European Journal of Molecular & Clinical Medicine (EJMCM)
ISSN: 2515-8260 Volume 09, Issue 07, 2022

Original research article

Cross Sectional Observational Study to Assess the Cardiovascular Risk in Healthy Obese and Non-obese Young Staff of Tertiary Care Center.

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Abstract

Aim: To assess the cardiovascular risk in healthy obese & non-obese young staff of tertiary care center by using non-invasive test. To assess the cardiac function in correlation not only to body mass index but also body fat percentage, waist circumference, waist to hip ratio, fat free mass index by using various autonomic function tests.

Method: The study involved 62 subjects (20-40 year). Out of which 31 were obese and 31 were healthy non-obese volunteer. In all study subjects four different non-invasive, simple, standardized autonomic function tests were done.

Result: Variation in heart rate (ΔHR) during deep breathing,Valsalva ratio, 30:15 ratios during orthostatic test was significantly lower in obese than non-obese. BMI, Body Fat %, Fat Free Mass Index, Waist Circumference, Waist Hip Ratio shows negative correlation with parasympathetic autonomic function.

Conclusion: There is decrease parasympathetic activity in obese subjects. As waist Hip Ratio, waist circumference and Body fat % increased, there is decreased in parasympathetic function. So, assessment of Waist Hip Ratio, Waist circumference and Body Fat % are important in healthy obese and non-obese subjects along with BMI.

Keywords: Obesity, autonomic function testing (AFT), deep breath test, Valsalva Manu ever

Introduction

In this modernized society obesity has became an lifestyle related disease inviting plenty of other metabolic abnormalities. Obesity is suggested to be an imbalance between energy intake and expenditure resulting from complex interaction of genetic, physiological, behavioral and environmental factors[1].

As a result of its abnormal metabolic background almost all the systems in body are affected by obesity. This may also includeANS in this multisystemic syndrome. As ANS is involved in energy metabolism and regulation of almost all the systems of the human body. ANS

functioning majority accounts for regular wages ofcardiovascular system hence a connection must be setup in between factors of obesity and autonomic nervus system[2,3]. Autonomic functions include control of respiration, cardiac regulation (the cardiac control center), vasomotor activity (the vasomotor center), and certain reflex actions such as coughing, sneezing, swallowing and vomiting. The autonomic nervous system has three branches: the sympathetic nervous system, the parasympathetic nervous system and the enteric nervous system[4,5,6,7]. Several studies in literature suggest that ANS of obese individuals is chronically altered[8,9]. A regulatory system that maintain constant energy storage is likely to involve complex interaction among humoral, neural, metabolic, and psychological factor. Autonomic nervous system act as central in coordination of this system. In present research, we have studied association of different parameter of obesity with parasympathetic function in obese subjects.

Material and method

Written informed consent was obtained from obese and healthy non-obese volunteers.

Selection criteria:

a) Study group:
1) Body mass index ≥ 25. 2) Age group 20-40 yr. 3) Informed consent obtained
b) Control group:
1) Healthy young subject of age 20-40year 2) Body mass index < 25. 3) Informed consent obtained.

Exclusion Criteria:

1. Patients of malignant hypertension, diabetes, psychological diseases, cardiac abnormalities, chronic obstructive lung diseases etc.
2. People doing yoga and physical training (regular exercise means one hour of exercise,4 times a week)34-35,
3. Patients with history of smoking/alcohol/drug abuse.
4. Patients taking medication e.g. Vasodilators, α blocker, β blockers, barbiturates, opiates, tricycle Antidepressants and phenothiazines that could affect autonomic functions were also excluded from the study.
5. Pregnant women.

Following parameter was studied: -

1) Weight: - It was recorded with weighing machine.
2) Height: - It was recorded with measuring tape.
3) BMI: - It was measured by Quetlet Index10
4) Body fat percentage: - It was measured by omoronkarada scan (HBF375).
5) Fat free mass index: - FFMI= Fat- Free Mass/ Hight2
6) Waist circumference: - It was measured with measuring tape.
7) Waist to Hip ratio: - It was measured with measuring tape.
8) Autonomic function tests: - Following tests was performed to access parasympathetic Functions in control & study group. 1) Deep breathing exercise test 2) Valsalva Maneuver test 3) Orthostatic test

Tests evaluating parasympathetic division:

1)Deep Breathing Test: - The respiratory sinus arrhythmia was recorded as a mean variation in heart rate in beats per minute during deep breathing at the rate of six breaths per minute11.

2) Valsalva maneuver: The heart rate response to Valsalva maneuver was recorded as the difference between maximum and minimum heart rates during and after the standard Valsalva maneuver in bpm.[12]

VR = Max R-R interval (Sec) during release
Min. R-R interval (Sec) during strain

3. orthostatic test: Heart rate response was measured immediately when subject stand from supine position[13].

30:15 ratio: R-R interval between 30-31st beat, R-R interval between 15-16th beat

Statistical analysis

All the data was presented as mean ± S.D. (standard deviation) and statistical analysis was done with student unpaired t test and spearman correlation. The p-value of less than 0.05 indicates that the results are significant statistically and p-value less than 0.0001 indicate that the results are statistically highly significant.

Result

The study involves 62 subjects (20-40 year) out of which 31 were obese and 31 were healthy non-obese volunteers. Mean weight & BMI was significantly higher in obese group than non-obese group (p=<0.05). While Deep Breathing Test (ΔHR), Valsalva Ratio & Orthostatic Test (30:15 ratio) was significantly lower in obese group than non-obese group.BMI,Body fat percentage, Fat free mass index,Waist circumference and Waist to Hip ratio showed statistically significant negative correlation with cardiac autonomic function.

Table 1: Comparison between different parameter among obese and Non-obese

Parameters	**Obese (n=31)**		**Non-Obese (n=31)**		**p-value**
	Mean	SD	Mean	SD	
Age (years)	29.19	5.49	28.96	5.18	>0.05
Height (cm)	161.41	7.40	165.12	6.48	>0.05
Weight (kg)	78.81	7.03	60.25	5.85	<0.05
BMI (kg/m^2)	29.04	1.89	22.07	1.42	<0.05
Deep Breathing Test (ΔHR)	10.85	0.83	22.72	3.79	<0.05
Valsalva Ratio	1.08	0.04	1.27	0.03	<0.05
Orthostatic Test (30:15 Ratio)	1	0.02	1.13	0.06	<0.05

Table 2: Association between different parameters and with Cardiac Autonomic Functions.

Parameter	**Dependent variable**	**Spearman rank Correlation**	**p-value**
BMI	**Deep Breathing Test (ΔHR)**	-0.7124	<0.05
	Valsalva Ratio	-0.7576	<0.05

	Orthostatic Test (30:15 Ratio)	-0.7203	<0.05
BodyFat%	**Deep Breathing Test (ΔHR)**	-0.7595	<0.05
	Valsalva Ratio	-0.7231	<0.05
	Orthostatic Test (30:15 Ratio)	-0.7392	<0.05
Fat Free Mass Index	**Deep Breathing Test (ΔHR)**	-0.3808	<0.05
	Valsalva Ratio	-0.4008	<0.05
	Orthostatic Test (30:15 Ratio)	-0.3625	<0.05
Waist Circumference(cm)	**Deep Breathing Test (ΔHR)**	-0.7392	<0.05
	Valsalva Ratio	-0.7834	<0.05
	Orthostatic Test (30:15 Ratio)	-0.7496	<0.05
Waist Hip Ratio	**Deep Breathing Test (ΔHR)**	-0.7658	<0.05
	Valsalva Ratio	-0.7765	<0.05
	Orthostatic Test (30:15 Ratio)	-0.7693	<0.05

Mean ± SD for age (year) in obese was 29.19 ± 5.49 and for non-obese group it was 28.96 ± 5.18. For BMI Mean ± SD in obese was 29.04 ± 1.89 and for non-obese group it was 22.07 ± 1.42. The difference in mean values of BMI was statistically significant ($p<0.05$). Mean ± SD for ΔHR in obese group was 10.85 ± 0.83 and for non-obese group it was 22.72 ± 3.79. The difference in mean values of ΔHR was statistically significant ($p<0.05$).

Discussion

With the present significant results with association between AFT and parameters Rinku Garg et al observed that the heart rate response to Deep Breathing test was significantly lowered in obese group as compared to non-obese group[14]which was similar to our study. Mean ± SD for 30:15 ratio in obese group was 1 ± 0.02 and in non-obese group it was 1.13 ± 0.06. The difference in mean values of 30:15 ratio was statistically significant ($p<0.05$). Mean value of 30:15 ratio was lower in obese group as compared to non-obese group which was statistically significant ($p<0.05$).

Similar results were shown by SimranGrewalet al.These indicate impaired vagal function in obese group[15].We found that there was statistically significant negative correlation of BMI with variation in heart rate during deep breathing test (-0.7124,$p<0.05$), Valsalva ratio during Valsalva maneuver (-0.7576,$p<0.05$), 30:15 ratio during orthostatic test (-0.7203,$p<0.05$). We found that there was statistically significant negative correlation of Body fat % with variation in heart rate (ΔHR) during deep breathing test (-0.7595,$p<0.05$), Valsalva ratio during Valsalva maneuver (-0.7231,$p<0.05$), 30:15 ratio during orthostatic test (-0.7392, $p<0.05$).

Swikruti Behera found in there study that Body fat % show negative correlation with variation in HR (ΔHR)&Valsalva ratio[16].We found that there was statistically significant weak negative

correlation of Fat Free Mass Index with variation in heart rate during deep breathing test (ΔHR) (-0.3808, $p<0.05$), Valsalva ratio during Valsalva maneuver (-0.4008, $p<0.05$), 30:15 ratio during orthostatic test (-0.3625, $p<0.05$).We found that there was statistically significant negative correlation of Waist Circumference with variation in heart rate (ΔHR) during deep breathing test (-0.7392, $p<0.05$), Valsalva ratio during Valsalva maneuver (-0.7834, $p<0.05$), 30:15 ratio during orthostatic test (-0.7496).

Breno Quintella Farah et al found in there study that increasing waist circumference was associated with decreased heart rate variability[17].We found that there was statistically significant strong negative correlation with variation in heart rate (ΔHR) during deep breathing test (-0.7658,$p<0.05$), Valsalva ratio during Valsalva maneuver (-0.7765,$p<0.05$), 30:15 ratio during orthostatic test (-0.7693,$p<0.05$).Arunima Chaudhuri,et al in there study found that Waist Hip Ratio shows strong negative correlation with variation in heart rate, Valsalva ratio, 30:15 ratio[18].

As increased BMI, Body Fat %, Fat Free Mass Index, Waist Circumference, Waist Hip Ratio associated with decreased parasympathetic cardiac autonomic functions of the body. assessment of Waist Hip Ratio, Waist circumference and Body Fat % are important in healthy obese and non-obese subjects along with BMI. They show strong correlation with cardiac autonomic functions.

It will be of great help in identification of high-risk subjects having decreased sympathetic and parasympathetic activity that are prone to various cardiovascular complications like heart attack and sudden death. Dietary modifications, exercise, and yoga are important to reduce central adiposity and body fat percentage, which may improve autonomic functions of subjects.

Conclusion

It appears from our study that autonomic functions are found to be altered in obese group as compared to non-obese group. Obesity is associated with decreased variation in heart rate (ΔHR), decreased Valsalva ratio and decreased 30:15 ratio. The observed changes possibly reflect decreased parasympathetic activity in obese subjects.

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