The Effect of Six-Minute Walk Test on Overweight, Obese and Underweight in Adults-A Comparative Study

Renu[1], Tarun Dhull[2], Hemlata Vats[3]
[1] *Master of Physiotherapy (Cardiopulmonary), Gurugram University, Gurugram (Haryana)*
[2]*Assistant Professor (MPT, Sports), Department of Physiotherapy, Gurugram University, Gurugram (Haryana)*
[3]*Assistant Professor, Faculty of Physiotherapy,Jamia Milia Islamia University*

Abstract- BACKGROUND: The 6MWT is a safe, simple, well-standardized in recent research. The reproducibility and validity of the 6MWT have been determined in adults with obesity, Overweight and underweight and easy to use in clinical settings.
OBJECTIVE: To determine the effect of 6-minute walk test on vitals of overweight, obese class-I and underweight adults.
METHODS: The subject will rest for about 10 minutes on a chair near the starting position before the test. 6 min will be conducted according to ATS guidelines. Firstly, the subject resting heart rate, blood pressure, respiratory rate was recorded. As soon as the subject starts to walk, the timer was set. Number of laps were counted each time when the subject return back to the starting point. Blood pressure, heart rate, respiratory rate was monitored immediately after the test. The distance walked by the subject was measured immediately. Anthropometric data of obese and lean adults was used to check the effect of 6-min walk distance in the population. The values obtained of the anthropometric data of obese and overweight adult from the six min walk test was compared with the vital values of underweight adults from the six-minute walk test.
RESULTS: This study shows that the comparison of overweight, obese class-1 and underweight according to different parameters and it was found that only heart rate and temperature reading had insignificant result at 0.05 level of significance rest of all the variables were significant at 0.01 level of significance.
CONCLUSION: The study concluded that 6-minute walk test (6MWT) is significantly affects the heart rate and increase the body temperature, alter respiratory rate and rise in blood pressure in overweight, obese class I and underweight subjects. We suggest that six-minute walk test to manage the signs and symptoms of overweight, obese and underweight subjects in regular clinical practice.

Keywords: Six-minute test, Body mass index, Overweight, Obese, Underweight.

I. INTRODUCTION

The 6MWT was developed in 1963 by Balke to evaluate functional capacity. The 6MWT is a practical simple test requires a 100-ft halfway(30m)but no exercise equipment or advanced training for technicians. The 6MWDis used to measure the maximum distance that a person can walk in 6 - minutes. The ability to ambulate for a distance is a quick and inexpensive measure of physical function and an important component of quality of life since it reflects the capacity for undertaking everyday activities. The Six-minute walk test is an example of a functional walk test that is practical and simple and only require the ability to work It is a form of clinical evaluation perform through a sub–maximal effort. Six- minute walk distance (6MWDis commonly used measure of functional exercise capacity in clinical practice and research. Performance tests, such as the six-minute walking test (6MWT), can unveil the limitations in cardio-respiratory and motor functions underlying the obesity- related disability [1]. The 6-min walk test (6MWT) is a simple, safe, and inexpensive test that evaluates physical performance and walking capacity the 6MWT has been used mainly in patients with chronic heart failure and pulmonary diseases to evaluate prognosis and treatment efficacy [2]. American Thoracic Society published in 2002 guidelines for the six-minute walk test (6MWT) (ATS,2002). The test was introduced in 1976 as a 12-minute walk test to determine exercise capacity for patients with respiratory disease and later developed

into the 6MWT [3,4]. Solway et al. (2001) performed a qualitative systematic overview of the most commonly used walk tests, and found the 6MWT to be easy to administer, better tolerated and reflected activities of daily living better than other walk tests [5]. Apart from lung and heart diseases, several other states of ill health might result in reduced six-minute walk distance (6MWD) [6]. Test could be used to assess any problem affecting walking capacity (ATS, 2002), and it is increasingly used in clinical practice, since it provides useful information on daily physical performance [7]. The 6MWT is a safe, simple, well-standardized and in recent research, the reproducibility and validity of the 6MWT have been determined in adults with obesity easy to use in clinical settings [8,9]. The 6MWT has been reported to be a reliable and valid test in healthy children, in children with cystic fibrosis and in children with congenital heart disease[6]. In 2016, 39% of adults 18 years and over (39% of men and 40% of women) were overweight. Overall, about 13% of the world's adult population (11% of men and 15% of women) [10].

Obesity, as defined by the World Health Organization (WHO), is a medical condition in which excess body fat accumulates to produce negative effects on health which ultimately leads to increased morbidity and reduced life expectancy [11]. Obesity predisposes an individual to various diseases such diabetes, obstructive sleep apnea, cancers of colon, breast, endometrium, coronary artery disease at an earlier age, non-alcoholic steatohepatitis, menstrual irregularities, and infertility [12]. Once restricted to high income countries, obesity is now also prevalent in low- and middle-income countries where its incidence is constantly increasing recent data from the WHO [13].

The BMI is defined as the body mass divided by the square of the body height, and is expressed in units of kg/m^2, resulting from mass in kilograms and height in meters. The BMI is a convenient rule of thumb used to broadly categorize a person as underweight, normal weight, overweight, or obese based on tissue mass (muscle, fat, and bone) and height. Major adult BMI classifications are underweight (under 18.5 kg/m^2), normal weight (18.5 to 24.9kg/m^2), overweight (25 to 29.9kg/m^2), and obese (30kg/m^2 or more) [11]. Underweight is associated with significantly higher mortality than being of normal weight. Both overweight and underweight in adults is a significantly public health issue. Worldwide among adults,8.8%of men and 9.7% of women are underweight and 10.8%of men and 14.9% of women are obese. Having underweight in adulthood can have various negative health effects, including death and having obesity has been associated with different non-communicable diseases (NCDs), including type 2 diabetes and cardiovascular disease, increasing mortality. As reviewed in Pengpid et al. factors associated with underweight in adulthood may include male sex, younger or older age, lower socioeconomic status, rural residence, health risk behaviors, such as smoking and insufficient food intake and fear of being obese[11]. Dietary risk behaviors' impacting on Obesity include the "consumption of energy-dense foods high in sugars and fat" and insufficient fruit and vegetable intake [13]. Engaging in physical activity, khat and tobacco use have been found to decrease the likelihood of having overweight and obesity. Obesity is linked with several chronic NCDs such as hypertension and type 2 diabetes. A high BMI can indicate high body fatness. The BMI has limitations that can make it less useful than some of the alternatives, especially when applied to individuals with abdominal obesity, short stature, or unusually high muscle mass. BMIs under 20 and over 25 have been associated with higher all-cause mortality, with the risk increasing with distance from the 20–25 range [12].

This study emphasis on physical fitness in overweight, obese and underweight subjects was compared by means 6-minute walk test according to the guidelines of American thoracic society.

BODY MASS INDEX		
Category	BMI (kg/m^2)	BMI Prime
Underweight (Severe thinness)	<16	<0.64
Underweight (Moderate thinness)	16.0 – 16.9	16.0 – 16.9
Underweight (Mild thinness)	17.0 – 18.4	0.68 – 0.73
Normal range	0.68 – 0.73	0.74 – 0.99
Overweight (Pre-obese)	25.0 – 29.9	1.00 – 1.19
Obese (Class I)	30.0 – 34.9	1.20 – 1.39

Obese (Class II)	35.0 – 39.9	1.40 – 1.59
Obese (Class III)	≥ 40.0	≥ 1.60

II. METHODOLOGY

A. STUDY DESIGN: Comparative experimental study designed approved by the institutional Review Board of Gurugram University. A total of100 participants were taken in the study. They were randomly divided into two groups named as Group A (underweight) and Group B (overweight and obese class-I). Random sampling technique was done. Study was done in Gurugram, Haryana. The study was conducted from 20th August 2022 to 5thOctober 2022.This study includes participants who were young healthy adult both males and females. Participants included in the study were in the aged group of 20 to 35 years. This study excludes participants who were less than 20 years of age and more than 35 years of age.Any health-related problems that might interfere with the ability to perform physical exercise was excluded in the study.

B. DATA COLLECTION PROCEDURE: The entire selected subjects were informed in details about the type and nature of the study. The consent form was filled by each participant prior to the study. The subject will rest for about 10minuteson a chair near the starting positionbefore the test. 6 min will be conducted according to ATS guidelines. Firstly, the subject resting heart rate, blood pressure, respiratory rate was recorded.As soon as the subject starts to walk, the timer was set. Number of laps were counted each time when the subject return back to the starting point. Blood pressure, heart rate, respiratory rate was monitored immediately after the test. The distance walked by the subject was measured immediately. Anthropometric data of obese and lean adults was used to check the effect of 6-min walk distance in the population. The values obtained of the anthropometric data of obese and overweight adult from the six min walk test was compared with the vital values of underweight adults from the six-minute walk test.

C. DATA ANALYSIS: The data were collected and entered in Microsoft excel sheet and were analyzed using statistical package for social science (SPSS) version 28. The mean and standard deviation of age, height and weight were calculated and hence comparison was calculated.

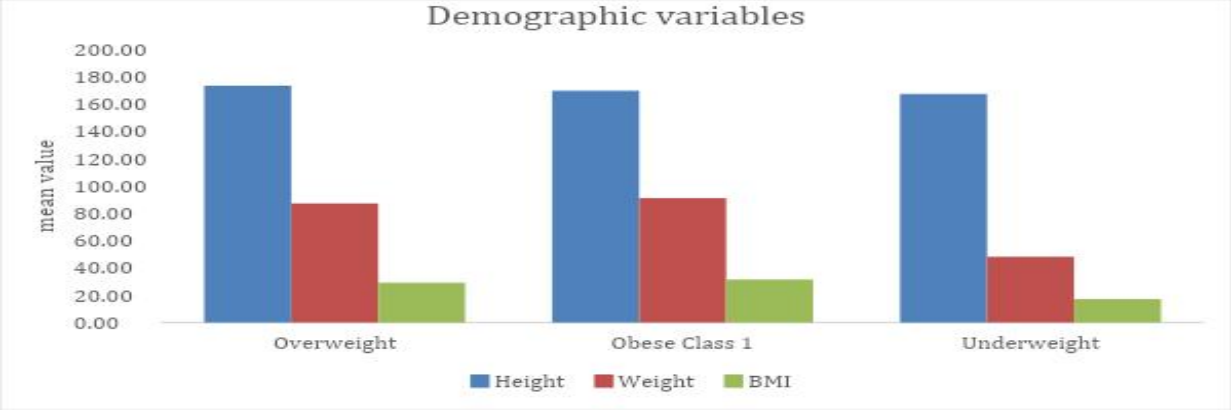
III. RESULTS

Table No.1. Comparison of demographic variables between the groups

		Mean	Std. Deviation	F-value	p-value
Height	Overweight	173.18	8.12	6.42	0.002*
	Obese Class 1	169.71	11.11		
	Underweight	167.34	5.80		
Weight	Overweight	87.19	10.47	280.17	0.001**
	Obese Class 1	91.08	11.74		
	Underweight	48.16	5.27		
BMI	Overweight	29.08	2.41	725.88	0.001**
	Obese Class 1	31.52	0.86		
	Underweight	17.13	1.02		

***= Significant at 0.01 level of significance.*

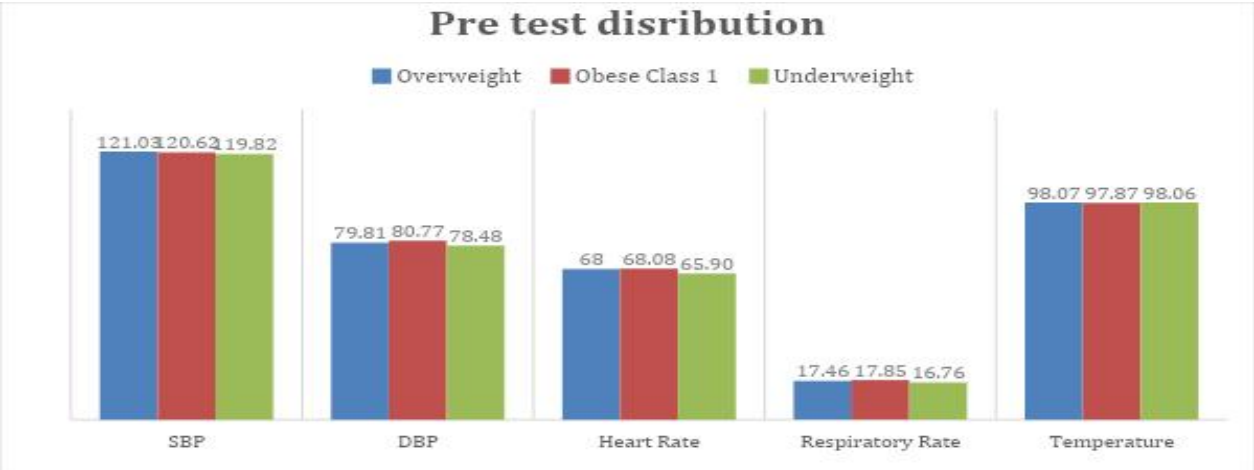
**= Significant at 0.05 level of significance.*



In this present study, table no.1 depicts that the comparison of three groups according to demographic variables. It was found that all the parameters had their mean differences. ANOVA test was applied and for all the variables result were significant at 0.05 level of significance.

Table No.2. Comparison of BP, HR, respiratory, temperature of pre-test between the groups

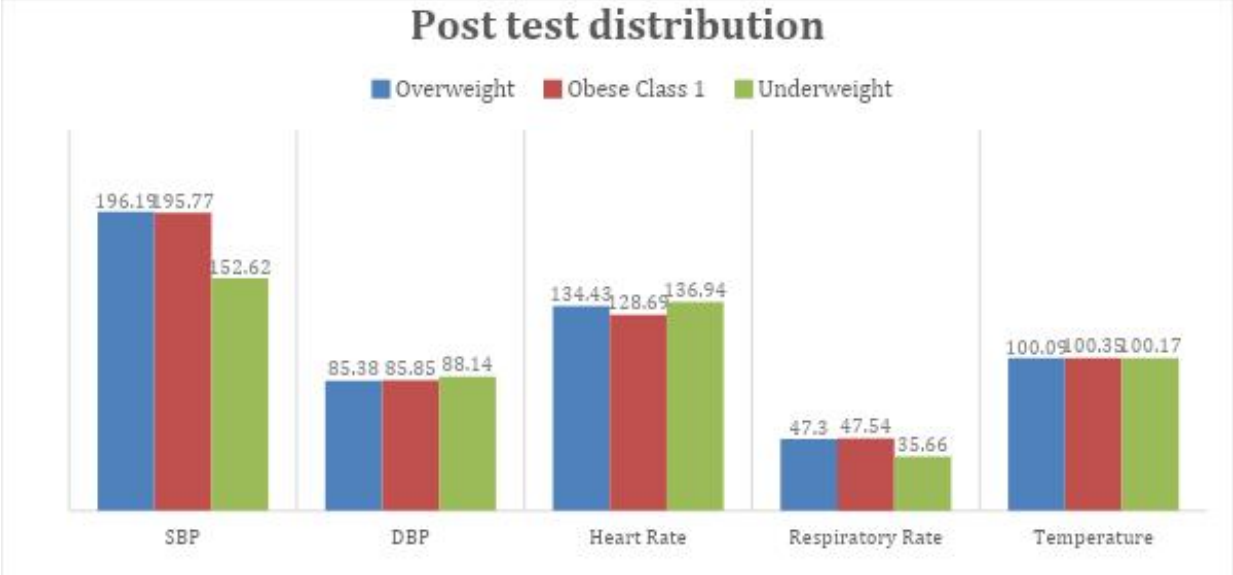
		Mean	Std. Deviation	F-value	p-value
Pre SBP	Overweight	121.03	4.01	1.09	0.341^{NS}
	Obese Class 1	120.62	7.44		
	Underweight	119.82	1.90		
Pre DBP	Overweight	79.81	2.85	4.6	0.012*
	Obese Class 1	80.77	4.02		
	Underweight	78.48	2.32		
PreHeart-Rate	Overweight	68.00	2.81	9.99	0.001**
	Obese Class 1	68.08	1.38		
	Underweight	65.90	2.21		
Pre-Respiratory	Overweight	17.46	1.14	3.74	0.027*
	Obese Class 1	17.85	1.21		
	Underweight	16.76	1.81		
Pre-Temperature	Overweight	98.07	0.49	0.901	0.409^{NS}
	Obese Class 1	97.87	0.49		
	Underweight	98.06	0.50		



In table no.2, it shows that the comparison of three group by different parameters at pre stages. Systolic Blood pressure and temperature results were not significant at 0.05 level of significance however, the Heart rate, respiratory rate and DBP had the results were significant at 0.05 level of significant.

Table No.3. Comparison of BP, HR, respiratory, temperature of post-test between the groups

		Mean	Std. Deviation	F-value	p-value
Post SBP	Overweight	196.19	5.08	1064.35	0.001**
	Obese Class 1	195.77	5.53		
	Underweight	152.62	4.18		
Post DBP	Overweight	85.38	3.93	4.16	0.018*
	Obese Class 1	85.85	4.20		
	Underweight	88.14	5.12		
Post Heart Rate	Overweight	134.43	14.65	2.86	0.062^{NS}
	Obese Class 1	128.69	11.97		
	Underweight	136.94	7.43		
Post Respiratory	Overweight	47.30	3.48	99.39	0.001**
	Obese Class 1	47.54	4.22		
	Underweight	35.66	4.57		
Post Temperature	Overweight	100.09	0.65	1.07	0.348^{NS}
	Obese Class 1	100.35	0.27		
	Underweight	100.17	0.48		



According to post-test analysis, table no.3 shows that the comparison of overweight, obese class 1 and underweight according to different parameters and it was found that only heart rate and temperature reading had insignificant result at 0.05 level of significance rest of all the variables were significant at 0.01 level of significance.

VI. DISCUSSION

The present study shows that the mean value of pre 6 MWT SBP and DBP of overweight participants was 121.03±4.01 mmHg and 79.81±2.85 mmHg respectively and post 6 MWT SBP and DBP was 196.19±5.08 and 85.38±3.93. Similar result was found in study conducted by Pathare N et al. (2012) [14]. In contrast to present study, Lívia S. Diniz et al. (2017) [15] reported that during the test, BP and HR displayed physiological behaviour, elevating during exertion and gradually returning to baseline values during rest. The elevation was mild, considering the entire patient sample. There was no statistical difference between groups for the variables assessed.

In our study we found that mean value of BMI of the obese class I participants was 31.52±0.86. Similar results were reported in study conducted by Manawat R et.al (2018) [10] founded that mean value of BMI of obese class 1 was 31.75±1.12.

In present study the pre 6 MWT and post 6 MWT heart rate of overweight population was found to be 68±2.81 bpm and 134.43±14.65 bpm respectively which shows a progressive increase in heart rate after 6 MWT. In contrast to the study conducted by

Morinder et al. (2009) [16] found that overall 6MWD and exercise HR were significantly lower in children and adolescents who were obese. In contrast to our study, another study conducted by Geiger R et.al (2011) [17] reported higher resting HR in children who were overweight.

In present study the pre 6 MWT HR of obese class I and underweight was 68.08±1.38 and 65.90±2.21 and post 6 MWT HR of obese class I and underweight was 128.69±11.97 and 136.94±7.43 i.e., HR increases in both the cases after 6 MWT. Whereas in study conducted by Larsson UE et al. (2008) [8] found that no significant difference in HR was found between adult participants who were lean and obese.

VII.CONCLUSION

The study concluded that 6-minute walk test (6MWT) is significantly affects the heart rate and increase the body temperature, alter respiratory rate and rise in blood pressure in overweight, obese class I and underweight subjects. The 6MWT is an easily performed, widely available and well-tolerated test for assessing the functional capacity of overweight, obese class I and underweight individuals in everyday clinical practice. We suggest that six-minute walk test to manage the signs and symptoms of overweight, obese and underweight subjects in regular clinical practice. Exercise HR significantly adds to predict the 6MWD and can be included to calculate effort-adjusted walk distances. Although maximal exercise tests, such as CPET, are the gold standard for assessing functional capacity, the 6MWT may provide reliable information about the individual daily activity and the short-term prognosis especially CVD and reduced ejection fraction, either in a chronic stable state or after an acute decompensation. The differences noted in BP are important because hypertension in adulthood has been shown to be linked to hypertension later in life. This information is vital to allow physical therapists to design exercises that match the patient's interests and physical abilities and to allow safe and successful participation in those activities. In the long term, this may promote an expanded role of physical therapists in community public health.

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