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COMPARISON OF PULSE RATE AND BLOOD PRESSURE RESPONSESTOSTEADY TREADMILL EXERCISE BETWEENOBESEAND NORMAL WEIGHT YOUNG ADULTS

Dr. Ashmita Chakraborty, Dr. Indira Ghosh*, Dr. M. S. Khan and Dr. A. B. S. Mahapatra

R. G. Kar Medical College & Hospital, Kolkata.

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***Corresponding Author**
Dr. Indira Ghosh
R. G. Kar Medical College & Hospital, Kolkata.

ABSTRACT

The purpose of this study is to determine the effect of physical activity at a moderate workload, i.e walking on a treadmillfor a fixed duration, on pulse rate and blood pressure of young (18-22 years) obese subjects and compare it to normal weight subjects who areage and sex matched. Each group had 25 (13 male and 12 female) subjects. All 50 subjects were selected from first professional M.B.B.S students after following the inclusion and exclusion criteria. All anthropometric data to determine who were obese were collected in a predetermined history proforma. It was seen that the mean of resting systolic blood pressure (S.B.P) and pulse rate did not vary but the resting diastolic blood pressure(DBP) did varyin a statistically significant manner between the two groups. The mean values of both the S.B.P and D.B.P immediately after 6 minutes of exercise too differ significantly in the two groups. Therefore, there are definite changes in blood pressure and pulse rate after dynamic aerobic exercise in obese young adults.

KEYWORDS: Obese, Pulse Rate, S.B.P., D.B.P.

INTRODUCTION

In the 21st century, there were great changes in lifestyle of common people leading to obesity. According to the World Health Organization (WHO) the prevalence of obesity is increasing rapidly in the world as well as in India. Large prospective studies such as the Framingham Heart Study have shown that obesity is associated with increased cardiovascular disease(CVD) risk. Currently used anthropometric measures for assessing obesity are body

mass index (BMI; weight in kilograms divided by square of height in meters), hip circumference(HC), waist circumference (WC), waist hip ratio (WHR; ratio of WC to HC), waist stature ratio (WSR; ratio of WC to height), etc. Out of them BMI and WC are most commonly used to measure obesity.

Longitudinal studies have shown significant correlation between exaggerated blood pressure response to exercise and higher incidence of developing in future, resting hypertension in subjects with hypertensive parents and also in those with normotensive parents. The purpose of this study is to predict future risk of hypertension in obese young adults on the basis of their pulse and blood pressure responses to steady state sub maximal exercise.

MATERIALS AND METHODS

After obtaining approval from the institutional ethical committee of R.G.Kar Medical College, the study was conducted in the department of Physiology, R.G.Kar Medical College, Kolkata. This is a cross-sectionalstudy involving 50 subjects (male 52% and female 48%), within the age group of 18 to 22 years, included after taking informed consent. All the subjects were students of first professional M.B.B.S.

The anthropometric data was collected on the pre designed history proforma. For measuring weight, the subject was requested to stand still on the platform of a pre-calibrated digital weighing machine. Height was measured using stadiometer with the help of a fixed scale. Body mass index was calculated by the formula: weight (kg)/height $(m)^2$. Waist circumference (WC) was measured mid-way between iliac crest and lowermost margin of the ribs. Hip circumference (HC) was measured at the maximum protruding part of buttocks at the level of the greater trochanter while keeping the feet together with the subjects wearing minimal clothing. Waist hip ratio was calculated with the help of the formula WC (cm.)/HC (cm).

All the recruited subjects were grouped into two categories (1) non-obese, and (2) obese as per the guideline followed in India, where, the diagnostic cut off, from and above which an individual will be considered overweight is 23 kg/m^2 and those with BMI above 25 kg/m^2 will be termed obese. So non obese belong to B.M.I. group 18.5-22.99. The guidelines were released jointly by the Health Ministry, the Diabetes Foundation of India, AIIMS, ICMR, the National Institute of Nutrition and 20 other health organisations in the year 2012.[12] As per the new cut off formulated by the Ministry of Health andFamily Welfare, Government of

India, abdominal obesity in Indian males corresponds to a waist – hip ratio above 0.90 (as opposed to 1.02 globally) and in Indian females above 0.80 (as opposed to 0.88 globally).

Indication of exercise testing

Clinical guidelines for exercise stress testing are based on The American College of Cardiology [ACC]/ the American Heart Association [AHA] guidelinesinitially formed in 1997. Based on these guidelines, testing in asymptomatic persons without known coronary arterydiseaseis.

Class III – Routine screening of asymptomatic men and women.

The goal of screening asymptomatic obese subjects for possible coronary artery disease, is to either prolong life or improve the quality of life.This has been supported by data from the Coronary Artery Surgery Study and the Asymptomatic Cardiac Ischaemia Pilot Study.[9] Clinically healthy male and female subjects were chosen after considering the following exclusion criteria.

EXCLUSION CRITERIA

- Age less than 18 years or more than 22 years.
- Any history of addiction.
- Any chronic disease or congenital anomaly if present (congenital heart disease, cardiomyopathy, suspecting or confirmed life threatening arrhythmia, hypertension).
- Any peripheral arterial disease, thyroid dysfunction, anemia.
- History of medicine intake like beta blockers, digitalis, calcium channel blockers and other anti arrhythmic agents which have direct effect on the heart rate**.**
- Family history of Coronary Artery Disease.
- Presence of arrhythmia in resting pulse rate.
- Any abnormality in resting E.C.G**.**

Considering the mean age of our sample to be 20 years and that they will perform submaximal exercise for 6 minutes on a flat platform i.e. the treadmill (i.e without any slope as is used in the standard Bruce Protocol), the maximum speed of walking was determined by a trial and error method to keep the maximum heart rate of most subjects within 140 beats/minute (50% of target heart rate).[39] The ambient temperature was around (30 +/-2)degrees celcius all through the procedure for every test subject.

The first stage was for 2 minutes at a speed of 2.6 km/hour, the next 2 minutes at a speed of 3.5 km/hour and the final 2 minutes at a speed of 4.5 km/hour.[46] Recovery period was kept 1 minuteat a speed of1.8 km/hour. The test was performed using RMS Vega 201, version 1.0 which is a computerised Tread mill machine with in-built protocols as well as provision for setting up personalised protocols that will be saved within the machine.

Resting blood pressure (both systolic and diastolic) and pulse rate measurements were made first with the subject seated comfortably, and after 5 minutes of rest after entering the procedure room. Two readings were made and their average calculated. All pulse and blood pressure measurements were made with automated B.P. machine.

At the end of three minutes of exercise and immediately at the end of six minutes of exercise, pulse rate and blood pressure (both systolic and diastolic) were measured with the automated B.P. machine following the same procedure as before with the subject in standing posture.

The recovery pulse rate and blood pressures were recorded 5 minutes after end of exercise, with the subject in sitting posture, following the same procedure.

Statistical analysis

The collected data were entered in Microsoft Excel computer program and checked for any inconsistency. The results were presented as Mean±SD and percentages. The statistical analysis was performed using SPSS (Version 17) statistical software package. The means were analysed using unpaired t test and p value < 0.05 was considered to be statistically significant.

RESULTS

Table 1: Demographic Profile of the Study Population.

VARIABLE	CATEGORY	MEAN	S.D.	p – Value
Age (in yrs)	Normal Wt.	20.36	3.14	0.41
	Obese	19.47	2.36	
B.M.I (kg/m²)	Normal Wt.	21.40	1.62	0.0001
	Obese	26.55	1.35	
WC: HC	Normal Wt.	0.80	0.085	0.009
	Obese	0.87	0.073	

Table 1 shows that the p value for age is not significant but for Body mass indexand Waist hip ratio, the p values are statistically significant.

Table 2: Resting Pulse Rate of the Study Population.

VARIABLE	CATEGORY	MEAN	S.D.	p – Value
Pulse Rate(beats/min)	Normal Weight	83.20	9.71	0.083
	Obese	87.44	11.51	

Table 2 shows that there is no significant difference in mean resting pulse rate between the obese and normal weight groups.

Table 3: Blood Pressure Responses of the Study Population At Rest.

VARIABLES	CATEGORY	MEAN	S.D.	p – Value
S.B.P. (mm of Hg)	Normal Weight	126.40	9.03	0.40
	Obese	127.04	9.74	
D.B.P. (mm of Hg)	Normal Weight	78.72	5.71	0.0025
	Obese	83.92	6.58	

Table 3 shows the resting SBP does not differ significantly between the case and control groups while the resting DBP differs in a statistically significant manner between the two groups; p value being < 0.005.

Table 4: pulse rate attained by the study population at the End of exercising for three minutes.

VARIABLE	CATEGORY	MEAN	S.D.	p – Value
Pulse Rate	Normal Wt.	95	22.4	0.087
	Obese	110.6	21.7	

Table 4 shows the mean pulse rate of obese subjects though higher during exercise but is not statistically significant compared to normal weight subjects.

Table 5: Mean Systolic and Diastolic Blood Pressures of Thestudy Population At the End of Three Minutes of Exercise.

VARIABLE	CATEGORY	MEAN	S.D.	p – Value
S.B.P.	Normal Wt.	134.18	13.6	0.37
	Obese	139.33	14.8	
D.B.P.	Normal Wt.	85.27	8.26	0.25
	Obese	87.73	9.89	

Table 5 shows that the mean systolic and diastolic blood pressures of the obese group are higher than the normal weight group during exercise but the differences are not statistically significant.

Table 6: Pulse Rate in the Study Population After 6 Minutes of Exercise.

VARIABLE	CATEGORY	MEAN	S.D.	p-Value
Pulse Rate (beats/min.)	Normal Weight	108.80	25.11	0.48
	Obese	114.71	28.00	

Table 6 shows that the mean pulse rate of the normal weight group immediately after exercise does not differ significantly from the obese group(p value being > 0.05), though the obese group have higher values of pulse rate at the end of 6 minutes of exercise.

Table 7: Mean Systolic and Diastolic Blood Pressure of the Study Population After 6 Minutes of Exercise.

VARIABLE	CATEGORY	MEAN	S.D.	p – Value
SYSTOLIC BP (in mm of Hg)	NORMAL WEIGHT	128.57	12.48	0.03
	OBESE	138.71	16.63	
DIASTOLIC BP (in mm of Hg)	NORMAL WEIGHT	82.28	8.45	0.0005
	OBESE	90.86	10.76	

Table 7 shows that the mean values of both the systolic and diastolic blood pressures at the end of 6 minutes of exercise differ significantly (p values for both being < 0.05) in the two groups, the diastolic blood pressure showing more significant difference than systolic.

Table 8: Mean Pulse Rate of the Study Population Five Minutes After Exercise.

VARIABLE	CATEGORY	MEAN	S.D.	p – Value
Pulse Rate (beats/min)	Normal Wt.	103.76	15.80	0.06
	Obese	111.36	18.78	

Table 8 shows that the mean pulse rate five minutes after exercise is higher in the obesegroup compared to the normal weight group but is not statistically significant as the p value is more than 0.05.

Table 9: Five minutes post exercise mean systolic and diastolic Bloodpressure in the study population.

VARIABLE	CATEGORY	MEAN	S.D.	p –Value
S.B.P.	Normal Wt.	132	9.27	0.02
	Obese	138	10.88	
D.B.P.	Normal Wt.	86.16	6.02	0.007
	Obese	91.72	9.20	

Table 9 shows the mean systolic and diastolicblood pressure five minutes post exercise are higher in the obese group compared to the normal weight group in a statistically significant manner.

Table 10: Comparison Of Peak Heart Rate With Recovery Heart Ratein Study Population.

VARIABLE	CATEGORY	MEAN	S.D.	p –Value
PEAK HEART RATE	NORMAL WEIGHT	108.11	25.76	0.1695
	OBESE	120.25	27.43	
HEART RATE RECOVERY(2 min. post exercise)	NORMAL WEIGHT	10	11.47	0.0603
	OBESE	19.95	18.83	
HEART RATE RECOVERY(5 min. post exercise)	NORMAL WEIGHT	15.44	19.05	0.3160
	OBESE	21.7	18.86	

Table 10 shows that there are no significant differences between the means of peak heart rate between the cases and controls of the study population. Similarly the mean of recovery heart rate, 2 minutes and 5 minutes post exercise, also do not differ significantly among the cases and controls.

DISCUSSION

Obesity has reached epidemic proportions in India in the 21st century with morbid obesity affecting 5% of the country's population. The overall prevalence of overweight and obesity among pre-adolescent and adolescent in India studied in 2008 were 14.2% and 11.1% respectively.

Significantly more children from higher socio-economic status were overweight and obese compared to lower social strata. No significant gender difference for obesity was seen among children from less priviledged background. However, among children from affluent families, significantly more boys were obese compared to girls.[5]

This scenario highlights the importance of early identification of subjects at risk of developing heart disease and its primordial prevention.

The cases and controls were age and sex matched. The B.M.I. and the waist – hip ratio of the cases were found to be different from the controls by a value which is statistically significant; p value being < 0.05.

It is observed from the tables 2 and 3 that though the mean of resting pulse rate and blood pressure (both systolic and diastolic) are higher in the obese group compared to the normal weight group but it is only the mean resting diastolic blood pressure that is significantly greater in the obese; the p value being < 0.05. A higher resting pulse rate is frequently observed in obese and is due to greater cardiacsympathetic nerve activity.

Tables 2 and 4 show that there is less difference between the baseline and exercising pulse rate in the obese compared to the normal weight as they also had a significantly higher resting pulse rate.

Tables 4 and 5 show that though the mean pulse rate, S.B.P and D.B.P are higher in the obese during exercise compared to the normal weight group; none of these parameters differ significantly, p values being > 0.05.

From table 10 it is evident that the mean value of the peak heart rate achieved during exercise testing was significantly higher in the cases compared to the controls. The cases had less difference between the baseline and peak exercise heart rate as they had significantly higher resting heart rate than the controls. However, the difference in peak heart rate between cases and controls is not statistically significant (p value being > 0.05).

Comparison of tables 4, 6 and 10 show that delayed heart rate recovery is present in the obese compared to the normal weight, with the p value of the mean post exercise heart rates of the cases compared to the controls being < 0.05 indicating statistically significant delay in recovery of post exercise heart rate towards baseline in the obese. Comparison of the 2 and 5 minutes heart rate in the post exercise period shows that there is no statistically significant difference between the cases and controls in both the events, p value being > 0.05 for both.

Table 7 shows that 5 minutes into the recovery period the systolic and diastolic blood pressures are higher in the obese compared to the normal weight in a statistically significant manner with p values for both systolic and diastolic pressures being < 0.05.

CONCLUSION

Our present study is a cross sectionalstudy involvingyoung adults classified into obese and normal weight groups depending on their BMI. It helped us to assess the capacity of obese subjects to handle exercise induced stress which may prove to be beneficial to them before initiating them into a regular exercise program involving the treadmill as well to achieve weight reduction in them as a means of primordial prevention of cardiovascular diseases associated with obesity.

Depending on the results of the exercise test parameters we concluded that all our subjects belong to the low risk group with regards to the future development of Coronary Artey Disease (CAD). For them regular physical activity is adequate measure to prevent the future development of CAD.

Thus, intervention in the form of life style modification to include regular physical exercise can hopefully prevent the development of cardiovascular diseases and metabolic complications in the obese if initiated early. This is the prognostic significance of our study.

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