

# Stressing 'Mental Stress' in Hypertension: A Rural Background Study

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## ABSTRACT

**Background:** Modern life is full of hassles, deadlines, frustrations and demands. Mental stress or psychosocial stress is one of the major risk factor for hypertension which itself is the risk factor for various other cardiovascular diseases.

**Objectives:** To find out the prevalence of hypertension among rural study population above 40 years of age and analyze the relationship between mental stress and Hypertension amongst them.

**Methodology:** A cross-sectional descriptive study was undertaken in rural Maharashtra from January 2007 till December 2008. Systematic random sampling was done to cover 3600 sample size above 40 years of age. A protocol was devised containing requisite items of socio-demographic data and data was collected from individual households with the help of ancillary staff. Mental stress score based on Presumptive stressful life event score (PSLES) was used. For statistical analysis, Chi-square test, F-test and Z-test were used.

**Results:** Prevalence of hypertension was found to be 5.92%. Males had maximum cases of hypertension [169 (7.27%)] compared to females [44 (3.44%)] which was statistically significant ( $\chi^2 = 21.63$ ,  $p < 0.001$ ). The rise in number of cases with increasing age was observed. Significant number of cases [127 (7.68%,  $p = 0.00006$ )] were found in study population belonging to 'More stress' group. Mean mental stress score of hypertensive study subjects was significantly higher (219) than normotensive study subjects (157). Males had significant higher stress score in both hypertensive and Normotensive group.

**Conclusion:** Total 213 cases of hypertension were detected (5.92%). As the stress increases, risk of hypertension increases. Statistically significant association was found between mental stress and hypertension for males. But in females, no such association was found. Mental stress definitely acts as risk factor for hypertension. Invention, propagation and practical application of various stress relieving measures & exercises should be done.

**Keywords:** DBP, Hypertension, Mental stress, Mental stress score, PSLES, SBP

## INTRODUCTION

"Nothing gives one person so much advantage over another as to remain always cool and unruffled under all circumstances." - Thomas Jefferson [1].

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 [2]. These risk factors have increased steeply in many developing countries in the last two decades. Modern life is full of hassles, deadlines, frustrations and demands. Such Mental or psychosocial stress is one of the major risk factor for hypertension which itself is the risk factor for various other cardiovascular diseases [3]. The purpose of this study is to analyze mental stress as a risk factor for hypertension among the rural Indian population, so as to contribute culture-congruent preventive and health modification strategies.

## OBJECTIVE

To find out the prevalence of hypertension among rural study population above 40 years of age and analyze the relationship between mental stress and Hypertension amongst them.

## METHODOLOGY

### Study setting

A Cross sectional descriptive community based study was undertaken during January 2007 to December 2008 in the rural

township of Tasgaon, which is 25 kms north-west of Miraj under Sangli district of Western Maharashtra, India. The majority of the population belongs to the lower socio-economic strata. Agriculture and animal husbandry are the major occupations. This area is Rural Health Training Centre under the Department of Community Medicine, Government Medical College, Miraj, India. As per the house to house survey carried out recently, total population of the area divided in four sectors was 35,500 and total population above age 40 yrs was 14352. Inclusion criteria for the study population comprised of the individuals above 40 years of age, residents of Tasgaon area and willing to participate in the study. Systematic random sampling was applied to get the desired sample size from four sectors of Tasgaon area.

### Sample size estimation

Considering assumed average of prevalence of 7% [4-7] (from various previous rural hypertension prevalence studies) and permissible error 0.9%, desirable minimum sample size for present study was estimated to be 3284. However, allowing non response and exclusion criteria as well as considering desirability to have larger sample for better validity of observations, (but also considering the limitations of time frame), sample size of 25 percent of total population above 40 years of age i.e. 3600 persons was considered and covered.

Score	Mental Stress
Up to 40	No Stress
41- 200	Less Stress
Over 200	More Stress

Age groups in Years	Male			Female			Total		
	Normo tensive	Hypertensive	Total	Normotensive	Hypertensive	Total	Normotensive	Hypertensive	Total
41-50	590 (25.38)	43 (1.85)	633 (27.23)	402 (31.5)	10 (0.78)	412 (32.28)	992 (27.52)	53 (1.48)	1045 (29)
51-60	707 (30.42)	32 (1.38)	739 (31.8)	377 (29.54)	9 (0.71)	386 (30.25)	1084 (30.12)	41 (1.13)	1125 (31.25)
61-70	608 (26.16)	45 (1.94)	653 (28.1)	325 (25.47)	13 (1.01)	338 (26.48)	933 (25.90)	58 (1.62)	991 (27.52)
71-80	231 (9.93)	32 (1.37)	263 (11.3)	118 (9.24)	9 (0.71)	127 (9.95)	349 (9.70)	41 (1.13)	390 (10.83)
> 80	19 (0.81)	17 (0.73)	36 (1.54)	10 (0.78)	3 (0.23)	13 (1.01)	29 (0.80)	20 (0.56)	49 (1.36)
Total	2155 (92.73)	169 (7.27)	2324 (100)	1232 (96.56)	44 (3.44)	1276 (100)	3387 (94.08)	213 (5.92)	3600 (100)

**[Table/Fig-1]:** Age and Gender-wise distribution with prevalence of Hypertension in study subjects

\* Parenthesis shows group-wise percentages. Total  $\chi^2 = 133.8$ ,  $df = 4$ ,  $p < 0.0000001$ , highly significant. For males,  $\chi^2 = 104.4$ ,  $df = 4$ ,  $p < 0.001$ , highly significant. For females,  $\chi^2 = 22.99$ ,  $df = 4$ ,  $p < 0.001$ , highly significant

Mental stress score	Male			Female			Total		
	Total	cases	%	Total	cases	%	Total	cases	%
0-40 (No Stress)	503	21	4.17	248	05	2.01	751	26	3.46
41-200 (Less Stress)	754	45	5.96	443	15	3.38	1197	60	5.01
201+ (More Stress)	1067	103	9.65	585	24	4.10	1652	127	7.68
Total	2324	169	7.27	1276	44	3.44	3600	213	5.92

**[Table/Fig-2]:** Distribution of study subjects according to Mental stress score & Hypertension

Total  $\chi^2 = 19.19$ ,  $df = 2$ ,  $p = 0.00006$ , highly significant. For males,  $\chi^2 = 18.03$ ,  $df = 2$ ,  $p = 0.00012$ , highly significant. For females,  $\chi^2 = 2.28$ ,  $df = 2$ ,  $p = 0.3197$ , not significant

	Mean Mental stress score					
	Hypertensive subjects		Normotensive subjects		Total study subjects	
	Total No.	Mean stress score	Total No.	Mean stress score	Total No.	Mean stress score
Male	169	238 ( $\pm 36.91$ )	2155	200 ( $\pm 33.36$ )	2324	208 ( $\pm 41.13$ )
Female	44	177 ( $\pm 19.26$ )	1232	137 ( $\pm 28.09$ )	1276	166 ( $\pm 34.98$ )
Total	213	219 ( $\pm 34.34$ )	3387	157 ( $\pm 36.36$ )	3600	188 ( $\pm 43.71$ )

Z-test score =

1. Between male and female hypertensive = 9.35 (HS)
2. Between hypertensive and Normotensive males = 20.82 (HS)
3. Between hypertensive and Normotensive females = 20.91 (HS)
4. Between hypertensive and Normotensive subjects = 25.46 (HS)

**[Table/Fig-3]:** Mean mental stress score of study subjects according to the blood pressure and Gender

Mental stress	Hypertensive subjects			Normotensive subjects		
	Total	Mean SBP	Mean DBP	Total	mean SBP	mean DBP
No stress	26	141 ( $\pm 7.49$ )	89 ( $\pm 8.95$ )	725	129 ( $\pm 9.58$ )	82 ( $\pm 13.46$ )
Less stress	60	144 ( $\pm 10.24$ )	89 ( $\pm 6.27$ )	1137	129 ( $\pm 11.20$ )	83 ( $\pm 19.87$ )
More stress	127	146 ( $\pm 6.86$ )	91 ( $\pm 8.65$ )	1525	130 ( $\pm 12.33$ )	84 ( $\pm 26.32$ )

Z score= SBP  
(Between Hypertensive & Normotensive)

- a) No stress : 07.93 (HS)
- b) Less stress : 11.00 (HS)
- c) More stress : 23.33 (HS)

F-test:

Hypertensive group:  
SBP - 4.633 ( $p = 0.010$ )  
DBP - 1.566 ( $p = 0.211$ )

Z-score= DBP  
(Between Hypertensive and Normotensive)

- a) No stress : 03.95 (HS)
- b) Less stress : 07.18 (HS)
- c) More stress : 09.02 (HS)

F-test:

Normotensive group:  
SBP - 3.21 ( $p = 0.0400$ )  
DBP - 2.13 ( $p = 0.1187$ )

**[Table/Fig-4]:** Mean Systolic (SBP) & Diastolic blood pressure (DBP) of study population according to the mental stress

## Ethical consideration

The institutional Ethical committee approved methodology and data collection procedure of the study.

## Data collection:

Pre-designed and pre-tested semi-structured proforma containing the requisite items of socio-demographic data and life events to calculate mental stress score was used to collect data from individual households. At first, every effort was made to relax the participant. Participants were explained about the nature of study and assured that the information given by him/ her is required only for study purpose and will be kept totally confidential. Blood pressure was measured thrice in right arm at one minute interval

using adult cuff size in sitting position. Finally average of second and third observations was considered and the first measurement was discarded. Hypertension was diagnosed as per JNC VII [8] criteria. Participants detected to be having active and acute complaints related to cardiovascular disorders were referred to the Rural Hospital, Tasgaon for pertinent investigations and further management.

## Data Analysis

Data was analyzed and appropriate statistical tests (Chi-square, F-test, Z-test) were applied. A value of  $p < 0.05$  was taken as significance level.

### Score used in the present study:

'Mental Stress Score' was given on the basis of Presumptive Stressful Life Event Score (PSLES) [9]. Standardized and statistically tested this score uses at least 51 stressful life events experienced by otherwise normal Indian population. The mean stress score for 51 life events have been formulated in the scale. All participants were interviewed and the cumulative summing of total life events is calculated as per the scale and the score is presented as follows:

## RESULTS

In the present descriptive cross-sectional study of Hypertension in relation with mental stress among the population aged over 40 years in a rural township of Tasgaon (District Sangli, Western Maharashtra, India), 3600 subjects were surveyed. Maximum age recorded was 88 yrs. Mean age was 56 yrs ( $\pm 9.9$  yrs) while Male to female ratio was 1.8: 1. Mean systolic blood pressure was 138mm/Hg ( $\pm 10.53$  mm/Hg) & diastolic blood pressure was 87mm/Hg ( $\pm 6.19$  mm/Hg).

[Table/Fig-1] indicates that, overall prevalence of hypertension in study population was 5.92%. Males had maximum cases of hypertension [169(7.27%)], while in females, cases were found to be 44 (3.44%). This difference was found to be significant. ( $\chi^2 = 22.99$ ,  $p < 0.001$ ) The rise in number of cases with increasing age was statistically significant. ( $\chi^2 = 133.8$ ,  $p < 0.0000001$ ).

[Table/Fig-2] shows that, Study subjects belonging to 'More Stress' group showed maximum number i.e. 127 (7.68%) cases of hypertension which was statistically significant in our study ( $p = 0.00006$ ). Prevalence of hypertension was minimum i.e. 3.46 % in 'No stress' group. When data was analyzed separately for both genders,  $\chi^2$  test indicated significant association between mental stress and occurrence of hypertension ( $p < 0.001$ ) in the total study groups as well as in males. However in females, the difference was not statistically significant ( $p = 0.3197$ ).

Mean stress score of the study population was 188. Mean stress score of hypertensive study subjects was much higher i.e. 219 than Normotensive study subjects (157) which was statistically significant ( $p < 0.001$ ). Males had significantly higher stress score in both hypertensive as well as Normotensive group. Z-score showed significant difference between hypertensive and Normotensive subjects [Table/Fig-3].

Two groups i.e. Normotensive and hypertensive were analyzed with mean systolic and diastolic blood pressure with the level of stress. It was observed that, as the stress increases mean systolic blood pressure in both group increases. It was found to be statistically significant by F-test [F-statistics-4.633 ( $p = 0.010$ )]. While insignificant changes occur in diastolic blood pressure [F-statistics-1.566 ( $p = 0.211$ )]. Systolic as well as Diastolic blood pressure was obviously higher in Hypertensive subjects in all stress groups as shown by Z-score test. Average blood pressure of Hypertensive group was 146/90 mmHg while in Normotensive group it was 130/83 mmHg [Table/Fig-4].

## DISCUSSION

Hypertension is a major health problem in India and in other developing countries. The various Indian studies estimated a prevalence rate of hypertension among rural population ranging from 1.99% to 21.2% [3-5]. The present study consisting study population above 40 years of age showed a prevalence of 5.92% which is comparable with recent studies carried out in various parts on India [10,11].

Age related increase of hypertension was observed in the present study. Maximum number of cases of hypertension was observed in population above 60 years of age [119 (55.8%)]. The rise of blood pressure with age is said to be due to ageing process, atherosclerotic changes in blood vessels, stress, strain and some unknown factors. This shows that blood pressure rises with age

probably due to effects of genetically programmed senescence in body system as well as accumulation of environmental influences. These results were comparable to study findings reported by Gupta et al., [12] and Todkar et al., [13].

A positive association was observed between level of stress and development of hypertension. Persons having higher mental stress (i.e. More stress group) were definitely having maximum number of cases of hypertension [127(59.6%)] whereas 'No stress' group showed only 26 cases (12.2%). It is proven fact that stress results in immediate sympathetic stimulation with a vasomotor response that result in high-output state and elevated blood pressure [14]. In a systematic review by John J. and Bhatt D. [15] over 'Emerging Risk Factors for Atherosclerosis' observed that five out of 13 studies showed that stress was strongly associated with hypertension. Similar observations were made by Piero Mustacchi [14] wherein he correlated emotional, sociocultural and occupational stress with prevalence of hypertension. So, as the mental stress score increases, prevalence of hypertension goes on increasing.

Influence of gender in hypertension prevalence has been observed among men who showed higher prevalence compared to women in the present study. Such observations were also reported by Prasanth et al., [16] in rural residents of Kerala, India. In the present study, men showed higher prevalence of hypertension as the level of stress increases [from 4.17% (No stress) to 9.65% (More stress)], but women had insignificant effect of stress on prevalence of hypertension [from 2.01% (No stress) to 4.10% (More stress)]. Taylor et al., [17] proposed the 'tend-and-befriend' female stress response for such difference as compare to 'fight-or-flight' response in males. The available literature emphatically shows that, women can adjust to the adverse psychosocial situations and the untoward, unfavorable events in a more composed manner owing to their unique psycho emotional profile; probably this is the factor which protects the women from the infliction of emotional insults consequent upon the mental stress. They are more able to cope up with such a stress by virtue of the parallel release phenomenon inherent to the female gender. This is the only plausible explanation to the observations recorded in relation to mental stress score in the present study.

It was observed that mental stress was more in hypertensive subjects ( $219 \pm 34.34$ ) compared to normotensive subjects ( $157 \pm 36.36$ ) as shown by mean mental stress score. Moreover, males had higher stress score than females in both the group. This was found to be statistically significant. This could be attributed to sympathetic activity and baroreceptor reactivity to mental stress as described earlier by Claude Julien [18].

Mean systolic and diastolic blood pressure of study population was analyzed in relation with level of stress. It was observed that mean systolic blood pressure was significantly increases as the level of stress increases in both Normotensive [(129 ( $\pm 9.58$ ) to 130 ( $\pm 12.33$ )] as well as hypertensive group [141 ( $\pm 7.49$ ) to 146 ( $\pm 6.86$ )] but there was insignificant difference in mean diastolic blood pressure. A cohort study conducted in Canada during 1978-82 by Carol Buck et al., [19] to study hypertension prognosis and onset of age showed similar results comparable with the present study.

To summarize the discussion, the present study consisting of study population above 40 years of age showed a prevalence of 5.92% while age related increase of hypertension was also observed. As the mental stress score increases, prevalence of hypertension goes on increasing.

## CONCLUSION

In the present descriptive cross sectional study on hypertension for evaluation of mental stress as a risk factor, total 213 cases of Hypertension were detected. Overall prevalence of hypertension was found out to be 5.92 %. It was found that, as the stress increases, risk of hypertension increases. Statistically significant association

was found between mental stress and hypertension for males. But in females, no such association was found. Mental stress definitely acts as risk factor for hypertension.

## RECOMMENDATIONS

- Prospective follow up studies involving the younger age group- if possible-from birth onwards which will help in blood pressure tracking as well as correlating the impact of mental stress for the longer period of time in the individuals should be carried out.
- Invention, propagation and practical application of various stress relieving measures & exercises should be done. Meta analysis of similar studies should also be done.
- For this continuing health education-formal as well as non formal is desirable.

## LIMITATIONS

- Though the Mental stress score was used, without the onsite help of psychiatrist, it was not possible to have the objective evaluation of stress impact.
- Also it was not possible to get all the detailed information about all the aspects related to mental stress, only few factors were studied with reference to specific prevalence and its association with blood pressure.

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## REFERENCES

- [1] Thomas Jefferson (1743–1826), U.S. president. Letter, May 21, 1816, to his grandson, Francis Wayles Eppes. The Family Letters of Thomas Jefferson, p. 415, eds. E.M. Betts and J.A. Bear, Jr. (1966).

- [2] Gaziano TA. Cardiovascular disease in the developing world and its cost-effective management. *Circulation*. 2005; 112:3547-53.
- [3] Andrew S. Psychophysiological Stress Reactivity and Hypertension. *Hypertension*. 2008;52:220-21.
- [4] Gupta SP, et al. Epidemiology of Hypertension based on total community survey in the urban population of haryana. *Indian Heart Journal*. 1978;30(6):315-22.
- [5] Sharma D, BKC Man, Rajbhandari S, Raut R, et al. Study of prevalence, awareness and control of hypertension in a suburban area of Kathmandu, Nepal. *Indian heart Journal*. 2006; 58:34-37.
- [6] Goel NK and Kaur P. Role of various risk factors in the epidemiology of hypertension in a rural community of varanasi district. *Indian Journal of Public Health*. 1996;40(3):71-76.
- [7] Gupta R, Gupta VP. Meta-analysis of coronary heart disease prevalence in India. *Indian Heart J*. 1996; 48:241–45.
- [8] Kottke TE et al. JNC 7- It's more than high blood pressure. *JAMA*. 2003;289:2573-75.
- [9] Gurmeet Singh, et al. 'Presumptive stressful life events scale. (PSLES)- A new stressful life events scale for use in India.' *Indian Journal of Psychiatry*. 1984;26(2):107-14.
- [10] Pardeep K and Chaudhary V. Epidemiological study of hypertension in a rural community of western rajasthan. *Indian Heart Journal*. 1991; 43:43-45.
- [11] Dash SC et al. Blood pressure profile, urinary sodium and body weight in the oranon' rural and urban tribal community. *JAPL*. 1994;42(11):878-80.
- [12] Gupta R, Gupta VP. Hypertension epidemiology in India: lessons from Jaipur Heart Watch. *Current Science*. 2009;97(3): 349-55.
- [13] Todkar SS, Gujarathi VV, Tapare VS. Period prevalence and sociodemographic factors of hypertension in rural maharashtra: A Cross-sectional study. *IJCM*. 2009;34(3):183-87.
- [14] Mustacchi P. Stress and Hypertension. *West J Med*.1990;153:180-85.
- [15] Jim J, Bhatt D. Emerging risk factors for atherosclerosis. *Indian Heart Journal*. 2007;59:28-37.
- [16] Prasanth TS, Vijaykumar K. Prevalence of systemic hypertension among the rural residents of Kerala. *Calicut Medical Journal*. 2008;6(3):e4.
- [17] Taylor SE, Klein LC, Lewis BP, Gruenewald TL, Gurung AR, & Updegraff JA. Biobehavioral responses to stress in females: Tend-and-befriend, not fight-or-flight. *Psycho-logical Review*. 2000; 107:411–29.
- [18] Claude J. Mental stress, hypertension and the baroreflex: what's new? *Journal of Hypertension*. 2009;27:31-33.
- [19] Carol B, Peggy B, Martin B, Allan D. The Prognosis of hypertension according to age of onset. *Hypertension*. 1987; 9:204-08.

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