ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

A Cross Sectional Study Of Parasympathetic Functions With Total Body Fat And Visceral Fat In Young Adult Males.

RS Paviaya[1], Rashmi Tomar[2], Keshav Kashyap[3], and Kiran Thorat[4]*.

[1]Assistant Professor, Department of Physiology, SRVS Govt. Medical College Shivpuri, Madhya Pradesh, India.
[2]Associate Professor, Department of Microbiology, SRVS Govt. Medical College Shivpuri, Madhya Pradesh, India.
[3]Associate Professor, Department of Physiology, CIMS Bilaspur, Chhattisgarh, India.
[4]Associate Professor, Department of Physiology, SRVS Govt. Medical College, Shivpuri, Madhya Pradesh, India.

ABSTRACT

Obesity is characterized by an excessive deposition and storage of fat in the body, which alters the parasympathetic functions.ANS through its Parasympathetic division regulates and modulates most of the visceral functions of the body. This cross-sectional study includes 200 healthy volunteer male subjects between 20 to 35 years of age, in and around Shivpuri. For all the subject's anthropometric data was collected by Karada scan and cardiovascular parasympathetic functions were assessed by sphygmomanometry and electrocardiogram. Descriptive statistics was done by using SPSS software version 16 for windows with descriptive analysis done by ANOVA analysis test which suggested increase in sympathetic and decrease in parasympathetic activity as visceral fat% increases. Study concludes that with increase in visceral fat% cardiovascular morbidity and mortality increases as compared to increase in total body fat %.

Keywords: Cardiovascular, Autonomic Function, Total Body Fat %, Visceral Fat%

https://doi.org/10.33887/rjpbcs/2023.14.3.1

Corresponding author

ISSN: 0975-8585

INTRODUCTION

The autonomic nervous system (ANS) regulates many functions, including circulation and metabolism. The ANS exerts direct control of adiposity at the cellular and molecular levels Both the sympathetic nervous system (SNS) and the parasympathetic nervous system (PNS) provide complex homeostatic control to specifically coordinate the function of adipose tissue; the SNS stimulates catabolism, and the PNS stimulates anabolism [1, 2].

Altered autonomic function is characterized by less adaptive modulation and sympathetic activation. Neurohumoral activation increases the risk of both first and secondary cardiovascular events and is also associated with subclinical cardiovascular disease [3].

In general, visceral fat seems stronger associated with CVD risk factors than subcutaneous fat. This may be explained by more macrophage infiltration and a higher secretion rate of pro-inflammatory cytokines [4]. Electrocardiographic markers that are commonly used to study parasympathetic functions are heart rate (HR) and HR variability. Three recent experimental studies showed that the sympathetic overdrive is also reflected in other changes on the standard electrocardiogram (ECG) [5]. In healthy individuals, an increase in the body mass index (BMI) correlates with increased sympathetic activity and lowered parasympathetic activity [6]. As the BMI increases in, the body fat percentage also incearse to higher levels, based on its location in the body, white fat can be further subcategorized into subcutaneous, visceral, and ectopic fat and the fat that surrounds the internal organs is generally considered as visceral fat [7]. The precise pathophysiology and mechanisms underlying increased mortality unrelated to cardiovascular risk factors associated with obesity remain unknown. A better understanding of the link between central adiposity parameters (i.e. EFT, WC) and autonomic dysfunction could help elucidate the mechanisms by which central adiposity contributes to the risk of cardiovascular morbidity and mortality [8].

Because the kinds of studies are found to be very few in this part of the country, Hence, the aim of the present study was to evaluate cardiovascular parasympathetic functions with the help of various cardiovascular parasympathetic function tests to examine their relationships with parameters of total body fat and visceral fat.

METHODS

This cross-sectional study was conducted over a period of one year in department of Physiology, at SRVS Govt Medical College Shivpuri (MP).

Inclusion criteria

100 young healthy adult male volunteers, between 20 to 35 years of age, in and around Shivpuri district (not having any major illness or chronic addiction) were selected for the study.

Exclusion criteria

Female subjects, children and male subjects apart from the selected age group, having major illnesses and addictions were excluded.

The tests were performed at the same time of the day in all the subjects and at a comfortable environment. Anthropometric data like body weight (kg), Body Mass Index (BMI), Body age (yrs), total body fat (%), visceral fat (%) was obtained from all the subjects with the help of **Karada scan (Omeron HBF 375 IN)** after taking the written informed consent.

ISSN: 0975-8585

All the parameter were collected and the test were performed in dept of Physiology on the patients and their relatives visiting the OPD of Hospital associated with SRVS Medical College Shivpuri in the morning between 10:00 AM and 2:00 PM. Subjects were explained the test procedure beforehand and allowed to complete physical rest about 30 min. prior beginning the tests [9].

Following tests were performed on each subject to evaluate cardiovascular Parasympathetic functions:

- Valsalva Ratio
- 30:15 Ratio
- Heart Rate Response To Deep Breathing

RESULTS

Descriptive statistics was done by using SPSS software version 16 for windows with descriptive analysis done by ANOVA analysis test which suggested decrease in parasympathetic activity as total body fat and visceral fat% increases.

Table1: Subject distribution depending on total body fat (%)

Total Body Fat %	No. of Subjects	Groups
< 20	58	Normal
20 - 25	46	Overweight
>25	96	Obese

All the subjects were categorized as Normal, overweight and obese depending on their total body fat (%) as < 20, 20 to 25 and >25 respectively – Table 1 [10].

Table 2: Subject distribution depending of visceral fat (%)

Visceral Fat %	No. Of Subjects	Groups
<10	100	Normal
10- 15	86	Overweight
>15	14	Obese

Similarly, all the subjects were categorized as Normal, overweight and obese depending on their visceral fat (%) as < 10, 10 to 15 and >15 respectively – Table 2 [11].

ISSN: 0975-8585

Table 3(a)

Relation of Valsalva Ratio with % Total Body Fat						
	% TBF	No. of Subjects	Mean	(SD)	P-value	significance
Valsalva Ratio	<20	29	1.1979	0.07078	0.000	Highly significant
	20- 25	23	1.1635	0.06596		
	>25	48	1.1213	0.07431		

Table 3(b)

Relation of Valsalva Ratio with % Visceral Fat						
	% VF	No. of Subjects	Mean	(SD)	P-value	significance
VR	<10	50	1.1858	0.07008	0.000	Highly significant
	10 to 15	43	1.1398	0.04543		
	>15	7	1.0029	0.09878		

Descriptive statistical analysis of cardiovascular parasympathetic parameters in respect to total body fat and visceral fat (%) were found to be highly significant for Valsalva Ratio as in Table 3 (a) and (b)

Table 4(a)

Relation of 30:15 Ratio with %Total Body Fat						
	% TBF	No. of Subjects	Mean	(SD)	P-value	Significance
30:15 RATIO	<20	29	1.7438	0.21278	0.000	Highly significant
	20- 25	23	1.5952	0.21047		
	>25	48	1.3871	0.21765		

Table 4(b)

Relation of 30:15 Ratio with % Visceral Fat						
	% VF	No. of Subjects	Mean	(SD)	P-value	Significance
30:15 RATIO	<10	50	1.6992	0.21492	0.000	Highly significant
	10 to 15	43	1.4247	0.17484		
	>15	7	1.0886	0.09353		

Descriptive statistical analysis of cardiovascular parasympathetic parameters in respect to total body fat and visceral fat (%) were found to be highly significant for 30:15 Ratioas in Table 4 (a) and (b)

Table 5(a)

Relation of Heart Rate Response to Deep Breathing with %Total Body Fat						
	% TBF	No. of Subjects	Mean	(SD)	P-value	Significance
HRRDB	<20	29	1.4469	0.08333	0.000	Highly significant
	20- 25	23	1.3813	0.10947		
	>25	48	1.2908	0.1012		

ISSN: 0975-8585

Table 5(b)

Relation of Heart Rate Response Deep Breathing with % Visceral Fat						
	% VF	No. of Subjects	Mean	(SD)	P-value	Significance
HRRDB	<10	50	1.4216	0.0929	0.000	Highly significant
	10 to 15	43	1.3144	0.09575		
	>15	7	1.1557	0.05682		

Descriptive statistical analysis of cardiovascular parasympathetic parameters in respect to total body fat and visceral fat (%) were found to be highly significant for Heart Rate Response Deep Breathingas in Table 5 (a) and (b).

DISCUSSION

In present study considering % Total Body Fat and % Visceral Fat the mean value of valsalva ratio in obese subjects (1.12/1.00) as compare to overweight (1.16/1.139) and in normal person(1.197/1.18) and this difference is highly significant(p 0.000) (Table No.3 a & b). The findings of present study are similar with the other studies [12, 13].

Principle of valsalva maneuver - when a normal subject attempt to exhale forcefully against a closed glottis, the intrathoracic pressure increases, venous return to heart decreases. The blood pressure falls. The barorecepter stimulation is decreased, so there is reflex tachycardia and vasoconstriction. When this intrathoracic pressure is released, the blood pressure overshoots because of continued sympathetic derive and the heart rate drops below basal level due to baroreflex activation. Failure of heart rate to increase during the positive intrathoric pressure phase point to sympathetic dysfunction, while failure of the rate to slow during the period of blood pressure overshoots to parasympathetic disturbances.

In the study considering % Total Body Fat and % Visceral Fat the mean value of 30:15 Ratio in obese subjects (1.38/1.08) as compare to overweight (1.59/1.42) and in normal person(1.74/1.69) and this difference is highly significant(p 0.000) (Table No.4 a & b).This study results are similar with other studies [13, 14] and results are contrast with Simran Grewalet al [15].

In this study considering % Total Body Fat and % Visceral Fat the mean value of heart rate response to deep breathing in obese subjects (1.29/1.15) is higher as compare to overweight (1.38/1.31) and in normal person(1.44/1.42) and this difference is highly significant(p 0.000) (Table No.5 a & b). Our findings are similar with Rinku Garget al [13], Irani FB et al [16], Simran et al [15]. HR increases during inspiration due to decrease in the cardiac vagal activity and HR decreases during expiration due to vagal activity. So, R-R interval variation during deep breathing is under vagal control (quoted by Ewings D.J. et.al)[16].

CONCLUSION

In this study high visceral fat % is giving highly significant low values for most of the parasympathetic tests, which suggested increased sympathetic and decreased parasympathetic activity as the deposition of visceral fat increases in the body as compare to total body fat. Thus the study concludes that there is overriding of sympathetic activity over the parasympathetic activity as the visceral fat % increases which is found to be the most common predisposing cause for the cardiovascular morbidity and mortality.

REFERENCES

[1] Messina G, Valenzano A, Moscatelli F, Salerno M, Lonigro A, Esposito T, et al. Front Physiol. 2017;8:137.
[2] Tomislav Smoljo, et al. J Obes Metab Syndr 2020; 29(3): 188–197.)
[3] Stefanie Hillebrand, et al. Obesity 2014;22(6):1553-1559.
[4] Lemieux I, Pascot A, Prud'homme D, Almeras N, Bogaty P, Nadeau A et al. Arterioscler Thromb Vasc Biol 2001; 21: 961- 967.

[5] Ramirez RJ, Ajijola OA, Zhou W, Holmstrom B, Luning H, Laks MM et al. J Electrocardiol 2011; 44: 694- 699.
[6] Hillebrand S, de Mutsert R, Christen T, Maan AC, Jukema JW, Lamb HJ, et al. Obesity (Silver Spring) 2014;22:1553–9.
[7] Andromeda M Nauli. Front. Physiol 2019; 10.
[8] The Association between Central Adiposity and Autonomic Dysfunction in Obesity. Med Princ Pract 2016;25:442–448.
[9] A K Jain. Manual of practical Physiology for MBBS. 4t edn. New Delhi – Arya Publication. 2014, page No. 285-291.)
[10] Body fat percentage charts for men and women. Medical News Today. https://www.medicalnewstoday.com/articles/body-fat-percentage-chart)
[11] NaparatSukkriang et al. Heliy 2021;7(2): e06264.
[12] Shahin Akhter, et al. J Bangladesh Soc Physiol 2008;(3):50-54.
[13] Rinku Garg, International Journal Of Medical Research & Health Sciences 2013;2(4):750-755.
[14] Talay Yar, Pak J Physiol 2010;6(1)
[15] IraniFb, Et Al. International Journal Of Medical Science And Public Health 2014;3(6):717.
[16] D J Ewing, I W Campbell, A Murray, J M M Neilson, B F Clarke. British Medical Journal 1978;1:145-147.