

## Effect of Gender on Reactivity to Cold Stress in Young Medical Students

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### ABSTRACT

**Background:** Previous studies have found contradictory results in reactivity pattern in males and females to cold pressor test. It is important to understand these differences and its subsequent relevance in the pathogenesis of cardiovascular diseases like hypertension and coronary artery disease.

**Aim:** The purpose of this study was to investigate the effect of gender on reactivity to cold pressor test in young healthy medical students.

**Methods:** 94 young medical students in the age group of 17 to 27 years were subjected to cold pressor test and the systolic and diastolic blood pressure recorded before and after the test.

**Results:** The mean systolic rise of blood pressure was found to be  $13.63 \pm 9.71$  mm Hg in females as compared to  $12.31 \pm 5.79$  mm Hg in males. The mean diastolic rise in blood pressure was  $9.71 \pm 4.58$  mm Hg in females as compared to  $8.84 \pm 4.14$  mm Hg in males. The difference of mean for both mean systolic and diastolic rise of blood pressure in male and female subjects was not found to be statistically significant ( $p$  value =  $>0.1$ ). The percentage of female hyper-reactors (36%) was found to be more than male hyper-reactors (31%).

**Conclusions:** No statically significant difference was found in the reactivity to cold pressor test between males and females. The percentage of female hyper-reactors was more probably due to lower threshold to cold induced pain.

**Keywords:** Cold pressor test, gender, hypertension.

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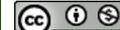
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### INTRODUCTION

Hypertension and coronary artery disease have emerged as a major epidemic reinforced by the modern sedentary lifestyle and stress. The hypothalamus mediates response to stress by activating the sympathetic nervous system to release epinephrine and nor-epinephrine, leading to intense vasoconstriction and increased systemic vascular resistance. ADH and aldosterone also contribute.<sup>1,2</sup>

The use of cold pressor test, given by Hines and Brown, in the prediction of hypertension is well established in a number of studies.<sup>3,4,5</sup>

But there are few studies on gender variations in response to cold pressor test. Estrogen is known to have both good

(vasodilator, increases HDL) and bad effects (increased tendency for thrombosis) on cardiovascular system. But by and large it is said to protect the cardiovascular system especially against coronary artery disease in the reproductive period.

Previous studies gave contradictory results on different response in males and females to cold pressor test. Understanding the different response to cold stress in both genders will give us an idea about the difference in pathogenesis of hypertension and coronary artery disease in males and females. Our study aimed at finding the same.

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## METHODS

Our study was done at Department of Physiology, SSMC Rewa (Madhya Pradesh), India. 94 medical students (Age 17-27 years) were taken as subjects in the study out of which 45 were males and 49 females. Due permission was taken from ethical committee of the institute and written informed consent taken from students. Blood pressure was measured before and after the cold pressor test. Statistics was done by MS Excel 2010 software.

## RESULTS

The mean systolic rise of blood pressure on applying the cold stimulus was found to be  $13.63 \pm 9.71$  mm Hg in females as compared to  $12.31 \pm 5.79$  mm Hg in males. The mean diastolic rise in blood pressure was  $9.71 \pm 4.58$  mm Hg in females as compared to  $8.84 \pm 4.14$  mm Hg in males. The difference between mean for both mean systolic and diastolic rise of blood pressure in male and female subjects was found to be not statistically significant ( $p$  value =  $>0.1$ ).

**Table 1: showing comparison of cold pressor reactivity between male and female subjects**

S No	Rise of BP after cold stress	Males (n=45)		Females (n=49)		Difference Of mean	P value
		Mean	S.D.	Mean	S.D.		
1	Systolic rise	12.311	5.799	13.633	9.714	1.322	>0.1
2	Diastolic rise	8.8444	4.145	9.714	4.583	0.8696	>0.1

A total of 32 students were found to be hyper-reactors out of which 18 were females and 14 were males.

**Table 2: showing distribution of male & female subjects regarding reactivity to cold pressor test**

Category	Number and percentage of Males (Total males = 45)	Number and percentage of Females (Total females = 49)	Number and percentage of Total Subjects (Total subjects = 94)
Hypo-reactors	31 (68%)	31 (63%)	62 (65.95%)
Hyper-reactors	14 (31%)	18 (36%)	32 (34%)

## DISCUSSION

Our study found that there was no significant difference to reactivity to cold stress amongst males and females. These results were similar to Kilogaur et al who found that males and females showed similar pressor response but blood pressure in males take longer to return to baseline. The explanation given was that men respond with greater and more prolonged peripheral adjustments (e.g., rise in SVR), whereas females are more like "cardiac" responders, with greater increases in heart rate and an attenuated blood pressure response to CPT.<sup>6</sup>

We also found that there was greater percentage of female hyper-reactors as compared to males. This may be due to higher threshold of pain in men as found by several studies.<sup>7-9</sup>

Also, Pierre-Julien et al found that myocardial blood flow as measured by CMR coronary sinus flow quantification revealed a higher response of myocardial blood flow in response to cold pressor test in women than in men. The reason given was gender differences in endothelial-

dependent vasodilatation.<sup>10</sup>

Mahalakshamma V et al found a greater rise in systolic blood pressure in females as compared to males whereas Srivastav et al found greater pressor response in females as compared to males in both systolic and diastolic values. The probable reasons for this variation were given as presence of more estrogen in females which has vascular protective actions especially in young females.<sup>11,12</sup>

McLean JK et al found reduced pressor response in females as compared to males and Rachel M et al also found similar results in addition to reduced dilatation of the common carotid artery in females as well. It was found that the mechanisms involved did not include a parallel difference in heart rate or venous plasma nor epinephrine concentration.<sup>13,14</sup>

Thus, a lot of further research is warranted to understand this gender variation in response to cold stress as it gives us an idea about the different pathogenesis of disease like hypertension and coronary artery disease in both genders especially pertaining to vascular endothelial factors.

## CONCLUSION

Although we did not find any significant difference in the reactivity to cold stress between males and females per say but further studies are necessary to understand the difference in response to cold pressor test in both the genders. The percentage of female hyper-reactors was more probably due to lower threshold to cold induced pain.

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