

How Much Stress Is Stressful?

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Abstract: Stress is unavoidable but how much stress is safer and how men and women react to the same type and intensity of stress is a never ending debate. The present study is designed on this basis. The effect of mental stress with and without harassment in age matched males and females (15 each) on the cardiovascular parameters viz systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP) and heart rate (HR) was assessed. Mental arithmetic without and with verbal harassment was the tool of mental stress. SBP, DBP and HR were recorded before and after the mental task by using automatic digital BP apparatus (OMRAN) and MAP were calculated from these values. The data were analyzed in SPSS version 17.0 using Students' t test with a significance level at $p < 0.05$. The results revealed that there was no significant change in all the parameters after harassment-free mental stress while harassment-induced mental stress increased all the parameters in both the genders. However, men and women responded in a similar way, i.e., there was no significant difference in the findings between men and women. The reason for this may be that the mechanism involved in bringing out these effects is the same in both the genders i.e. stimulation of the limbic system that processes the psychological stress. In conclusion, stress as it is, is not harmful but combined effect of more than one stress at a time is the threat to the physiological functions.

Keywords: Mental stress, Harassment, Cardiovascular parameters

I. Introduction

“Stress arises when individuals perceive that they cannot adequately cope with the demands being made on them or with threats to their well-being.”[1]. ‘There is so much to do in so little time’ is a common expression that arises when a person faces one stressor with more intensity or more stressors with equal or more intensity. It will finally end up with the anxiety and frustration because of the feeling that he/she cannot cope up with the posed demand/task. This is very much true among the young individuals, especially student population.

A minimal amount of stress is however needed to achieve the goal, but excessive stress may incapacitate the subject from performing the task up to the mark and may end up with psychosomatic problems like generalized anxiety disorder and mental depression or/and pathophysiological problems like hypertension and myocardial infarction. Thus a question arises as to how much stress is actually stressful and harmful to the health.

We reported in our previous study that mental stress in the form of arithmetic task was well taken by the subjects and did not alter the cardiovascular parameters significantly and it was noted equally both in men and women. By comparing the results of more or less similar studies in the literature with different outcome, we speculated that our results could have been because of the method of applying the mental stress which would have lacked the intensity [2]. This triggered the curiosity to see whether the response could be different if the mental stress was intensified. So we decided to assess the cardiovascular response to mental stress by altering the method of application and intensity of the stress in normal healthy student population of both the genders.

Gender-specificity of stress response was also reported in literature where it was high-lighted that the stress-induced illnesses was different between men and women. Interestingly, several studies stated that the expression of stress-effect was more of subjective in women who showed higher stress vulnerability with more physical and psychological symptoms than men [3, 4, 5, 6, 7, 8]. In case of psychiatric disorders also, more often, women develop anxiety, depression, phobia, or panic disorders whereas men show more of antisocial behavior like aggression, anger and aversion [9, 10, 11]. But whether verbal reports of stress-induced feelings (subjective parameters) can be equated to actual physiological responses (objective parameters) is debatable. Thus in the present study an attempt had been made to look into the relation between the intensity of mental stress and the cardiovascular changes and to probe the gender difference in this respect

II. Materials And Methods

30 normal subjects in the age group of 18 to 20 years (15 males and 15 females) from the student population of Madha medical College & Research Institute in Chennai participated in this study. All were

normal healthy subjects without any psychological, psychiatric, cardio-respiratory, neurological, endocrinal and allergic disorders. Regular or habitual smokers, alcohol consumers and those who were on medication for some reason or other were excluded from the study. Even those who were on regular exercise or yoga practice were also not considered for this study. Institutional Ethical Committee approved the study and written informed consent was obtained from all the subjects after making them to understand the details of the study.

The experimental procedures were carried out in the forenoon between 9 and 11 AM to avoid the circadian variations. Subjects were instructed to report in the Department of Physiology and were rested for 15 minutes. The anthropometric measures (age, height and weight) were recorded and BMI was calculated by using the formula $BMI = \text{Weight in Kg} / \text{Height in. m}^2$. The basal values of cardiovascular variables viz Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP) and Heart Rate (HR) were recorded before the stress procedure by using automatic digital blood pressure apparatus (OMRAN) and Mean Arterial Pressure (MAP) was calculated by using the formula $DBP + 1/3$ of pulse pressure. Then they were subjected for the stress procedure.

Stress procedure

Mental stress without harassment:

The participants were subjected to mental stress by making them to perform a challenging arithmetic task in the form of serial subtraction of 13 from a 4 digit number for 5 minutes. It was a paper work done in a quiet room and the subjects were not disturbed in any form during the task. After five minutes, paper was collected and the parameters were recorded immediately.

Mental stress with harassment:

The subjects were rested for 30 minutes and the basal values of the parameters were recorded again. Then the subjects were asked to perform a similar arithmetic task of serial subtraction but with different numbers - 17 from a 5 digit number for 5 minutes. But this was an oral performance and the subjects were prompted for a faster response and were harassed by criticizing the wrong answers and demanding for a quick correct answer. At the end of five minutes, the parameters were recorded again.

Statistical analysis

The data were analyzed in SPSS version 17.0 using Students ‘t’ test. The values were expressed as mean ± standard error of the mean (mean ± SEM). $p < 0.05$ was considered to be statistically significant.

Results

Demographic particulars:

There was no significant difference in the age, weight and body mass index (BMI) between males and females. Height and basal metabolic rate (BMR) were more in males ($p < 0.004$ and 0.009) and percentage of body fat (BF%) was more in females ($p < 0.006$) and the differences were statistically significant (Table 1)

Table 1. Demographic particulars of males and females

Variable	Males	Females	Sig. p<
Age	18.00 ± 1.32	18.07 ± 0.15	0.80
Height	169.6 ± 1.32	156.50 ± 1.12	0.004*
Weight	62.17 ± 3.53	53.67 ± 2.46	0.06
BMI	21.53 ± 1.30	21.85 ± 0.09	0.84
BF%	19.52 ± 1.60	28.42 ± 1.30	0.006*
BMR	1557.27 ± 83.07	1284.60 ± 49.62	0.009*

Effect of mental stress without harassment:

In all the 30 participants: There was no significant change in the variables (SBP, DBP, MAP and HR) after mental stress without harassment (Table 1).

In males and females: Both males and females responded in a similar way to the mental stress without harassment, ie., there was no significant change in all the variables (Table 3)

Between males and females: There was no significant difference in the response between males and females (Table 5).

Table 2: Effect of mental stress on cardiovascular parameters

Mental stress	Variable	Before stress	After stress	Sig. p<
Without harassment (30)	SBP	114 ± 1.87	115.00 ± 2.3	0.346
	DBP	71.93 ± 1.57	68.93 ± 1.71	0.371
	MAP	86.26 ± 1.53	84.29 ± 1.56	0.714
	HR	82.77 ± 1.50	84.70 ± 1.68	0.902
With harassment (30)	SBP	113.97 ± 1.84	129.37 ± 2.32	0.007*
	DBP	67.20 ± 1.60	77.37 ± 2.06	0.01*
	MAP	82.79 ± 1.50	94.70 ± 1.90	0.000*
	HR	79.13 ± 1.60	96.43 ± 2.50	0.03*

Effect of mental stress with harassment:

In all the 30 participants: There was highly significant increase in SBP and MAP (p<0.007 and 0.000) and moderate increase in DBP and HR (p<0.01 and 0.03) after harassment induced mental stress (Table 2).

In males and females: Both the genders showed highly significant increase in all the parameters after harassment-induced mental stress (p value ranging from 0.003 to 0.000) (Table 4)

Between males and females: There was no significant difference in the response between males and females (Table 5).

Table 3: Effect of mental stress without harassment on cardiovascular parameters in males and females

Gender	Variable	Before stress	After stress	p value
Males (N = 15)	SBP	120.07 ± 2.06	121.40 ± 3.51	0.656
	DBP	73.93 ± 1.82	69.33 ± 2.22	0.075
	MAP	89.31 ± 1.76	86.69 ± 2.21	0.254
	HR	82.87 ± 2.32	86.47 ± 2.14	0.264
Females (N = 15)	SBP	109.73 ± 2.53	108.60 ± 1.93	0.634
	DBP	69.93 ± 2.52	68.53 ± 2.62	0.579
	MAP	83.20 ± 2.28	81.89 ± 2.08	0.581
	HR	82.67 ± 1.99	82.93 ± 2.57	0.887

Table 4: Effect of mental stress with harassment on cardiovascular parameters in males and females

Gender	Variable	Before stress	After stress	Sig. p<
Males (N = 15)	SBP	118.87 ± 2.42	133.53 ± 3.13	0.000*
	DBP	70.80 ± 2.52	79.07 ± 3.26	0.001*
	MAP	88.68 ± 2.46	97.22 ± 2.87	0.004*
	HR	77.07 ± 2.52	92.40 ± 2.78	0.000*
Females (N = 15)	SBP	109.07 ± 2.17	125.20 ± 3.17	0.000*
	DBP	63.60 ± 1.58	75.67 ± 2.56	0.000*
	MAP	78.76 ± 1.57	92.18 ± 2.43	0.000*
	HR	81.20 ± 1.88	100.47 ± 3.99	0.000*

Table 5: Gender difference in the effect of mental stress

Type of mental stress	Variable	Male: before - after difference	Female: before - after difference	Sig. p<
Without harassment	SBP	-1.33 ± 2.93	1.13 ± 2.33	0.515
	DBP	4.60 ± 2.39	1.4 ± 2.47	0.361
	MAP	2.62 ± 2.21	1.31 ± 2.32	0.685
	HR	-3.60 ± 1.54	-0.27 ± 1.85	0.177
With harassment	SBP	-14.67 ± 1.95	-16.13 ± 2.73	0.664
	DBP	-8.27 ± 2.07	-12.07 ± 2.19	0.218
	MAP	-10.40 ± 1.47	-13.42 ± 1.6	0.175
	HR	-15.33 ± 2.16	-19.27 ± 3.45	0.342

III. Discussion

This work is the continuation of our earlier publication [2]. The present study was designed on the speculation that the effect of mental stress with harassment might be different because it would be the cumulative stress effect (mental arithmetic and harassment). Surprisingly it was proved to be true – mental stress without harassment did not show any significant change on the cardiovascular parameters (SBP, DBP, MAP and HR) while all parameters showed highly significant increase after mental stress with harassment (Table 2, 3 and 4).

Some of the earlier reports also showed increase in heart rate [12, 13, 14] and cardiac output after mental stress [15, 16, 17]. As our earlier report was contradictory to these statements, we probed into the cause of this and found that the intensity of the stress was more in earlier studies and harassment was included along with mental arithmetic which we consider as an additional stress along with arithmetic task and the outcome might be the cumulative effect. It shows that mental stress with low intensity may be well tolerated by the subjects and it is almost like positive stress which can be a stimulant rather than a stress and can yield good outcome rather than upsetting the physiological functions in the body.

Another outcome of the present study is that the mental stress with or without harassment yielded the same results in males and females i.e., there was no gender difference. This lack of gender difference in the effect of mental stress was already reported by us in our previous study [2] and similar reports were found in some of the earlier studies also [18, 19]. In those reports, the low intensity of mental stress was speculated as the cause for it. But the results of the present study clearly show that irrespective of the intensity of the mental stress, the cardiovascular changes show no difference between males and females after harassment-free or after harassment-induced mental stress. This contradicts the reports of other earlier studies in which greater acute Hypothalamus-pituitary-adrenal (HPA) activity and autonomic responses in men were shown as the cause compared to adult women in response to psychosocial stressors such as public speaking and arithmetic tasks [20, 21].

When we probed the literature for the cause of increased BP and HR after harassment-induced mental stress in both men and women, we found that stimulation of limbic system (prefrontal cortex, the hippocampus, and amygdala) was focused to be involved in it (processing of psychological stress) [22, 23]. The earlier reports suggested that there is a gender difference in the cognitive processing that involves hippocampal structure and neurobiological mechanisms [22, 24, 25]. In spite of similar effect in both the genders, the mechanism involved in bringing out this change seems to be different. In men, increased vascular resistance was shown as the cause for increase in BP and in females it was found to be due to increased HR and cardiac output [17, 18, 19]. It is applicable not only to mental stress but also physical stress [2].

IV. Conclusion

Harassment-free mental stress did not alter the cardiovascular parameters significantly but harassment-induced mental stress increased all the variables equally in both the genders. These results open the gate to understand the problems faced by the people in the modern life. Stress as such is not a problem but the cumulative effect of two or more stressors at a time is bad for the physical and mental health. Modern system of education or/and the working style of high-tech companies or/and the families with both-the-parents employed etc pose the similar cumulative stress which may be the cause for the early onset of diabetes mellitus, hypertension, gastro-intestinal ulcers and many psychosomatic problems among the youngsters. One or more than one stress at a time cannot be avoided. But learning the method of coping up may help the people to face the stressors but not to allow them to eat our health.

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