

## Original article

# Study of relation of BMI with cardiovascular autonomic function

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### Abstract

**Background**-Chronic imbalance of the autonomic nervous system is a prevalent and potent risk factor for adverse cardiovascular events, including mortality. Although not widely recognized by clinician, this risk factor for adverse cardiovascular events, including mortality. Although not widely recognized by clinicians, this risk factor is easily accessed by measure such as resting and peak exercise rate, heart rate recovery rate variability. The present study was done to establish the relation of BMI on cardiovascular autonomic functions. The present study was carried out among office staff in the age group [38-58] years in Gauhati medical college.

**Materials and method**-While selecting the cases only those cases were taken who were free from systemic disease. They were divided into four groups according to BMI, normal, moderately obese, obese and underweight. Various autonomic tests such as deep breath and valsalva ratio for parasympathetic function, and hand grip test and orthostatic hypotension test for sympathetic function were performed.

**Result:** It was seen that sympathetic activity increased as BMI increased and parasympathetic activity decreased as there was significant decrease in the valsalva ratio and deep breadth test in moderately obese and obese compared to the normal BMI. On the other hand there was a significant increase in handgrip test and orthostatic hypotension test in obese compared to that of normal BMI.

**Conclusion:** Sympathetic imbalance was seen in moderately obese and obese, parasympathetic activity was significantly decreased.

**Key words :** Obesity , Autonomic functions , Sympathetic , Parasympathetic

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### Introduction

Chronic imbalance of the autonomic nervous system is prevalent and potent risk factor for adverse cardiovascular events including mortality. Any factor that lead to inappropriate activation of the sympathetic nervous system. Any factor that lead to inappropriate activation of the sympathetic nervous system can be expected to have an adverse effect on this measures. Any factor that augments vagal tone tends to improve outcome. Factors linking obesity to

increase BP and blood volume and cardiac output that is caused by increased metabolic demand. There is enough previous study to prove that sympathetic activity has been enhanced in obesity and increased vagal tone in people with underweight. This study has been undertaken to establish relation of BMI with autonomic function.

### Materials and method

The study was carried out among 200 medical students and staff members in the age group 18 to

35yrs. Proper history of medical illness, any medication or alcohol consumption was recorded. Consent were taken prior to performing different autonomic test. The body mass index was calculated by using the formula  $wt[kg]/Ht[m^2]$ . Weight was measured with help of weighing machine and height with the help of anthropometer.

The following classification of BMI was used

Underweight	<18.5
Normal	from [18.5 to 24.9]
Moderately obese	from [25 to 29.9]
Obese	from [30 to 40]

The BP was measured using a sphygmomanometer. The subjects were requested to come to the department at 9am after having light breakfast and to abstain from tobacco or caffeine beverage that day. The subject was made to lie supine in a examination bed large enough to support the subjects entire body. So that he or she was completely Relaxed. For parasympathetic function deep breath test and valsalva test were performed. For sympathetic function hand grip test and orthostatic test were done.

## Results

All the 200 cases were divided into different according to BMI [ $<18.5$ ] was 20, BMI [18.5-24.9] was 140, BMI [25-29.9] was 35 and of BMI [30-40] was 5. Statistical Analysis was performed using student t Test. Data presented as means  $\pm$  SD. correlation between various BMI were computed. Comparison of all four groups of BMI were done. There was a significant difference in valsalva ratio between BMI [18.5-24.9] and BMI [ $<18.5$ ]. P value  $<.05$ . The valsalva ratio in underweight was less than that of normal weight people. Comparison of valsalva ratio between BMI [18.5-24.9] and BMI [25-29.9] has highly significant difference. P value  $<.05$ . The valsalva ratio in BMI [25-29.9] was highly significantly decreased compared to that of BMI [18.5-24.9]. The valsalva ratio of BMI [18.5-24.9] and BMI [30-40]. P value  $<.01$ . It was found that hand grip test between BMI [18.5-24.9] and BMI [ $<18.5$ ] was very highly significant difference. P value [ $<.01$ ] the mean value of BMI [ $<18.5$ ] was highly significant. P value [ $<.01$ ]. The mean value of BMI [18.5-24.9] There was very highly significant increase in mean value of hand grip test in obese case compared to that of underweight. P value [ $<.001$ ].

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**Table –1 Study of different autonomic function test according to BMI**

BMI	No of cases	Valsalva test			Deep breadth test [beats /min]			Orthostatic test [mmHg]			Hand grip test [mmHg]		
		Mean	SD	SE	Mean	SD	SE	Mean	SD	SE	Mean	SD	SE
<18.5	20	1.51	0.015	(3.3500)-03	20	4.47	0.051	10	0.00	0.00	11.25	2.63	0.58
18.5-24.9	140	1.57	0.041	[3.46]-03	19.67	4.3	0.365	9.7	0.207	0.207	18.8	2.15	0.181
25-29.9	35	1.48	0.113	0.019	19.6	4.63	0.783	8.9	0.247	0.247	22.42	4.16	0.78
30-40	5	1.43	0.316	0.316	17	4.47	2.00	7.9	0.695	0.695	23.2	4.6	2.062

**Discussion**

comparative study was done with student ‘t’ test and the following conclusion was done. That decreased parasymp-athetic activity in BMI[18.5-24.9] was statistically significant [p<.05]. Difference of valsalva ratio in BMI[18.5-24.9] and [25-29.9] was highly significant. P value [ <.01].

Valsalva ratio in BMI [18.5-24.9] and [30-40] was very highly significant P value <.001. Valsalva ratio between BMI [ <18.5] and [25-25.9] was highly significant. P value [ <.05] Comparison of valsalva ratio between BMI [18.5-24.9] and BMI [25-24.9] has highly significant difference. P value <.05. The valsalva ratio in BMI [25-29.9] was highly significantly decreased compared to that of BMI [18.5-24.9] It was found that hand grip test between BMI [18.5-24.9] and BMI [ <18.5].

There was very highly significant difference in deep breadth test between BMI [18.5-24.9] and [30-40]. The deep breadth test was decreased in BMI [30-40]. P value <.01. The deep breadth test in case of obese case was less compared to normal. P value [ <.01].

There was very highly significant difference between BMI [ <18.5] and BMI [30-40]. P value <.01. There was very highly significant increase in mean value of hand grip test in obese case compared to that of underweight. P value [ <.001]

In the present study comparative study was done with student ‘t’ test and the following conclusion was done

That decreased parasympathetic activity in BMI [18.5-24.9] was statistically significant [p<.05]. Difference of valsalva ratio in BMI [18.5-24.9] and BMI [25-29.9] was highly significant. P value [ <.01]. Valsalva ratio in BMI [18.5-24.9] and BMI [30-40] was very highly significant P value <.001. Valsalva ratio between BMI [ <18.5] and BMI [25-25.9] was highly significant. P value [ <.01].

The valsalva ratio was less in moderately obese compared to that of underweight. In a study done by Briam M. Curtis in , he found that there is a relationship between parasympathetic activity and obesity. Reduction of weight leads to increase in parasympathetic activity and decrease in sympathetic tone [6] In another study done by A. Gandhi have

shown that parasympathetic function R.R ratio during valsalva maneuver was significantly higher in obese compared to normal subject[7] On the otherhand GS Gaur et al found that valsalva ratio between underweight and normal did not vary significantly[8]

In the present study the mean value of difference of diastolic BP in hand grip test of BMI <18.5,[18.5-24.9], [25-29.9],[30-35] were 11.25mmHg, 18.30mmHg,22.42mmHg,23.20mm. Comparative study was done with student 't' test.It was seen that handgrip test between BMI[18.5-24.9] and <18.5]was less than that of BMI[18.5-24.9].

There was a highly significant increase in mean value of handgrip test in obese case compared to that of underweight,p value[<.001] . Difference of valsalva ratio in BMI[18.5-24.9] and [25-29.9] was highly significant[p value<.01].Valsalva ratio in BMI between [18.5-24.9] and [30-40]was very highly significant P value <.001 less in moderately obese compared to that of underweight.In the present study the mean value . Of difference of valsalva ratio BMI[18.5-24.9] and[25-29.9]was highly significant.P value[.<01].Valsalva ratio between BMI[<18.5]and [25-29.9] was highly significant.P value <.01.The valsalva ratio was less in moderately obese compared to that of underweight. In a study done by Brian M Curtis,2002 he found that there is relationship between parasympathetic activity and obesity[6]

In another study done by Asha Gandhi 2003,she proved that for parasympathetic function R.R ratio during valsalva maneuver was significantly higher in obese compared to normal subject[7] . In the present study the mean value of difference of diastolic BP in hand grip test of BMI[<18.5],[18.5-24.9],[25-29.9],[30-35] were 11.25mmHg, 18.80mmHg,22.42mmHg,23.20mmHg

In a study done by Gunjan and Gulati she found that comparison between balanced weight And underweight ,the difference in handgrip test was statistically significant co-related with nutritional Status.BP [8 I,Epsito K et al found that there is sympathetic overactivity in obese women compared to woman of normal weight[9]N,Sathyaprbhu found that weight has direct relation with resting BP[10] . GS Gaur proved that there was altered sympathetic cardiac response in undernourished . Children[11] In the present study both systolic and diastolic blood pressure is raised in overweight group suggesting increased risk of diabetes ,hypertension and heart diseases.In the present study the overweight adults are found to have sympathovagal imbalance and might have risk for adverse cardiovascular events

#### **Conclusion:**

The following relation was established that there is a relationship of cardiovascular autonomic function with BMI.As BMI increases parasympathetic decrease and sympathetic activity increase. It was found that there was a significant decrease in valsalva ratio in BMI [<18.5],[25-29.9],[30-40] compared to that of BMI[18.5-24.9]

On the other hand it was seen that there was significant increase in handgrip test in BMI[25-29.9] and [30-40] compared to normal BMI[18.5-24.9].Changes in the autonomic nervous activity begins in the overweight

And sympathetic imbalance is seen in obese thus indicating cardiovascular risk such as sudden death, Ischemic heart disease, coronary artery disease. Thus the study of autonomic function has gained popularity over the years

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