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## Influence of powerlifting on cardiovascular responses in obese individuals

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### Abstract

**Introduction:** Powerlifting has three disciplines includes, squat, bench press, and dead lifting. There may be heavy weights are lifted during training and competitions (1). In the competitions the powerlifter has to lift each technique 3 times and highest weight was considered. It is calculated as four times more than own body weight. During training, muscle strength increased by submaximal loads, and in a previous study, powerlifters exercised, on average,  $6.1 \pm 2.4$  h/week (2). During the powerlifting techniques the cardiac output gets increased and it increases heart rate within the magnitude of the increase dependent upon the intensity of the exercises (9). During physical exertion there is an increase in cardiac output, a rise in systolic blood pressure is a natural consequence of dynamic exercises. Diastolic blood pressure remains unchanged or shows only a slight increase as a consequence of metabolic vasodilatation of the peripheral vessels (10).

**Objectives:** To determine the Heart Rate variation in obese person - pre and post powerlifting exercises. 1. To determine the systolic Blood Pressure changes in obese person - pre and post powerlifting exercises. 2. To determine the Diastolic Blood Pressure variation in obese person - pre and post powerlifting exercises.

**Inclusion Criteria:** Male participants with BMI more than 25.2.age group of 23—35 years.

**Exclusion Criteria:** 1.No prior history of any form of musculoskeletal disabilities, neurological or respiratory complains.2.Absence of high blood pressure or low blood pressure.3.No cardiac diseases.

**Methodology and procedure:** An experimental study was done with 50 obese individuals were selected after assessing their physical functions, Participants were recruited from the pool of 120 obese individuals who visit to the gymnasium for the recent time. Participants were given clear instructions about the study and those who accepts were involved in the selection process. The selection of the participants was based on the selection criteria. The age group of participants was 23—35 years, participants with BMI more than 25, male participants only involved, without any history of musculoskeletal problems, participants without any neurological or respiratory complains, participants without any history of high blood pressure or low blood pressure or any sort of cardiac diseases. Participants are instructed to stop from the study at any time. Written consent form was obtained from all the participants. A detailed explanation was presented to them through power point slides about the study. All the participants were involved in power lifting for 35 mins, which includes 5 mins of warming up, 5 mins of dead lifts, 5 mins for mini squats, 5 mins of bench press and 10 mins of power lifting based on the individual 10 Repetition maximum and 5 mins of cool down exercises. The study was for one week with 4 days of exercises. The data were collected on the day one of the patient and after exercises, and at the end of first week. The data were collected through pulse oximetry for heart rate and sphygmomanometer for diastolic and systolic blood pressure. The collected data was analysed through SPSS 21.0.

**Results:** The results have identified that there were significant differences shown within the exercises and between the exercises. Anova analysis of the p-value corresponding to the F-statistic of one-way ANOVA is lower than 0.05, suggesting that the one or more exercises are significantly different. On analysing with the post hoc test. The results of this study show both exercises were improved whereas there was a significant improvement noted on Pre-test, immediate post and 1 week after post. So, this study rejects null hypothesis.

**Conclusions:** This study concludes that there is a significant rise in the heart rate and blood pressure following exercises, but the elevation of these cardiac parameters will tend to reduce following regular exercises.

**Keywords:** Powerlifting techniques, obesity, BMI, heart rate, blood pressure etc.

### Introduction

Powerlifting has three disciplines includes, squat, bench press, and dead lifting. There may be heavy weights are lifted during training and competitions [1].

In the competitions the powerlifter has to lift each technique 3 times and highest weight was considered. It is calculated as four times more than own body weight. During training, muscle strength increased by submaximal loads, and in a previous study, powerlifters exercised, on average,  $6.1 \pm 2.4$  h/week [2].

Resistant training always cause change in the cardiovascular systems [3]. The magnitude of the cardiovascular response to resistant exercises often affected with several factors, one of the common is the intensity of the muscle contraction [4]. Resistance training could cause abrupt increase in blood pressure, heart rate and cardiac output which is always a concern [5, 6].

Physical activities would increase cardiovascular response in the beginning of the exercises, later there is an adjustment of the mechanism happens [7]. Due to increase activity of the autonomic nervous system, the sympathetic and parasympathetic branches in the sinus node response to vagal activity auto rhythmically, There are many mechanism which would cause raise in the heart rate is which is progressively inhibited when exercises starts and the sympathetic activity when exercises is further incremented [8].

During the powerlifting techniques the cardiac output gets increased and it increases heart rate within the magnitude of the increase dependent upon the intensity of the exercises [9]. During physical exertion there is an increase in systolic blood pressure, a rise in cardiac output is a natural solution of dynamic exercises. Diastolic blood pressure not changed or shows only a slight high as a consequence of metabolic vasodilatation of the peripheral vessels [10].

Powerlifting or resistant training has been shown to attenuate the cardiovascular response and attributed to increase in vasodilation of blood vessels, decreased sympathetic outflow from central nervous system and after exercise hypertension [11]. Since there may be alteration in the cardiovascular changes noted in various studies but not the level of changes approximately. The aim of the study was to analyse the influence of powerlifting techniques on cardiovascular changes. The study hypothesized that there is no variation in the cardiovascular changes.

### Methodology

An experimental study was done with 50 obese individuals were selected after assessing their physical functions, Participants were recruited from the pool of 120 obese individuals who visit to the gymnasium for the recent time. Participants were given clear instructions about the study and those who accepts were involved in the selection process. The selection of the participants was based on the selection criteria. The age group of participants was 23-35 years, participants with BMI more than 25, male participants only involved, without any history of musculoskeletal problems, participants without any neurological or respiratory complains, participants without any history of high blood pressure or low blood pressure or any sort of cardiac diseases. Participants are instructed to stop from the study at any time. Written consent form was obtained from all the participants. A detailed explanation was presented to them through power

point slides about the study. All the participants were involved in power lifting for 35 mins, which includes 5 mins of warming up, 5 mins of dead lifts, 5 mins for mini squats, 5 mins of bench press and 10 mins of power lifting based on the individual 10 Repetition maximum and 5 mins of cool down exercises. The study was for one week with 4 days of exercises. The data collection started on day one visit of the patient and after exercises immediately, and at the end of a week. The data were collected through apparatus namely pulse oximetry for heart rate and Sphygmomanometer for systolic and diastolic blood pressure. The collected data was analysed through SPSS 21.0.

### Result

Repeated measures ANOVA for Diastolic blood pressure, Heart rate and Systolic blood pressure(including pre exercise, post exercise and 1<sup>st</sup> week) is shown in table 1, once the F statistics is significant post hoc test is used to compare the post-test values at 0.05 level of significance. All the values are given in the tables.

**Table 1:** Heart rate

Groups	Anova Analysis Heart Rate			
	N	Mean	Std.Dev	Std. Error
Pre value	50	79.56	5.072	0.72
Immediate post	50	87.92	3.75	0.53
1st week	50	95.58	3.54	0.50
Source	SS	df	MS	f-value
Between-Exercises	6420.09	2	3210.05	F = 184.31
Within-Exercises	2560.18	147	17.42	
Total	8980.27	149		

The *f*-ratio value is 184.31. The *p*-value is < .00001. The result is significant at *p*<.05.

**Table 2:** Systolic Blood pressure

Groups	ANOVA Systolic Blood Pressure			
	N	Mean	Std. Dev.	Std. Error
Pre value	50	141.28	2.96	0.42
Immediate post	50	146.62	3.12	0.44
1st week	50	151.88	4.66	0.66
Source	SS	df	MS	f-value
Between-Exercises	2809.05	2	1404.5267	F = 104.74
Within-Exercises	1971.14	147	13.4091	
Total	4780.19	149		

The *f*-ratio value is 104.74. The *p*-value is < .00001. The result is significant at *p*<.05.

**Table 3:** Diastolic Blood pressure

Groups	Anova for Diastolic Blood pressure			
	N	Mean	Std. Dev	Std. Error
Pre value	50	92.22	2.08	0.29
Immediate post	50	95.78	1.58	0.22
1st week	50	99	0.93	0.13
Source	SS	df	MS	f-value
Between-Exercises	1150.17	2	575.09	F = 224.14
Within-Exercises	377.16	147	2.57	
Total	1527.33	149		

The *f*-ratio value is 224.14. The *p*-value is < .00001. The result is significant at *p*<.05.

**Table 4:** Post hoc Test

Between Exercises	Tukey HSD Q Statistics	Tukey HSD p-value	Tukey HSD Influence
<b>Heart Rate</b>			
Pre vs Immediate post	8.36	14.16	0.005
Pre vs 1 <sup>st</sup> week	16.02	27.14	0.005
Immediate post vs 1 <sup>st</sup> wk.	7.66	12.98	0.005
<b>Systolic Blood Pressure</b>			
Pre vs Immediate post	5.34	10.31	0.005
Pre vs 1 <sup>st</sup> week	10.6	20.47	0.005
Immediate post vs 1 <sup>st</sup> wk.	5.26	10.16	0.005
<b>Diastolic Blood Pressure</b>			
Pre vs Immediate post	3.56	15.72	0.005
Pre vs 1 <sup>st</sup> week	6.78	29.93	0.005
Immediate post vs 1 <sup>st</sup> wk.	3.22	14.21	0.005

The results have identified that there were significant differences shown within the exercises and between the exercises. Anova analysis of the p-value corresponding to the F-statistic of one-way ANOVA is lower than 0.05, suggesting that the one or more exercises are significantly different and calculating with the post hoc test. The results of this study show both exercises were improved whereas there was a significant improvement noted on Pre-test, immediate post and 1 week after post. So, this study rejects null hypothesis.

### Discussion

This study was to identify the influence of powerlifting technique on cardiovascular response in obese individual. Numerous studies have been conducted to identify the cardiovascular responses to exercises and all those supported that the resistance training has produce change.

In general, obese individuals normally low cardiovascular fitness than lean counterparts. Cardiovascular responses to the exercises are always proportional to the skeletal muscle demands on oxygen for any given rate of load and oxygen uptake rise linearly with increasing rates of work [12].

Cardiovascular variables produce a fundamental significance on the heart rate and blood pressure and it varies in the rest to work [13]. Traditional resistance exercises have combination of static and dynamic contraction with varying positions, powerlifting technique has included static contractions and heavy resistance which cause sufficient time to overcome the load resistance [14].

There are lot of hemodynamic changes with respect to the resistance exercises, acute heart rate changes will be manifested as a functional variable and includes load, movement of velocity, rest intervals, amount of muscle mass involves, duration of exercises, age and training status [15, 16].

There are changes in the stroke volume, cardiac output and heart rate changes with rising rates of work [17]. While exercises, high amount of blood flow to the active skeletal muscles and leads to increase temperature flow more blood to skin. It satisfy the low demand area as well increase in cardiac output [18].

Arterial blood pressure rise due to dynamic exercises, there is an increase in diastolic blood pressure and systolic blood pressure. Mean arterial pressure is equal to cardiac output generally, the observed rise in mean arterial pressure results from an rise in cardiac output which weights concomitant deprived in peripheral resistance [19].

High level of clinical correlation exists between both coronary blood flow and myocardial oxygen consumption and the heart rate was produced, and blood pressure (15). This is called as double produce (Heart Rate x Systolic Blood Pressure) is generally used to calculate coronary blood requirements and myocardial oxygen. During vigorous exercises, all the three

major determinants of myocardial oxygen requirements rise above the resisting level [20].

Recent studies have shown that higher loads lead to larger increase in heart rate and blood pressure in addition to that the exercises utilised on the powerlifting session can lead to high values of heart rate and blood pressure [21, 22] which our studies also shown high significantly [23].

Despite rise blood pressure levels and greater posterior wall thickness and left ventricular mass found in this study among powerlifters, shows no cardiac and endothelial function impairment. Therefore, high blood pressure found in powerlifters seems to be related to increased PVR rather than endothelial function impairment [24].

### Limitation of study

This study does have some limitations, first, the increase in blood pressure and heart rate mechanism was not evaluated. The choice of auscultation method in used in assessing blood pressure, third the assessment on the vascular resistance or the sympathetic activity was not assessed and fourth the is no invasive methods used in evaluation.

### Conclusion

This study concludes that there is a significant rise in the blood pressure and heart rate post exercises, but the increase of these cardiac parameters will tend to reduce follow up regular exercises.

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### Conflict of interest: NIL

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