airwarriors (Table 2). Since lifestyle diseases/comorbidities are uniformly distributed among three age groups (Table 3) and there is no modifiable risk factor which is uniformly distributed in this group, possibility of strong genetic predisposition is very high. However, the same could not be confirmed in this study as family history of hypertension was nil among hypertensive cases with CVS comorbidities. No cause-effect analysis was done as it was beyond the scope of present study.

Prevalence of overweight and obesity cases in this peripheral IAF base is 6.3%. 5.6% of the airwarriors of this airbase is overweight. 0.7% of this airbase is obese. Studies have shown prevalence of overweight and obesity among men range from 18.6 % to 30.9% in rural and urban areas respectively. As per National Family Health Survey 2007 data, 14.4% of male population of the state in which this airbase is located is overweight (8). Even though prevalence of deranged anthropometric parameters is low as compared to the civilian population, it is far from desired. A fighting force like Indian Air Force should have ideally no overweight and obese case. The rising trend of deranged anthropometric parameters with age is similar to other studies, however, prevalence is much low in this age group as well (1).

Overall prevalence of smoking in hypertensive cases is 13.3%. 10% of hypertensive cases with lifestyle diseases smoked. Only 15 of hypertensive cases without lifestyle diseases smoked. Smoking causes activation of the sympathetic nervous system, oxidative stress and vasoconstrictive effect associated with the increase in inflammations related to hypertension (9). This warrants higher percentage of hypertensive cases who smoked. However, overall prevalence of smoking habit in this cohort of hypertensive airwarriors is comparable to Brazilian Air Force where it is 12.9% and among Indian population where it is 15.6% (7, 10).

The mechanism of alcohol-induced hypertension is unclear (11). Alcohol consumption has been shown to be associated with an increase in hypertension prevalence, probably due to its direct harmful action on the cardiac muscle (12). Effects on the renin-angiotensin-aldosterone axis, adrenergic nervous system discharge, heart rate variability, ionic fluxes, cortisol secretion, or insulin sensitivity have been proposed as underlying mechanisms of action. The large number of such hypotheses suggests that none is sufficient to explain the relationship. Furthermore, any such mechanism must reconcile the acute vasodilator effect of ethanol with a longer-term increase in blood pressure. 5% of hypertensive cases of this airbase consumed alcohol. 10 % of hypertensive cases with lifestyle diseases and only 2.5% of hypertensive cases without lifestyle diseases consumed alcohol.

One very interesting fact has come out in this study with regards to association of diet with hypertension which has no rational explanation. 78.3% of hypertensive cases are vegetarian. 77.5% of hypertensive cases without lifestyle diseases and 65% of hypertensive cases with lifestyle diseases are vegetarian. This raises the possibility of association of vegetarian diet to prevalence of hypertension in a community. However, literature survey suggests otherwise. The Dietary Approaches to Stop Hypertension (DASH) study showed that diets rich in fruits and vegetables and reduced in saturated fat can lower both the risk for high blood pressure and assist with blood pressure control in hypertensive persons (13). The DASH study prediction was

on the observation that vegetarian diets are associated with markedly reduced risk of hypertension. Majority of hypertensive cases with or without lifestyle diseases are vegetarian and hence it does question this established notion of DASH diet which is predominantly vegetarian. However, all these studies are predominantly done in western population. Present finding questions the utility of DASH diet in Indian subcontinent.

This study brings out clearly that prevalence of hypertension is far low in this airbase as compared to other Airforce and civil society around it. This could be because of the active lifestyle, stringent monitoring of health and effective screening of all the candidates during enrolment. To be admitted to the Air Force, the individuals are submitted to a selection process in which some characteristics are required, like minimum limit of height and weight, good health condition, absence of physical or mental disability and aptitude for physical activity. Very low prevalence of deranged anthropometric parameters and prevalence of hypertension in 30- 39 yrs of age group indicate that the initial biological and health characteristics observed in the selection, are probably still prevalent. Therefore, it is a group of individuals with a small probability of presenting serious health problems which could interfere in the associations of some variables with the outcome. However, effects of these factors appear to diminish after the age of 40 yrs as mean age of hypertension case is 47.5 yrs and most of the deranged anthropometric parameters (overweight & obesity) and cases of hypertension fall in this group of 40 and beyond.

### Conclusion

This study brings out the prevalence of hypertension and its determinants among airwarriors of a peripheral airbase which is much lower than its counterpart around the world and civilian population. There is a tendency to increase in overweight, obesity and cases of hypertension beyond 40 yrs of age and hence, remedial measures and strict medical supervision to halt or early detection of hypertension is desirable. The role of vegetarian diet and its association with hypertension among Indian population needs to be further studied.

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