RESEARCH ARTICLE

©2023 The Academy of Environmental Biology, India

Journal of Ecophysiology and Occupational Health, *Vol 25(1), DOI: 10.18311/jeoh/2025/41898, 55-59, March 2025*

ISSN (Online) : 0972-4397
ISSN (Online) : 0974-0805

The Effect of BMI on Risk of Fall Using Berg Balance Scale in Middle Age Patients with Type-2 Diabetes

Rashi Agrawal*, Sana Rai and Suvarna Ganvir

Department of Neurophysiotherapy, Dr. Vitthalrao Vikhe Patil College of Physiotherapy, Ahmednagar - 414111, Maharashtra, India; agrawalrashi2820@gmail.com

Abstract

Background: Given how closely obesity and diabetes are related that the term "diabesity" was coined and Obesity is known to be the major factor of risk of fall. Therefore, this study examined the relationship between middle-aged type-2 diabetic patients' BMI and their risk of falling. **Objective**: To find the effect of BMI on risk of fall using Berg Balance Scale in middle age patients with type-2 diabetes. **Method**: After getting approval, patients were screened between age group of 35-55 years suffering from type-2 diabetes. Three groups including a total of sixty patients were taken - normal, overweight and obese based on BMI. They were assessed on the basis of the 14 components of Berg Balance Scale and interpretation of risk of fall was calculated from the total Berg Balance Scale score. **Result**: 20 participants in normal BMI group 15 had low risk of fall and 5 with medium risk of fall. In over weight group 4 had low risk of fall & 16 with medium risk of fall and among obese group all the 20 participants showed medium risk of fall. **Conclusion**: Middle-aged patients with type-2 Diabetes Mellitus have a relationship between their BMI and their risk of falling with an increase of falls in patients belonging to obese category (BMI ≥ 30) as compared to the patients belonging to overweight and normal category.

Major Findings: Physical inactivity due to high BMI is one of the risk factor of falls and diabetic neuropathy increases the chance of fall. It is important to emphasize this fact so that more evidence is added to the current evidence and clinicians will take necessary action to reduce physical inactivity in patients with diabetes.

Keywords: Berg Balance Scale, BMI, Diabetes Mellitus, Risk of fall

1. Introduction

Long-term metabolic disease, Diabetes Mellitus (DM) makes it difficult for the body to regulate blood sugar levels. With an increase in Type 2 DM prevalence that is strongly correlated with lifestyle factors, Diabetes Mellitus (DM) is a severe health concern[1,2].

Research indicates that nearly half of those suspected of having diabetes do not receive diagnosis for a decade after the condition first manifests. Consequently, the true prevalence of diabetes worldwide must be extraordinarily high[3].

Angina, myocardial infarction, peripheral artery disease, congestive heart failure and stroke are common in patients with Type 2 diabetes[4]. The main microvascular problems associated with Type 2 diabetes are neuropathy, retinopathy, nephropathy, and small vessel vasculopathy, which can result in amputation of the lower extremities. And Type 2 diabetes is a major contributor to lower limb amputations, renal failure, and blindness[5].

An elevated BMI has been reliably linked to a higher incidence of Type 2 diabetes. Due in part to the fact that obesity frequently coexists with the metabolic syndrome, a collection of conditions that includes hyperglycemia, dyslipidemia, and hypertension, Type 2 diabetes development is significantly influenced by obesity[6].

Over 300 million people worldwide are impacted by the obesity pandemic. It is an important risk factor for patients with Type 2 Diabetes Mellitus. Clinically speaking, visceral adipose tissue is known to produce chemicals that can cause diabetes. Body mass index (kg/m^2) is used to quantify general obesity, whereas waist circumference and the waist/hip ratio are used to measure central obesity[7]. Obese people are urged to control their weight and preserve metabolic health by engaging in regular physical activity[8].

*Author for correspondence

Article Received on: 01.03.2024 Revised on: 11.08.2024 Accepted on: 13.08.2024

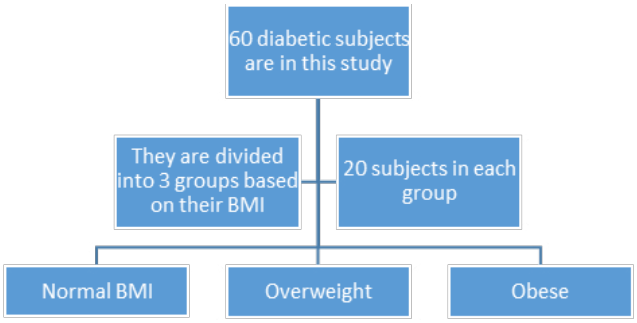
For senior citizens with Type 2 diabetes, poor balance is a well-established cause for falls.

The preservation or restoration of an individual's center of mass within their range of stability is known as balance. Another independent risk factor for falls in older persons is Type 2 diabetes. Compared to senior citizens without Type 2 diabetes, those with the disease have a far higher rate of falls. Falls can have disastrous effects on mobility, avoidance of activities, institutionalization, and fatality. Impaired balance ability is one of the most often found cause linked to falls[9].

One of the major concerns for senior citizens with Diabetes Mellitus is falls. Up to 39% of senior diabetics experienced falls on a yearly basis. Diabetics who experience declines in sensory function due to neuropathy or retinopathy may be more likely to fall[10].

Though ample literature is available in older population, the risk of fall has not been investigated in the age group of 35-55 years. Thus, the purpose of this research was to determine how BMI affected middle-aged individuals with Type 2 diabetes's risk of falling using the Berg Balance Scale.

2. Methodology



This study was carried out in Dr. Vitthalrao Vikhe Patil Memorial Hospital, Physiotherapy OPD Ahmednagar. This is an observational cross-sectional study and the sampling method was purposive sampling, study duration was of 1 year.

Inclusion Criteria	Exclusion Criteria
Subjects diagnosed with diabetes type-2	Subject associated with stroke
Subjects willing to participate & sign the written informed consent	Subject associated with fracture
Age group of between 35-55 years	Sever cognitive impairment
Both males and females	Significant psychiatric illness
Ambulatory & community dwelling	Other significant neurological or orthopedic condition

Demographics data of the subjects were noted and subjects were examined using Berg Balance Scale. Berg Balance Scale is a gold standard scale for assessing balance. It has 14 components with maximum score of 56. Risk of fall is estimated from total score with score 0-20 high risk of fall, 21-40 medium risk of fall and 41-56 low risk of fall.

3. Result

Table 1. Patient characteristics and distribution according to BMI

		Normal	Overweight	Obese
		n=20	n=20	n=20
Age(years)	35-45	6	3	4
	45-55	14	17	16
Gender	Male	17	15	15
	Female	3	5	5
Duration of Diabetes	< 1year	2	0	1
	>1year	18	20	19
Occupation	Business	9	5	5
	Farmer	3	6	2
	Worker	5	4	8
	Housewife	3	5	5
Exercise habit	Yes	10	5	2
	No	10	15	18
Exercise Habit	Walking	9	5	2
	Yoga	1	0	0
Type of Therapy	Insulin	2	0	2
	Oral	12	17	17
	Diet	6	3	1

Table 2. Distribution of risk of fall using berg balance scale according to BMI

Interpretation	Normal BMI	Over wt.	Obese
Low risk of fall	n=15	n=4	n=0
Medium risk of fall	n=5	n=16	n=20
High risk of fall	n=0	n=0	n=0
Mean BBS score	47.8	38.25	34.9

BBS- Berg Balance Scale

4. Discussion

In previous study by Maurer MS, Burcham J, *et al*, association of Diabetes Mellitus with increased risk of fall was found. This study shows that the fall incidence rate for the patients with diabetes was more than that of non-diabetic, with majority having gait and balance impairments with mean Berg Balance s score (29±15) The difference in the study was that the study was carried out on elderly population and various other factors were considered like medications, orthostatic changes in blood pressure and it did not consider the BMI of the patients[11].

IS Al-Ardhi, HH Atiyah conducted a study on the association between the risk for falls and body mass index among diabetic elderly patients. A three-part questionnaire was used to collect data from patients who were 60 years of age or older and had been diagnosed with diabetes. Part 1 of the questionnaire asked about the sociodemographic characteristics of elderly diabetic patients, Part 2 asked about patient-related variables, and Part 3 included the Berg Balance Scale. The elderly who are overweight or obese are at a higher risk of falling, according to the researcher, who also discovered a substantial correlation between the risk of falling and body mass index. Additionally, they discovered that a person's balance would be affected if their body mass index deviated from the normal range, meaning that they would become underweight, overweight, or obese, which would raise their chance of falling among the elderly[12].

Because obesity affects both changes in the body's centre of gravity and a higher percentage of fat than muscle mass, it may support previous observations that obesity has an impact on balance and walking.

The study was carried out by Herrera-Rangel *et al*., to evaluate association between falls and BMI, persons with Type 2 Diabetes Mellitus. Data was obtained from 134 patients, however none of the participants were seeking medical care for balance or sensory problems. They reported falls, answered questions about symptoms associated with balance, and underwent a sensory evaluation during the initial assessment. Following a 6-month interval, they reported falls once more. Based on the number of falls that had occurred the year before, patients were divided into two groups: N = 92, who had no falls, and N = 42, who had falls. Age, gender, and BMI all had an impact on the frequency of falls. Subjects with falls had a higher BMI and made up a larger percentage of patients with a BMI ≥35 than patients without falls; also, patients with a BMI ≥35 were younger than those with a BMI <35. Balance and the risk of falls in individuals with Type 2 Diabetes Mellitus may be impacted by a BMI of 35, which may be unrelated to aging[13].

Similarly, Deshpande N. conducted a study on Falls and Balance dysfunctions in Older Adults with Type 2 Diabetes. They discovered that Type 2 diabetic problems could quicken several body systems' normally aging processes. Consequently, it is not unexpected that senior citizens with Type 2 diabetes possess an increased chance of fall and balance problems than seniors without the disease.

A study was taken to determine the relationship between severity of diabetic neuropathy on balance ability and on the fall risk in patients with Type 2 Diabetes Mellitus, Timar B *et al*., they found that Diabetic neuropathy is linked to decreased balance and a subsequent rise in the chance of falls[14].

Do Nascimento JA *et al.,* conducted a study on static and dynamic balance in sedentary obese young adults to investigate the association between BMI, posture and postural balance, The researchers evaluated the postural control of obese young people with that of normal body mass index during various static and dynamic postural adaptations in order to compare the same. It was discovered that the majority of the obese volunteers had postural abnormalities, maximally with head protrusion followed by hyperkyphosis and hyperlordosis. Obese participants showed increased mean time to complete the TUGT and limits of stability test as well as medial-lateral dynamic displacement and risk of falling ($P < 0.05$). There were no apparent distinctions between the groups in the static balance tests using unipeadal and bipedal stance($P>0.05$)[15].

Lee JJ, *et al.,* conducted a study on relationship between obesity grades and balance ability in the community-dwelling elderly population. According to it, older adults who are obese have poor balance performance, which is linked to weakened lower limb muscles and compromised postural stability. Additionally, obesity based on BMI may increase the chance of falling[16].

According to Carral JM *et al.*, the connection between older people's BMI and balance may be influenced by their level of physical activity. As they found a strong significant correlation between active and inactive obese patients with static and dynamic balance[17].

Corbeil P *et al.,* conducted a study examining the increased risk for falling associated with obesity:

mathematical modelling of postural control. According to their research, obese people-especially those with an unusual distribution of body fat in the abdomen- may be more likely to fall than lighter people when they are subjected to daily postural stresses and perturbations[18].

5. Limitations

Although our study indicated that a greater proportion of obese individuals were at high risk of falling, the limited sample size makes it difficult to generalize the findings. We also limited our study to those who were middle-aged. It is possible to do more study with a larger sample size and people from a different age range.

6. Conclusion

Among middle-aged patients who have type-2 Diabetes Mellitus, there is a relationship between BMI and the likelihood of fall with an increase of falls in patients belonging to obese category (BMI ≥ 30) as compared to the patients belonging to overweight and normal category.

7. References

1. Binns E, Dixon CJ, Ihaka B, Knight T, O'Brien D. Clinical measures of balance in people with type two diabetes: A systematic literature review. Gait Posture. 2017; 58:325-32. https://doi.org/10.1016/j.gaitpost.2017.08.022
2. Ganvir S, Mishra S, Rai S, Singh S. Quality of Life among Type II diabetes Mellitus patients using the Modified Diabetes Quality of Life (MDQOL-17): An observational study. 2023; 10(2). https://doi.org/10.46858/vimshsj.10201
3. Hu X, Yang Y, Zhang Q, Zou R. Diabetes Mellitus and risk of falls in older adults: A systematic review and meta-analysis. Age Ageing. 2016; 45(6):761-7. https://doi.org/10.1093/ageing/afw140
4. Ganvir S, Kunde C, Someshwar H. Predicting probability of falls in geriatrics using traditional timed up and go test and dua task constraint timed up and go test: An observational study. Int J Health Allied Sci. 2017; 6: 88-92
5. Gill SV, Kim D, Lewis CL, Silverman AK. Changes in dynamic balance control in adults with obesity across walking speeds. J Biomech. 2022; 144:111308. https://doi.org/10.1016/j.jbiomech.2022.111308
6. Ahmad SI, Chibber R, Kaul K, Kohner EM, Tarr JM. Introduction to Diabetes Mellitus. Adv Exp Med Biol. 2012; 771:1-11. https://doi.org/10.1007/978-1-4614-5441-0_1
7. Beulens JWJ, Grobbee DE, Neal B, Van der Schouw YT, Van Dieren S. The global burden of diabetes and its complications: An emerging pandemic. Eur J Cardiovasc Prev Rehabil off J Eur Soc Cardiol Work Groups Epidemiol Prev Card Rehabil Exerc Physiol. 2010; 17(Suppl 1):S3-8. https://doi.org/10.1097/01.hjr.0000368191.86614.5a
8. Hiengkaew V, Kraiwong R, Vongsirinavarat M, Von Heideken Wågert P. Effect of sensory impairment on balance performance and lower limb muscle strength in older adults with Type 2 Diabetes. Ann Rehabil Med. 2019; 43(4):497-508. https://doi.org/10.5535/arm.2019.43.4.497
9. Duval S, Jacobs DR, Silventoinen K, Vazquez G. Comparison of body mass index, waist circumference, and waist/hip ratio in predicting incident diabetes: A meta-analysis. Epidemiol Rev. 2007; 29:115-28. https://doi.org/10.1093/epirev/mxm008
10. Cheng H, Burcham J, Maurer MS. Diabetes Mellitus is associated with an increased risk of falls in elderly residents of a long-term care facility. The Journals of Gerontology Series A: Biological Sciences and Medical Sciences. 2005; 60(9):1157-62. https://doi.org/10.1093/gerona/60.9.1157
11. Al-Ardhi IS, Atiyah HH. Association between risk of falls and body mass index among elderly diabetic patients. Pak J Med Health Sci. 2022; 16(03):1014-. https://doi.org/10.53350/pjmhs221631014
12. Aranda-Moreno C, Burcham J, Jáuregui-Renaud K, Mantilla-Ochoa T, Zainos-Saucedo L. Influence of the body mass index on the occurrence of falls in patients with Type 2 Diabetes Mellitus. obesity research and clinical practice. 2015; 9(5):522-6. https://doi.org/10.1016/j.orcp.2015.02.006
13. Deshpande N. Falls and balance impairments in older adults with Type 2 Diabetes: Thinking beyond diabetic peripheral neuropathy. Can J Diabetes. 2016; 40(1):6-9. https://doi.org/10.1016/j.jcjd.2015.08.005
14. Gaiță L, Levai C, Lungeanu D, Oancea C, Timar B, Timar R. The impact of diabetic neuropathy on balance and on the risk of falls in patients with Type 2 Diabetes Mellitus: A cross-sectional study. PloS One. 2016; 11(4):e0154654. https://doi.org/10.1371/journal.pone.0154654
15. Do Nascimento JA, Dos Santos HH, De Almeida Ferreira JJ, De Andrade PR, Silva CC. A preliminary study of static and dynamic balance in sedentary obese young adults: the relationship between BMI, posture and postural balance. Clin Obes. 2017; 7(6):377-83. https://doi.org/10.1111/cob.12209
16. Choi KM, Chon J, Hong DW, Lee JJ, Lee SA, Soh Y, Yang M, Won CW. Relationship between obesity and balance in the community-dwelling elderly population: A cross-sectional analysis. Am J Phys Med Rehabil. 2020; 99(1):65-70. https://doi.org/10.1097/PHM.0000000000001292

17. Ayán C, Carral JM, Gonzalez G, Sturzinger L. Relationships between body mass index and static and dynamic balance in active and inactive older adults. J Geriatr Phys Ther. 2019; 42(4):E85-90. https://doi.org/10.1519/JPT.0000000000000195

18. Corbeil P, Rancourt D, Simoneau M, Tremblay A, Teasdale N. Increased risk for falling associated with obesity: Mathematical modeling of postural control. IEEE Trans Neural Syst Rehabil Eng. 2001; 9(2):126-36. https://doi.org/10.1109/7333.928572

Access this journal online	
	Quick Response Code
Website: www.informaticsjournals.co.in/index.php/JEOH/index	