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Original Research Paper

Physiology

COMPARATIVE STUDY OF OBESE AND NON OBESE INDIVIDUALS FOR CARDIAC AUTONOMIC EVALUATION.

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ABSTRACT Obesity is the current burning issue in the developing countries. It has got multi facet of influence on the human body. Autonomic nervous system has got interconnection with obesity.

AIM: To know the sympathetic activity of the Autonomic nervous system in obesity by doing isometric exercise.

MATERIALS AND METHODS: The study was conducted in male and female subjects (n =60) aged between 18-30 years, taken randomly from Guntur Medical College, Guntur.

RESULTS AND DISCUSSION: Subjects were divided according to WHO guidelines into obese and non obese groups. Resting Heart rate and blood pressure recorded initially and also after isometric exercise.

CONCLUSION: Initial clinical trials will help clinicians in eliciting autonomic dysfunction in ruling out obesity induced health issues and finally promote health to community

KEYWORDS : obesity, body mass index, autonomic function test, blood pressure.

I. Introduction

Background:

Autonomic nervous system (ANS) has got pivotal role in the utilisation and restoration of metabolic resources and the body reserves. Obesity results from greater energy intake than energy expenditure. Childhood over nutrition is a cause of early obesity. Alterations of the ANS might be involved in the pathogenesis of obesity, on the other hand the excess weight induces ANS dysfunction, which may cause haemodynamic and metabolic alterations that increase the cardiovascular risk in obese individuals, making them prone to hypertension, insulin resistance and dyslipidaemia. The autonomic nervous system plays a major role in the integrated regulation of food intake, involving satiety signals and energy expenditure. Thus ANS dysregulation might favour body weight gain. Conversely, obesity might trigger alterations in the sympathetic regulation of cardiovascular function[1].

Interaction between the sympathetic nervous system (SNS) and the renin-angiotensin-aldosterone system (RAAS) has been long appreciated. RAAS activation in obesity has been attributed to increased synthesis of angiotensinogen by visceral fat and finally contribute to rise in blood pressure[2]. The assessment of ANS requires recording the response of an end organ to physiological manoeuvre. Stimulation of rise in Blood Pressure (BP) is a reflection of sympathetic activity and changes in heart rate is a reflection of parasympathetic modulation activity. Together, they determine autonomic activity.[3]

Factors, such as reduced NO formation, increased angiotensin II levels, baroreflex dysfunction, and reduction in adiponectin and ghrelin levels may contribute to alteration of sympathetic nervous system (SNS) in obesity. These factors likely to precipitate their individual effects on SNS activity and blood pressure. [4] Low resting muscle sympathetic nerve activity may be at risk for body weight gain resulting from a lower metabolic rate. It is documented that low sympathetic activity and a low activity of adrenal medulla leads to development of central adiposity.[5] The rise in resting heart rate in obesity was primarily due to withdrawal of parasympathetic tone rather than increased sympathetic activity or increased intrinsic heart rate. However, obesity impairs renal-pressure natriuresis and causes sodium retention. Sodium retention and volume expansion in obesity are not due to renal vasoconstriction or decreased glomerular filtration rate (GFR), as GFR and renal plasma flow are elevated in obese animals and sodium retention is due mainly to increased renal tubular reabsorption. Obesity increases renal tubular sodium reabsorption, impairs renal-pressure natriuresis, and causes hypertension Elevated levels of nonesterified fatty acids (NEFA) also contribute to increased blood pressure in obese hypertensive subjects [6].

OBJECTIVES OF THE STUDY:

The primary objective was to assess the sympathetic activity of the Autonomic nervous system in obesity by doing isometric exercise.

II. MATERIALS & METHODS

The present study was conducted in 60 individuals (n= 60) test and control group constitutes 30 each, their age ranging from 20 to 40 years. Subjects were taken randomly from Guntur Medical College, Guntur. Ethical Committee clearance was obtained from the Institutional Ethical Clearance Committee. Prior to the study, consent was taken from the subjects to carry out the research work and each subject was informed in detail of the objectives and aim of the research protocol and methods to be used. The data was collected using a predesigned and pre tested proforma.

Since autonomic function tests are simple, non-invasive, and reliable, they can be used as a mode of screening for cardiovascular risk factors, which helps in early intervention and to prevent the associated morbidity and mortality in obese individuals and causes little discomfort to the subjects. Data thus generated was statistically analyzed.

EXPERIMENTAL PROTOCOL

The study constitutes estimation of height, weight, body mass index. Portable stadiometer is used for measuring height. For the measurement of standing height, the subject was asked to

stand with his/her back against the board. Standing height for each subject was measured by making the subject stand barefoot with heels, buttocks and shoulders touching the vertical surface and head in the Frankfurt plane. The back, scapulae and buttocks are in contact with the vertical board if possible, or whichever part of the body touches the board first. The weight was measured barefooted and the subject is asked to step up backwards onto the scale and stand still over the center of the scale with body weight evenly distributed between both feet. The subject's arms should be hanging freely by the sides of the body, with palms facing the thighs. The subject should hold his/her head up, and face forward. BMI was calculated using Quitlet's formula, BMI = Weight (In Kilograms)/ Height (In Metres)^2.

Tests for autonomic function were done in the laboratory using isometric hand grip test. During isometric contraction with Handgrip dynamometer, muscle gets a chance for liberal blood flow during relaxation, but flow remains restricted throughout the activity. Therefore there is not much scope for impairment of circulation which causes delay in the onset of fatigue.

Subjects were asked to take rest for 30 minutes and then resting heart rate and resting blood pressure were recorded. Procedure for hand grip test was explained to the subjects and experiment was done with dominant hand. Subject was asked to compress the handle with maximum effort as hard as possible and the tension developed was measured and again after 3 minutes subject was asked to repeat the same procedure till he gets fatigue. Heart rate and blood pressure were measured as soon as the subject has stopped the procedure. Post exercise values of heart rate, blood pressure of non obese group were compared with the post exercise values of heart rate and blood pressure of obese group. In the IHG test, there is rise in heart rate and blood pressure. The normal response is rise in systolic pressure of more than 30mm Hg and rise in the heart rate by about 30%.

STATISTICAL ANALYSIS

Data were reported as mean and standard deviation [mean±SD]. Means were compared between two groups by unpaired 't' test. A p 'value of <0.05 was considered statistically significant. Descriptive statistical analysis was carried out in the present study by using SPSS software.

III. RESULTS

Table 1: metabolic parameters of 2 groups before and after exercise

PARAMETER	NORMAL	OBESE	t VALUE	p VALUE
HEIGHT	161.80±7.77	159.33±6.93	1.2952	0.2004
WEIGHT	59.87±6.27	72.10±5.08	8.3039	0.0001
BMI	22.807±1.289	28.447±1.834	13.7803	0.0001
HEART RATE POST EXERCISE	75.80±5.61	62.47±7.13	8.0508	0.0001
SBP POST EXERCISE	125.87±4.90	150.73±7.40	15.3494	0.0001
DBP POST EXERCISE	81.80±1.92	101.00±7.35	13.8465	0.0001

In the present study, we compared BMI of non obese and obese individuals, p value was found to be 0.0001 which was statistically significant. Even the results of heart rate and BP were found to be statistically significant (0.0001). It proves, there was a close association between BMI and cardiac parameters.

IV. DISCUSSION

We have correlated BMI with heart rate and blood pressure. We found statistically significant increase in blood pressure and decrease in heart rate in obese individuals when compared to non obese group and our results coincides with yaylali et al[7].

During the early phases of obesity, primary sodium retention exists as a result of increase in renal tubular reabsorption. Plasma renin activity, angiotensinogen, angiotensin II and aldosterone values display significant increase in obese individuals. Insulin resistance and inflammation may promote an altered profile of vascular function and consequently hypertension. Leptin and other neuropeptides are possible links between obesity and the development of hypertension. Obesity should be considered as a chronic medical condition which is likely to require long-term treatment.[8]

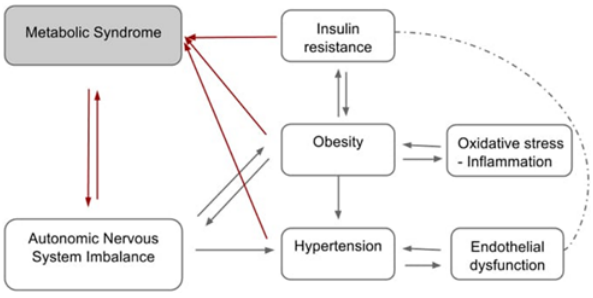

Fig 1. Relation between obesity and hypertension

In terms of metabolism, the sympathetic nervous system is fundamental in controlling daily energy expenditure via the regulation of resting metabolic rate. It is important to note that not all organs are targeted equally by the sympathetic nervous system with the metabolic effects ensuring increased central sympathetic outflow in dependent on the adrenergic receptors present in the target organ[9].

Decreased heart rate in the obese individuals is due to the lowered sympathetic response activity at the level of target tissue but not due to the increased level of catecholamines[10].

V. CONCLUSION

From the study we assume that, 23 to 32.1 kg/m2 of BMI are found to be cardiac risk category of young individuals. With this we conclude that early clinical interventions will help in the autonomic modulation as a treatment for obesity. This will help in reducing the risk of fatality and lethality of cardiac risk factors. Since, autonomic function tests are cost effective, easily available, can be used as diagnostic tool for early evaluation of obesity related complications in community trails.

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DECLARATIONS

Conflict of Interest:
None declared

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ETHICAL APPROVAL: The study was approved by the Institutional Ethics Committee of Guntur Medical College & Hospital, Guntur.

LIMITATIONS:

First, the sample used in this study was a convenient sample and thus findings need to be interpreted with caution. Further qualitative studies are needed for better understanding to plan for interventions.

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