



# Association between Stress and Hypertension among Adults More Than 30 Years: A Case-Control Study

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**Financial Support:** None declared  
**Conflict of Interest:** None declared  
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#### How to cite this article:

Bhelkar S, Deshpande S, Mankar S, Hiwarkar P. Association between Stress and Hypertension among Adults More Than 30 Years: A Case-Control Study. Natl J Community Med 2018;9(6):430-433

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**Date of Submission:** 04-05-18

**Date of Acceptance:** 25-06-18

**Date of Publication:** 30-06-18

## ABSTRACT

**Background:** Stress has long been listed as a potential and important cause of hypertension. Acute stress can induce transient elevation of blood pressure. But it is unclear whether stress results in sustained elevation of blood pressure and hypertension.

**Aims & Objectives:** To study the association between hypertension and stress among hypertensive subjects aged above 30 years using perceived stress scale.

**Material & Methods:** Newly diagnosed hypertensive patients aged 30 and above with age and gender matched controls were selected. Sociodemographic variables, history of addiction and physical activity were recorded using predesigned proforma. BMI was calculated for assessing obesity. Stress was assessed using Perceived Stress Scale. Blood pressure was recorded as per JNC-VII criteria.

**Results:** High stress was significantly associated with hypertension. Overweight and obesity, and lack of adequate physical activity were found to be significantly associated with hypertension. These factors were analysed in logistic regression model. Stress was found to be an independent risk factor for hypertension.

**Conclusion:** High stress is significantly associated with hypertension and is an independent risk factor for hypertension.

**Keywords:** Stress, Hypertension, Perceived Stress Scale

## INTRODUCTION

Among all non-communicable diseases cardiovascular diseases are the number one cause of death amounting to 17 million deaths worldwide each year and more than 9 million of these deaths are due to complications of hypertension.<sup>1</sup> Cardiovascular disease epidemics especially hypertension is driven by demographic and socio-economic changes that influence the living, eating and working habits of population. Such changes have resulted in population-wide escalation in major risk factors for hypertension like mental stress (psychosocial stress), tobacco use, physical inactivity, obesity and unhealthy dietary pattern.<sup>2</sup>

Stress has long been listed as a potential and important cause of hypertension among other risk factors such as obesity, low physical activity and addictions. Modern life is full of hassles, deadlines, frustrations and demands. Such mental or psychosocial stress can be one of the major risk factors for hypertension.<sup>3</sup>

Acute stress can induce transient elevation of blood pressure.<sup>1</sup> It is unclear whether stress results in sustained elevation of blood pressure and hypertension.

**Aims & Objective:** To study the association between hypertension and stress among adults aged above 30 years using Perceived Stress Scale.

## METHODS

A Case-Control study was conducted at Tertiary care hospital in from June 2014 to October 2015 among adults more than 30 years of age.

**Cases:** Newly diagnosed hypertensive patients attending Medicine out-patient department

**Controls:** Normotensive patients from other OPDs. Controls were group matched for gender & age ( $\pm 5$  years)

**Inclusion criteria:** Newly diagnosed hypertensive Patients

**Exclusion criteria:** All critically ill patients, those with secondary hypertension, those who did not consent to participate in the study.

Approval from Institutional Ethics Committee was sought. Informed consent of the study participants was taken after explaining the purpose of study.

### Sample size and Sampling

Considering the prevalence of Hypertension to be 20%<sup>4</sup>, proportion of exposure in general population as 0.2, odds ratio to be 2.2, power=80%, alpha=5% sample size came to be 102 cases & 102 controls. Newly diagnosed hypertensive patients were enrolled from medicine outpatient department whereas controls were enrolled from other outpatient departments.

A predesigned proforma was used for noting history regarding socioeconomic variables, history of current addictions like tobacco or gutkha chewing, smoking and alcoholism and adequacy of physical activity. History of past one week was asked for assessing adequacy of physical activity. Adequate physical activity was defined as at least 150 minutes of moderate intensity aerobic physical activity throughout the week or at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate and vigorous intensity activity.<sup>5</sup>

Stress was assessed by using Perceived Stress Scale. Perceived Stress Scale is used to assess the degree to which people perceive their lives as stressful. Subjects indicate how often they have found their lives unpredictable, uncontrollable, and overloaded in the last month. It has ten questions based on five point likert scale. Individual scores on the PSS can range from 0 to 40 with higher scores indicating higher perceived stress. Scores ranging from 0-13 are considered low stress. Scores ranging from 14-26 are considered moderate stress and scores ranging from 27-40 are considered high perceived stress.<sup>6</sup>

Height was measured using stadiometer. Weight was measured using electronic weighing machine.

BMI was calculated by using formula weight (kg)/height<sup>2</sup> (m) and individuals were classified as overweight, obese and normal weight according to World Health Organisation (WHO) classification.<sup>7</sup> Blood pressure readings were taken as per JNC-VII criteria.<sup>8</sup> Blood pressure of the subjects was recorded using mercury sphygmomanometer (Diamond- 112 APR 13 05837) by auscultatory method in right hand, seated with his or her back supported, feet on the floor, right hand supported and cubital fossa at heart level. If excessively high blood pressure was found, then the reading was repeated after half hour. Then second and third readings were taken two minutes apart and average of three readings was calculated.

**Statistical Analysis:** Data was entered in excel sheet and analysed by using Epi info version 7 software. Chi-square test was used to determine the association. Univariate analysis for risk calculations was done by odds ratio & their 95% Confidence intervals. Logistic regression analysis was done. P value less than 0.05 was considered to be statistically significant.

## RESULTS

Mean age of cases was 58.62 ( $\pm 10.31$  SD) years and that of controls was 54.54 ( $\pm 10.78$ ) Range: 31, 75 years. Maximum number of cases (42.2%) and controls (34.3%) belonged to > 61 years. Number of females slightly outnumbered males (52.9%). Maximum cases belonged to the Upper Middle class and Lower Middle class category (35.3%). Maximum controls belonged to the Lower Middle class category (39.2%). Cases and controls were comparable with respect to demographic characteristics. [Table 1]

**Table 1: Demographic profile of study subjects**

| Demographic profile         | Cases (%)<br>(n=102) | Controls (%)<br>(n=102) |
|-----------------------------|----------------------|-------------------------|
| <b>Age group</b>            |                      |                         |
| 30-40                       | 4 (3.9)              | 14 (13.7)               |
| 41-50                       | 19 (18.6)            | 27 (26.5)               |
| 51-60                       | 36 (35.3)            | 26 (25.5)               |
| $\geq 61$                   | 43 (42.2)            | 35 (34.3)               |
| <b>Gender</b>               |                      |                         |
| Male                        | 48 (47.1)            | 48 (47.1)               |
| Female                      | 54 (52.9)            | 54 (52.9)               |
| <b>Socioeconomic status</b> |                      |                         |
| Upper                       | 4 (3.9)              | 5 (4.9)                 |
| Upper Middle                | 36 (35.3)            | 23 (22.6)               |
| Middle/Lower Middle         | 36 (35.3)            | 40 (39.2)               |
| Lower/Upper Lower           | 24 (23.6)            | 34 (33.3)               |
| Lower                       | 2 (1.9)              | 0 (0)                   |

**Table 2: Level of stress among study subjects using perceived stress scale**

| Level of stress | Cases (%)<br>(n=102) | Controls (%)<br>(n=102) | Total<br>(n=204) |
|-----------------|----------------------|-------------------------|------------------|
| Low Stress      | 1 (0.9)              | 1 (0.9)                 | 2                |
| Moderate Stress | 8 (7.9)              | 19 (18.6)               | 27               |
| High Stress     | 93 (91.2)            | 82 (80.5)               | 175              |

Chi square (High stress v/s others)= 4.86, df=1, P=0.027 (S), OR (CI)=2.52 (1.08, 5.84); Chi square for linear trend = 3.29, P=0.069 (NS)

High stress was significantly associated with hypertension. Cases with high stress had 2.52 times higher chance of hypertension. But increasing levels of stress was not significantly associated with hypertension (Chi square for linear trend = 3.29,

P=0.069). [Table 2]

Some other risk factors for hypertension were studied like history of current addictions like tobacco or gutkha chewing, smoking and alcoholism, adequacy of physical activity and obesity. Overweight and obesity and lack of adequate physical activity were found to be significantly associated with hypertension. [Table 3]

Logistic regression analysis was done to find whether stress is an independent risk factor for hypertension. Overweight and obesity and lack of adequate physical activity were studied in logistic regression model. Stress was found to be an independent risk factor for hypertension [P=0.035, OR (CI)= 2.49 (1.06, 5.86)].

**Table 3: Some risk factors for hypertension (n=Cases=controls=102)**

| Risk factors                       | Cases (n=102)(%) | Controls (n=102) (%) | P value* | OR (CI)          |
|------------------------------------|------------------|----------------------|----------|------------------|
| Overweight/Obese                   | 32 (31.33)       | 17 (16.66)           | 0.013    | 2.28 (1.17,4.45) |
| History of addiction               | 47 (46.07)       | 43 (42.15)           | 0.57     | 1.17 (0.67,2.03) |
| Lack of adequate physical activity | 76 (74.50)       | 54 (52.94)           | 0.002    | 2.49 (1.37,4.51) |

\* Chi square test

## DISCUSSION

Stress is defined as a process in which environmental demands strain an organism's adaptive capacity resulting in both psychological demands as well as biological changes that could place at risk for illness. Since blood pressure and serum cholesterol increases during stress, the relationship between stress and hypertension has long been suspected.<sup>9</sup> It is an accepted fact that psychosocial factors operate through mental processes, consciously or unconsciously, to produce hypertension. Virtually all studies on blood pressure and catecholamine levels in young people revealed significantly higher noradrenaline levels in hypertensives. This supports the contention that over-activity of sympathetic nervous system has an important part to play in pathogenesis of hypertension.<sup>10</sup>

Age related increase of hypertension was observed in the present study. It has already been proved that the prevalence of hypertension increases with age in both genders. This can be due to natural aging process and also response to cumulative environmental factors. Similar pattern was found in study by Sagare SM et al<sup>11</sup> and Jadhav SB et al.<sup>12</sup>

Present study used perceived stress scale for assessment of stress. originally developed in 1983. It helps us to understand how different situations affect our feelings and our perceived stress. The questions in this scale ask about feelings and thoughts during the last month.<sup>6</sup> Various studies on stress and hypertension have used different scales for assessing stress like Gurmeet Singh et al

Presumptive Stressful Life Events Scale (PSLES)<sup>13</sup>, visual analog scale<sup>14</sup>, Survey of Recent Life Experiences<sup>15</sup>.

In the present study, high stress was significantly associated with hypertension. Cases with high stress had 2.52 times higher chance of hypertension. Similar findings were seen in study by Sagare SM et al<sup>13</sup> and Jadhav SB et al<sup>12</sup> where stress was found to be significantly associated with development of hypertension. Study by Lin S et al<sup>16</sup> showed cases were more likely than controls to be categorized into the high level of occupational stress and a significant elevation of risk for hypertension was observed for the high level of occupation stress. In a study by Garda Vera MP et al<sup>15</sup>, the sustained hypertensive group showed higher stress than did the normotensive group. While it was observed by Suter PM et al<sup>14</sup> that individual stress perception was inversely related with the systolic BP (SBP). No relation was found between the diastolic BP (DBP) and stress perception.

In the current study High stress was significantly associated with hypertension but increasing levels of stress was not significantly associated with hypertension. Contradictory finding was observed by Lin S et al<sup>16</sup> where positive association was observed between level of stress and development of hypertension.

Factors affecting blood pressure through stress include white coat hypertension, job strain, race, social environment, and emotional distress. Furthermore, when one risk factor is coupled with

other stress producing factors, the effect on blood pressure is multiplied.<sup>17</sup> In the present study, cases and controls were matched for age and gender. Cases and controls were comparable with respect to socio demographic variables. To study the effect of stress on hypertension some other known risk factors for hypertension were studied. In a study done by Jood K et al<sup>18</sup> after adjustment for age and gender in a binary logistic regression model, significant associations between permanent self-perceived psychological stress and hypertension ( $P < 0.01$ ) were found.

In a systematic review by Jim J et al<sup>19</sup> five out of 13 studies showed that stress was strongly associated with hypertension. Study by Redmond N et al<sup>20</sup> analyses were stratified by income level because of significant interactions with stress. High stress was associated with greater risks of CHD and death for individuals with low but not high income

Clinical trials demonstrating that measures to control stress are effective in lowering blood pressure would be helpful in confirming the link between stress and hypertension. Stress results in immediate sympathetic stimulation with a vasomotor response that result in high-output state and elevated blood pressure.<sup>21</sup>

## CONCLUSION

Stress is found to be significantly associated with hypertension and is found to be an independent risk factor for hypertension.

## RECOMMENDATION

Awareness about stress as a risk for hypertension should be done among masses. Measures to mitigate stress should be emphasized in the initiatives for prevention and control of hypertension.

## Limitation of the study:

As it was a hospital based study, study subjects may not be true representative of the population and therefore generalizability is limited.

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