

## Original Article

# Obesity as a noticeable cause of physical stress; a study on relationship of physical exertion and cardiovascular parameters

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## Abstract

**Introduction** Physical tension is a response to environmental pressures, needs or demands or any vigorous bodily activity leading in altering physiological responses, is counted as physical stress such as aerobics, work outs, injury or aches. It may also count on physical traumas as cuts, burns, sprains, broken bones, surgery etc. In other words physical stress is bodily response to substantial pressures such as exertion, noise, illness or exercises. **Methodology** The purpose of this study is to observe the severity of physical stress in individuals with respect to their BMI, subjects were assessed pre & post for blood pressure and pulse while Physical stress scores were calculated through Sadaf stress scale (SSS), the data was then analyzed using SPSS 19.0. **Results** showed that physical stress increases with increased BMI while it also shows significant difference in obese individuals presystolic and pre diastolic with post systolic and post diastolic pressures. **Conclusion** From this study we conclude that BMI is directly proportional to physical stress. So maintenance of normal body weight is the utmost requirement for healthier life.

## Key words

Exercise, physical stress, physical exertion, obesity, stress.

## Introduction

Obesity is a condition in which an individual is having abnormal or excessive body fat, it is a complex multifactorial chronic disease that develop from an interaction of genotype and environment (Gumbiner, 2001). Likewise, Obesity is the consequence of autonomic and largely uncontrollable responses to an environment with excessive food availability and aggressive and unrelenting cues that cause people to eat too much (Gao, et al. 1996 & Cohen, 2008). New research indicates that fluid consumption in general and water consumption in particular can have an effect on the risk of adolescent obesity (Kleiner, 1999). Usually lack of sleep or reduced sleep at night is associated with obesity in youngsters. The people with reduced sleep had reduced leptin and elevated ghrelin. Due to sleep deprivation,

differences in leptin and ghrelin are likely to increase appetite, and causes increased BMI (Myers et al., 2010 & Taheri et al., 2004). It is observed that obese subjects had inferior performances on all physical activity tests compared with non-obese (Deforche, et al., 2003). The poorer performances in obese individuals are probably due to the fact that their excess body fat is an extra load to be moved during weight-bearing tasks (Astrand, et al., 1977). The hurdles faced by obese individual are because their bodies exert much physical stress in response to heavy physical activity. Any internal or external strain can lead to altered physiological responses is counted as physical stress. Such as exercise, noise, pregnancy, physical workload, injury & physical contact (Shamooun, 2014). This physical stress is evaluated through Sadaf Stress Scale (SSS),

which contains 19 symptoms & categorizes severity of physical stress into normal, mild, moderate and severe (Shamoon, et al., 2013). The increasing prevalence of obesity is particularly alarming due to the numerous healthy implications associated with this condition including coronary artery disease, hypertension, diabetes, hyperlipidemia, cancer & various musculoskeletal conditions (McInnis, 2000). The pathophysiology underlying the development of hypertension associated with obesity includes sodium retention and associated increases in vascular resistance, blood volume, cardiac output, increased sympathetic nervous system and insulin resistance (Panel, 1998). Patient have increased pre-load, after-load and increased mean pulmonary artery pressure (PAP) (Jay B. Brodsky 2005). Due to which physical exertion is much more & exercise endurance is usually lesser in such individuals, their blood pressure after physical activity get severely increase hence they fatigue earlier if it's not in their routine habit.

November, 100 healthy subjects including both genders with age group of 20-30 years were randomly selected from different departments of University of Karachi, Pakistan. Informed consent was provided to all participants before asking preliminary questionnaire which includes questions for their demographic data, family history & lifestyle.

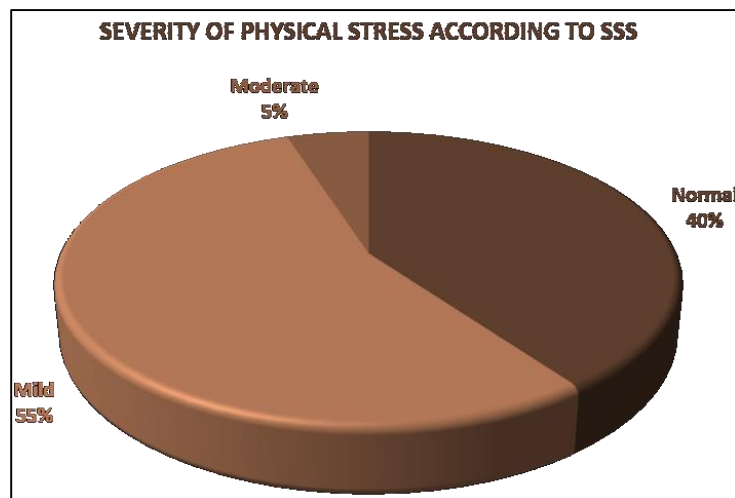
Obesity is classified on the basis of BMI, although BMI does not directly measure body fat (or muscle or bone for that matter) (Lauren, 2011). BMI is a calculated number, based on height and weight of an individual (Judith, 2009).

Subjects were asked to do physical activity i.e. brisk walking on tread mill for 15 Minutes. Pre & post Blood pressures & pulse were monitored, while Physical stress score evaluation was done by using Sadaf Stress Scale (SSS) and Data was analyzed on SPSS version 19.0.

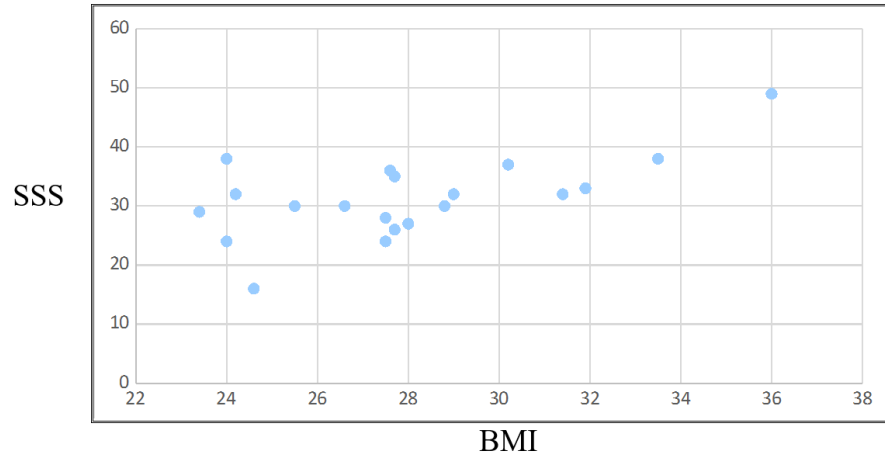
## Methodology

The present observational study was conducted in year 2015 from January to

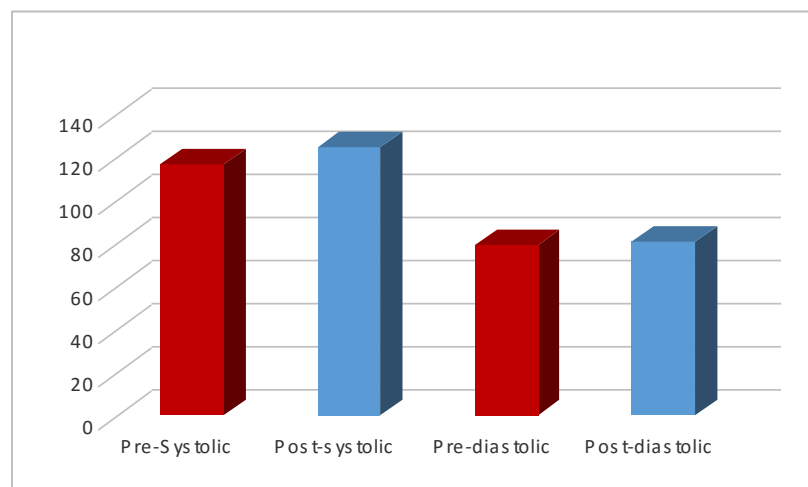
## Results



**Figure 1: Showing severity of physical stress according to SSS, about 60% of obese individual showed mild to moderate physical stress.**



**Figure 2: Showing BMI in relation to Physical stress; there is direct relation between BMI and physical stress. The correlation is significant (at 0.01 level) between SSS & BMI of obese subjects after exercise.**



**Figure 3: Showing Relationship of blood pressure pre and post exercise in obese patients; Pre and post systolic and diastolic BP has compared with reference to BMI. Before exercise, systolic and diastolic BP of obese subjects were normal (about 120/80mmHg) whereas after exercise systolic & diastolic BP of obese subjects were raised from normal range.**

### Discussion

Obesity itself constitute a chronic stressful state and may cause HPA axis dysfunction after mild physical exertion (George, 2005). We had observed that in obese subjects, physical stress develop much more intensely and even earlier as compare to normal subjects this might be because of fat

deposition mainly in central body & as the body fat percentage increases the individual has to exert much more force in order to achieve certain physical activity and leads to increase physical distress on body (Hryhorczuk, et al., 2013). The increase amount of fat in their body does not allow them to do sufficient physical activity and

body ultimately faces stress responses, this stress response is categorized as physical stress. The stress response causes to hyperactivate HPA and then there is increase release of cortisol in the blood (Vicennati et al., 2009) in the present study, it was observed that more the subjects were obese harder it was for them to do physical activity thereby increase in the increase amount of physical stress.

It was also observed that obese subjects reported more intense individual symptoms after exercise. That was an indication of increase load bearing and much physical exertion, clearly reflected by greater physical stress scores. The poorer performances of physical activities by obese individuals is probably due to the fact that their excess body fat is an extra load to be moved during the tasks (Astrand, 1977). For this reason, regular moderate intensity exercise is important because it enhances long-term weight maintenance & also improves insulin sensitivity, glycemic control, and selected risk factors for cardiovascular disease (i.e., hypertension and dyslipidemia) and increased aerobic fitness decreases the risk of coronary heart disease (Klein et al., 2004). Even light activities on daily basis such as standing, walking around at home, household work and brisk walking are associated with a significantly lower risk of obesity & build better exercise endurance in our body (Frank et al., 2003 and Bouchard, et al., 1993). However, sedentary lifestyle along with environmental factors increases obesity rate.

After exercise, increase in blood pressure of obese subjects can be due to activation of the sympathetic nervous system as obesity is known to be associated with endothelial dysfunction and renal functional abnormalities that may play a role in the development of hypertension (Panel, 1998).

On the other hand high accumulation of intra-abdominal fat displayed significantly lower HDL- Cholesterol. Obesity is associated with increased risk of cardiovascular disease in adults. Fitness has a significant influence on blood fluid. In fitter individuals blood is more fluid. Cardiovascular risk factors are also associated with abnormalities in the flow properties of blood (Daniel et. al., 1999 and Despres et. al., 1989). High BP is defined as mean systolic BP  $\geq 140$  mm Hg or mean diastolic BP  $\geq 90$  mm Hg (Panel, 1998). Obesity is associated with arterial wall stiffness and endothelial dysfunction. Low plasma apolipoprotein A-I, insulin resistance, and android fat distribution may be the main risk factors for these arterial changes, which are of considerable concern as possible early events in the genesis of atheroma (Tounian, et al., 2001). It is also accompanied by a large number of coagulation and fibrinolytic abnormalities. This suggests that obesity induces a prothrombotic state. This prothrombotic state can promote the development of atherosclerosis (Grundy, 2004). The vasoconstriction produced as a result of atheroma or less clearly defined stimulus, possibly of renal origin, is thought to be the cause of essential rise in hypertension. Such as vasoconstriction, especially of unequal amount of blood in differing parts of the body, could have a marked effect at the openings of the larger vessels, due to the alteration of pressure gradient in these places (Fox, et al., 1966). All these factors accompany high BP even after exercising for shorter time period. Sometimes factors that are thought to have an important bearing on the development of atheroma are stress and exercise. The effect of exercise on the circulation is to increase flow volumes; in effect, this is an increase in flow velocity. The structures most likely to be affected by exercise are the heart and the legs (considering "exercise" in its usually

accepted meaning). Even if there was an increased tendency to stagnant deposition in arteries because of viscosity alterations, regular and fairly frequent increases of flow rates as a result of exercise would introduce violent turbulence into the static areas causing high blood pressures (Fox, et al., 1966).

### Conclusion

Obese individual develop physical stress after any physical activity for even shorter period of time. The present study suggests that individual with BMI greater than 26 can develop physical stress. In such individuals, physical stress develop much more and even earlier assigning mild to moderate range in SSS scores as compare to subjects with normal BMI. Hence, obesity is considered as one of the most important physical stressor due to the reason that greater amount of central fat in the body leads to greater physiological alterations after exercise. Moreover, our findings presented that after all the physiological alterations the characteristics symptoms of physical stress as reported by obese subjects were also indicating psychological distress.

### Competing Interests

All the authors disclose that there are no competing interests in the preparation of this article.

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