

Effect of BMI on Endurance In Middle Aged Patients with Type 2 Diabetes: A Cross sectional study

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Abstract:

Background: The prevalence of obesity and diabetes is rising. The aim of this study was to determine the association of endurance performance among normal, overweight and obese middle-aged patients with type 2 diabetes. **Objectives:** To find out endurance in Normal, Overweight and Obese middle age patient with type 2 diabetes. **Methodology:** After getting the ethical approval, patients were screened and informed consent form was taken from them. To accomplish the aim, 60 patients with diabetes were taken in which 20 patients were taken in each group of Body Mass Index (BMI) i.e. normal, overweight & obese. The endurance was assessed by 6 min walk test and step test. **Results:** Distance covered is more in overweight as compared to normal and obese. Steps are decreased in obese followed by overweight and normal population. **Conclusion:** The study shows that there is no any correlation between the in the endurance test.

Key words: 6 min walk test, step test, type 2 diabetes, endurance

Introduction:

Diabetes mellitus (DM) is characterized by chronic hyperglycaemia and impaired carbohydrates, lipids, and proteins metabolism caused by complete or partial insufficiency of insulin secretion and/or insulin action. There are two primary forms of diabetes, insulin-dependent diabetes mellitus (type 1 diabetes mellitus, T1DM) and non-insulin-dependent diabetes mellitus (type 2 diabetes mellitus, T2DM). T2DM is the most common form of DM, which accounts for 90% to 95% of all diabetic patients.[1]

Many studies have shown that awareness about the diabetes and its complications is poor among the general population especially in the rural areas. There is an urgent need to create awareness among the population regarding diabetes and about the serious consequences of this chronic disorder.[2] Although not a direct cause of death, diabetes mellitus yields serious damages by causing blindness, kidney failure, non-traumatic limb amputation, and complications such as coronary artery disease and stroke. Therefore,

as a chronic disease whose symptoms can be controlled but cannot be cured, the goal of diabetes mellitus management, which is a lifelong task, is to improve symptoms, maintain normal blood glucose levels, and prevent acute and chronic complications.[3]

The American Diabetes Association (ADA), in the Standards of Medical Care in Diabetes 2014, stated that adults with diabetes should be advised to perform at least 150 min/week of moderate-intensity aerobic physical activity, spread over at least 3 days/week with no more than 2 consecutive days without exercise.[4] The incidence of overweight has been increasing dramatically worldwide due to increased uptake of high-calorie food, lack of physical activity, and genetic predisposition. Accordingly, obesity and its associated metabolic diseases such as type 2 diabetes mellitus (T2DM) have become an epidemic health threat and economic burden.[5]

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The step test is designed to measure the aerobic fitness and can be conducted using simple equipment, and is easy to perform, with no practice required. It is usually performed in a short period and is excellent for many individuals. In particular, the 6-minute walk test (6-MWT) is also a widely used method for evaluating cardiopulmonary performance. Therefore, walking is an attractive aerobic exercise that is easily selected for exercise testing.[3]

A simple, safe, and reliable method of measuring cardiovascular endurance that can be performed with minimal indoor space without requiring expensive equipment is necessary for patients with diabetes mellitus³. An increase in body fat is generally associated with increased risk of metabolic diseases such as type 2 diabetes mellitus, hypertension and dyslipidaemia.

However, not all overweight or obese patients have metabolic diseases, and vice versa. While these concepts may be well-accepted, and assumed to be readily accessible in the literature, the authors are unaware of any single report presenting comprehensive data regarding the relationship between BMI and metabolic diseases.

Hence the purpose of the study is to find out endurance in normal, overweight and obese BMI middle age patient with type 2 diabetes.

Methodology:

It is an Observational cross-sectional study conducted over the duration of 1 year at Dr. Vithalrao Vikhe Patil Memorial Hospital, Ahmednagar & Physiotherapy OPD. A total of 60 subjects were included in the study which was further divided into 3 groups by purposive sampling. Both male and female, community dwelling and ambulatory patients in the age group of 33-55 years who were diagnosed with diabetes, and were willing to participate in the study were included in the study. Informed consent was taken from all the patients.

Patients diagnosed with systemic or musculoskeletal diseases that can hinder exercise training, Cancer, Asthma, Bronchiectasis or any symptomatic cardiovascular disease were excluded from the study.

The study was approved by Institutional Ethical Committee of DVVPF's College of Physiotherapy,

Ahmednagar. All the patients were screened and demographic characteristics including Name, Age, Address, Type of Diabetes, and Duration of Diabetes was recorded. The subjects who meet the inclusion criteria was asked to participate in the study, all the procedure was explained to the subjects in patient's language, written informed consent from each patient prior to participation. Six-minute walk test & step test performed.

The 6-MWT was performed in accordance with the guidelines of the American Thoracic Society. The subjects were instructed to walk for 6 minutes at a given time along a 30-m line at an interval of 1.5 m in an outdoor corridor, and the distance walked was recorded in meters. The walk tests were conducted in hallways or outdoor corridors, and the patients were encouraged to continue walking as fast as possible.

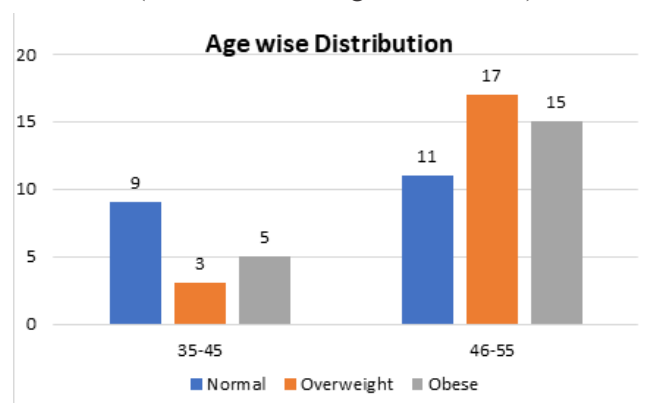
The cardiopulmonary capacity of the step test was determined using the Tecumseh step test method. This low-intensity step test was performed using the method used in a large-scale epidemiological study conducted in Michigan. The procedure was performed using a bench height of 20.3 cm and a rate of 24 steps per minute for 3 minutes. The rest period of 5min is given in between both the test.

Statistical Analysis:

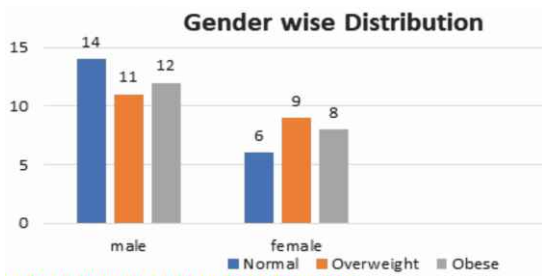
Data was stored in Microsoft Excel sheet, Descriptive analysis was used to express various demographic parameters. Graph pad Instat was used for data analysis. Unpaired t- test was used to compare the parameters between 3 subgroups and endurance test in patients with diabetes.

Results:

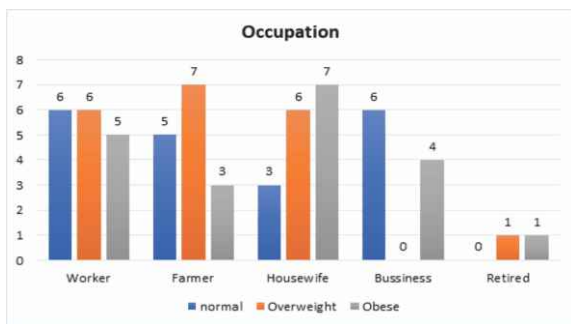
Graph 1: List of Age group according to BMI (Normal, Overweight, and Obese)



Graph 2: List of Gender according to BMI (Normal, Overweight, Obese)



Graph 3: List of occupation according to BMI (Normal, Overweight, Obese)



Graph 4: List of Addiction according to BMI (Normal, Overweight, Obese)

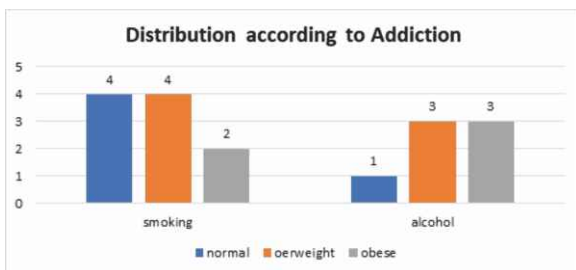


Table 1: List of Exercise Habit according to BMI (Normal, Overweight, Obese)

Exercise	Normal	Overweight	Obese
Yoga	1	0	6
Walking	0	2	0

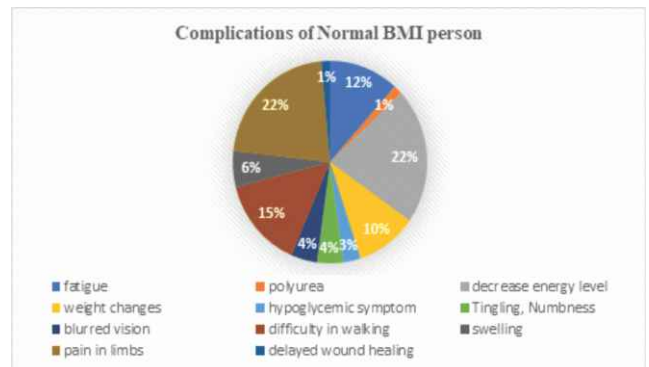
Table 2: List of Duration of Diabetes according to BMI (Normal, Overweight, Obese)

Duration	Normal	Overweight	Obese
0-6 months	4	0	1
7months-1year	5	2	0
more than 1 year	11	18	19

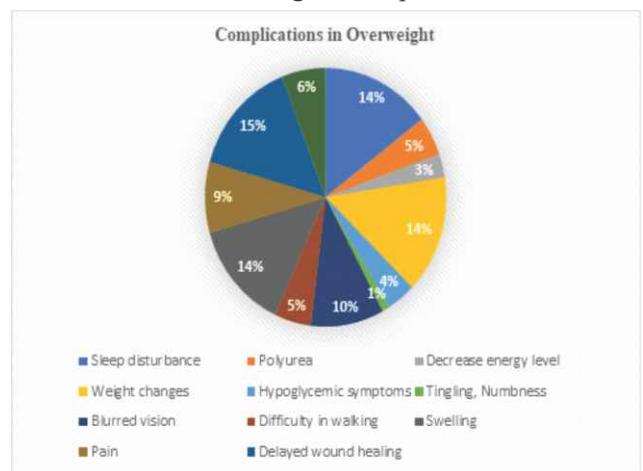
Table 3: List of Type of therapy of Diabetes according to BMI (Normal, Overweight, Obese)

Types	Normal	Overweight	Obese
Insulin	3	4	1
Oral	16	15	19
Diet	1	1	0

Graph 5: List of Complication according to Normal BMI person



Graph 6: List of Complication according to Overweight BMI person



Graph 7: List of Complication according to Obese BMI person

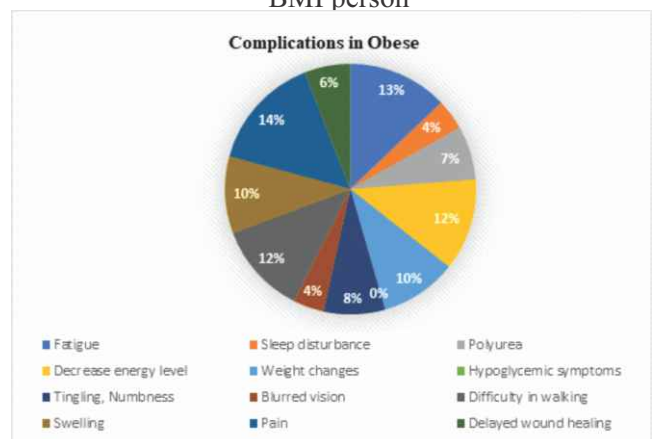


Table 4: Shows mean value and standard deviation and comparison of means of various parameters of 6 min walk test and step test with BMI (Normal, Overweight, Obese)

Parameters	Normal		Overweight		Obese		P value	Relevance
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation		
6 MWT	74.1	12.769	75.9	15.868	74.6	15.329	0.9626	Not significant
Step test	63.85	15.076	60.8	18.386	58	16.482		

Discussion:

This study aimed to find out the effect of BMI on Endurance in Middle Aged Patients with Type 2 Diabetes. To accomplish the aim, 60 patients with diabetes were taken in which 20 patients were taken in each group of BMI i.e. normal, overweight & obese.

In Previous study He Zou, *Et.al* did study Reference Equations for the Six-Minute Walk Distance in the Healthy Chinese Han Population, Aged 18–30 Years. They found that age had negative correlation with the 6MWD. This study shows the negative correlation between BMI and the distance walked but BMI was not represented in the final regression equation. They also found that weight was not associated with the distance walked in their study. The possible reason may be that the subjects in their study were recruited from local technical college and university, and their weights were within the normal range.[6]

Our study also shows negative correlation between BMI and distance walked in six minutes, as distance covered is more in overweight as compared to normal and obese. The possible reason may be that the subjects in our study were physically active in overweight population as compared to normal and obese population. This could be the reason that their muscle mass, muscle strength and maximal oxygen uptake gradually decreased with age.

A similar study by Węgrzynowska-Teodorczyk *et al.* claim that the 2MST, independently from assessing cardiorespiratory fitness, could be considered for the evaluation of lower-limb strength. They obtained a correlation of 2MST and 6MWT results with quadriceps strength in men with heart failure. Due to the movement biomechanics involved in the 2MST, presumably, the lower-body-strength intensity in the 6MWT would be higher. In the 2MST execution, participants raise their knees to a height equal to the mid-level between the patella and the iliac crest, requiring greater physical skills, intensity, and duration of single leg support compared to the standard step when walking. In this regard, the possibility of higher physiological demand with the similar movement of climbing stairs with the 2MST, even when this test is shorter than the 6MWT, could explain why the RPE was significantly higher in the 2MST (5.82 ± 1.87) compared to that of the 6MWT

(4.11 ± 2.03 ; $p < 0.001$).[7]

Our study also shows a positive correlation between BMI and total number of steps in 3 minutes. As steps are decreased in obese followed by overweight and normal population. The possible reason may be the age factor above 50 in which osteoporosis is commonly observed and due to this reason, the biomechanical effort is more for step up and step down as compared to walking on plane surface.

A study done by Patrícia Lúcia Gontijo *et.al* shows a negative and moderate association between the distances covered in the 6MWT and BMI, when the obesity grade and the distance covered over the 6MWT were correlated, in which the lower the obesity grade, the longer the distance covered.[8]

Conclusion:

The present shows that there is no any correlation between the in the endurance test i.e. six-minute walk test and step test with the BMI because distance covered is more in overweight as compared to normal and obese and steps are decreased in obese followed by overweight and normal population.

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