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HEART RATE MONITORING OF OVERWEIGHT AND UNDERWEIGHT YOUNG SUBJECTS

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ABSTRACT

Background: Excessive adipose tissue mass is referred to as obesity, and it is typically measured by body mass index, or BMI. One test used to evaluate the impact of autonomic control on the heart is heart rate variability, or HRV.

Aim: The purpose of this study was to evaluate the heart rate variability of young volunteers who were overweight (BMI >25 kg/m2) and underweight (BMI <18 kg/m2), respectively.

Methods: In order to measure changes in heart rate variability in young people as determined by body weight, the current study comprised participants ages 18 to 25. Anthropometric measures including blood pressure, resting pulse rate, and 5-minute supine heart rate variability were measured in each participant from both groups. In two groups, the effects of body weight on heart rate variability were assessed and contrasted.

Results: According to the study's findings, subjects in the overweight group had significantly lower levels of the following: TP (total power), SDNN (standard deviation of NN interval), HF (high frequency), RMSSD (square root of mean squared difference of successive NN interval), and LFnu. The study's findings also revealed a noteworthy inverse relationship between the two study groups' HFnu, LFnu, and RP (resting pulse).

Conclusions: According to the current study, overweight group individuals have autonomic dysfunction, which can lead to early heart-related issues. This dysfunction is defined by a decrease in parasympathetic and an increase in sympathetic activity.

Keywords: Heart rate, heart rate variability, heart disease, obesity, overweight, underweight

INTRODUCTION

Nutritional disorders can affect the body mass index (BMI) in two ways: either as obesity from overeating or as malnutrition from inadequate consumption.

An excess of adipose tissue mass is referred to as obesity. In India as well as around the world, the prevalence of obesity and overweight is startlingly rising. In developing countries like India, it is now a major health risk. According to estimates, between 20% and 40% of adults and 10% to 20% of adolescents and children live in developing countries. In India, 22% of men living in urban areas and 8.6% of females living in rural areas are obese, respectively.[1]

BMI is a practical and accurate measure of body fat. Numerous health issues, including as psychiatric, gastroenterological, orthopedic, metabolic, pulmonary, and cardiovascular issues, are brought on by obesity and are particularly prominent in obese individuals.

Because cardiovascular diseases are linked to either increased sympathetic activation or reduced parasympathetic activation, obese patients are more likely to die. The cause of this association is yet unknown, despite comparatively comparable findings indicate a higher frequency of cardiovascular illness in obese patients.[2]

According to research from the literature, a number of variables, such as a decrease in high-density lipoprotein, hypertension, and insulin resistance, are associated with the development of obesity. Additionally, it has been proposed that a decline in autonomic function, which is crucial for controlling body fat percentage and energy expenditure, may be the mechanism underlying an increase in cardiovascular disorders in obese individuals. Heart rate variability, or HRV, evaluates how autonomic function affects just the heart. As a result, it could be the best way to evaluate how obesity affects cardiovascular disease.[3]

Malnutrition, on the other hand, is an old age problem in India. In India, many students attend schools or universities without receiving the necessary and sufficient nourishment. Nearly half of Indian adults are thought to be undernourished if their BMI, measured in kilograms per square meter, is less than 18.5. These individuals also have low height, which is a sign of stunting from inadequate childhood nutrition intake.[4] In light of these variables, the current study sought to evaluate the heart rate variability of young volunteers who were overweight (BMI>25 kg/m2) and underweight (BMI<18 kg/m2), respectively.

MATERIALS AND METHODS

The goal of the current prospective clinical investigation was to evaluate the heart rate variability of young patients who were overweight (BMI>25 kg/m2) and underweight (BMI<18 kg/m2), respectively. The research participants came from the Institute's Department of Medicine. Prior to their involvement in the study, all individuals gave their written and verbal informed consent.

The 60 participants in the study were medical college students of both sexes who were at least 18 years old and between the ages of 18 and 25. Subjects who did not smoke or drink and had no history of serious disease met the study's inclusion requirements. Participants with hypertension or other systemic ailment were excluded from the research.

A mercury sphygmomanometer, a weighing machine, a stopwatch, a stethoscope, a height measurement stand, a flat, comfortable cot, an RMS Polywrite D instrument, and a stethoscope were among the tools utilized in the study. All volunteers had their clinical histories taken before to the study's commencement, and they were all given five minutes to relax before the test began. All individuals' weight and height were measured for BMI, with height measured in meters and on a measuring stand. A weighing machine was used to record weight in kilos for the purpose of weight evaluation. kg/m2 was used to calculate BMI. It was recommended that each participant relax for five minutes before having their heart rate variability (HRV) measured while they were comfortably laying on the bed.

To obtain frequency domain (spectral) analysis by TP (total power), Low-Frequency Normalized Unit (LFnu), RMSSD (square root of Mean Squared difference of successive NN interval), LF/HF ratio, and time domain analysis by SDNN (standard deviation of NN interval), continuous ECG tracings were obtained for five minutes using the RMS Polyrite D instrument.

The statistical analysis of the collected data was conducted using the chi-square test, Fisher exact test, one-way ANOVA (analysis of variance), and SPSS (Statistical Package for the Social Sciences) software version 24.0 (IBM Corp., Armonk, NY, USA) for evaluating descriptive measures. The findings were presented as frequency, percentages, mean, and standard deviation. Statistical significance was defined as a p-value of less than 0.05.

RESULTS

The goal of the current prospective clinical investigation was to evaluate the heart rate variability of young patients who were overweight (BMI>25 kg/m2) and underweight (BMI<18 kg/m2), respectively. In order to evaluate the differences in heart rate variability in young people as determined by body weight, the current study recruited 60 adult study participants, ages 18 to 25.

Anthropometric measures including blood pressure, resting pulse rate, and 5-minute supine heart rate variability were measured in each participant from both groups. With p=0.08, the research participants' mean ages were 20.6±0.95 and 18.3±0.66 years for the overweight and underweight groups, respectively. The overweight group's systolic blood pressure was 117.7±8.7 mmHg, which was substantially higher than the underweight group's 113.1±5.9 mmHg (p=0.03).

Overweight and underweight participants had similar diastolic blood pressure (p=0.45). The pulse rates of overweight and underweight patients were 87.51±3.0 and 71.44±3.50 beats/min, respectively, and were substantially higher in the former

group (p=0.06). Additionally, the BMI of overweight patients was considerably higher (27.2±1.02 kg/m2) than that of underweight subjects (18.3±0.55 kg/m2, p=0.03) (Table 1).

When HRV (heart rate variability) characteristics were evaluated in two study groups, Sup-HF (ms2) was considerably greater in underweight patients (p<0.0001) and was 516.1±171.7 and 1069.1±345.4 ms2 in overweight and underweight groups, respectively. With p=0.173, Sup LF was statistically similar in participants who were overweight and underweight. Sup-TP was considerably lower in the overweight group (p=0.003), measuring 1292.1±177.6 ms2 in the overweight group and 1907.4±366.4 ms2 in the underweight group (Table 2).

When comparing the mean HRV parameters of the overweight and underweight study participants, the underweight group's Sup-RMSSD was substantially greater than the overweight group's (p=0.02). Subjects who were underweight had a substantially greater Sup-SDNN than those who were overweight (p=0.03). Compared to participants who were underweight, the overweight group's Sup LF/HN was considerably greater (p=0.02). Underweight participants had considerably greater Sup-HFnu than the overweight group (p<0.0001), whereas the overweight group had significantly higher Sup-LFnu than the underweight group (p=0.001) (Table 3).
According to the study's findings, there was a significant negative correlation between the physiological traits of underweight and overweight study participants on Sup-HFnu, Sup-LFnu, and RP, with correlation coefficients of -0.387, -0.384, and -0.365, respectively.

In the two groups under investigation, Sup-HF and Sup-LF showed negative correlations, with correlation coefficients of -0.210 and -0.184, respectively. Other factors, however, displayed a positive connection that was not statistically significant (Table 4).

DISCUSSION

In order to evaluate the differences in heart rate variability in young people as determined by body weight, the current study evaluated 60 adult study participants, ages 18 to 25. Anthropometric measures including blood pressure, resting pulse rate, and 5-minute supine heart rate variability were measured in each participant from both groups. The mean ages of the overweight and underweight groups of research participants were 20.6±0.95 and 18.3±0.66 years, respectively, with p=0.08. The systolic blood pressure of the overweight group was 117.7±8.7 mmHg, significantly higher than that of the underweight group, which was 113.1±5.9 mmHg (p=0.03).

Overweight and underweight participants had similar diastolic blood pressure (p=0.45). The pulse rates of overweight and underweight patients were 87.51±3.0 and 71.44±3.50 beats/min, respectively, and were substantially higher in the former group (p=0.06). Additionally, overweight participants had a substantially higher BMI (27.2±1.02 kg/m2) than underweight patients (18.3±0.55 kg/m2, p=0.03). These records were similar to those from other investigations by Sekine M et al. (2001) and Pal GK et al. (2012), in which the authors evaluated participants using illness and demographic data similar to those used in this study.

When comparing the HRV (heart rate variability) characteristics between the two study groups, it was found that Sup-HF (ms2) was considerably greater in the underweight patients (p<0.0001) and was 516.1±171.7 and 1069.1±345.4 ms2 in the overweight and underweight groups, respectively. With p=0.173, Sup LF was statistically similar in participants who were overweight and underweight. Sup-TP was considerably lower in the overweight group (p=0.003), measuring 1292.1±177.6 ms2 in the overweight group and 1907.4±366.4 ms2 in the underweight group. These findings were in line with those of Mohan V et al. (2006) and Matsumato T et al. (2001), who reported heart rate variability parameters comparable to those used in this study in their separate investigations.

According to the study's findings, Sup-RMSSD was considerably greater in the underweight group than in the overweight group (p=0.02) when comparing the mean HRV parameters of the two groups. Subjects who were underweight had a substantially greater Sup-SDNN than those who were overweight (p=0.03). Compared to participants who were underweight, the overweight group's Sup LF/HN was considerably greater (p=0.02). Underweight participants had considerably greater Sup-HFnu than the overweight group (p<0.0001), whereas the overweight group had significantly higher Sup-LFnu than the underweight group (p=0.001). These results were consistent with those of Laederach-Hofmann K et al. (2000) and Sztajzel J. (2010), whose mean HRV parameters were similar to those of the current research.

With correlation values of -0.387, -0.384, and -0.365, respectively, it was shown that there was a strong negative association between the physiological features of underweight and overweight study participants on Sup-HFnu, Sup-LFnu, and RP. The

correlation coefficients for Sup-HF and Sup-LF in the two groups under investigation were -0.210 and -0.184, respectively, indicating a negative association. Other factors, however, displayed a positive connection that was not statistically significant. These findings were consistent with research conducted by Rastović M et al. in 2017 and Yadav RL et al. in 2017, wherein the authors revealed a similar link between physiological features in underweight and overweight patients.

CONCLUSIONS

Given its limitations, the current study shows that overweight group participants have autonomic dysfunction, which can lead to early heart-related issues. This dysfunction is defined by a decrease in parasympathetic and an increase in sympathetic activity. To draw a firm conclusion, more research with longer evaluations and bigger sample numbers is required in the future.

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Characteristics	Overweight (mean)	Underweight (mean)	p-value
Age (years)	20.6±0.95	18.3±0.66	0.08
Systolic BP (mmHg)	117.7±8.7	113.1±5.9	**0.03**
Diastolic BP (mmHg)	79.0±4.69	79.7±4.22	0.45
Pulse (beats/min)	87.51±3.0	71.44±3.50	**0.006**
BMI (kg/m2)	27.2±1.02	18.3±0.55	**0.03**

Table 1: Comparison of demographic data

Parameters	Overweight (mean)	Underweight (mean)	p-value
Sup-HF (ms2)	516.1±171.7	1069.1±345.4	**<0.0001**
Sup-LF (ms2)	798.3±63.6	813.7±58.7	0.173
Sup-TP (ms2)	1292.1±177.6	1907.4±366.4	**0.003**

Table 2: HRV parameters

Parameters	Overweight (mean)	Underweight (mean)	p-value
Sup-RMSSD	50.55±7.29	74.12±2.41	**0.02**
Sup-SDNN	45.7±5.44	63.0±2.14	**0.03**
Sup LF/HN	1.35±0.29	0.96±0.22	**0.02**
Sup-HFnu	39.1±7.1	56.91±10.51	**<0.0001**
Sup-LFnu	57.63±14.3	44.3±10.7	**0.001**

Table 3: Mean HRV parameters in overweight and underweight study subjects

	BMI	RP	Sup-TP	Sup-LF	Sup-HF	Sup-LFnu	Sup-HFnu	Sup LF/HF
BMI (O)	0.122							
RP (O)		**-0.365**						
Sup-TP (O)			0.074					
Sup-LF (O)				-0.184				
Sup-HF (O)					-0.210			
Sup-LFnu (O)						**-0.384**		
Sup-HFnu (O)							**-0.387**	
Sup LF/HF (O)								0.023

Table 4: Correlation of physiological traits in underweight and overweight study subjects