

# Prevalence of Postural Sway in Obese Individuals

Pranoti A Nikam<sup>1</sup>, Dr. Ankita Durgawale<sup>2</sup>

<sup>1</sup>Final Year Student, Krishna College of Physiotherapy, KVV, 415539, Agashivnagar, Malkapur, Maharashtra, India, Email id: [pranotin1616@gmail.com](mailto:pranotin1616@gmail.com)

<sup>2</sup>Assistant Professor, Department of Neurosciences, Krishna College of Physiotherapy, KVV, 415539, Agashivnagar, Malkapur, Maharashtra, India, Email id: [jadhavankita509@gmail.com](mailto:jadhavankita509@gmail.com)

## ABSTRACT

### Background

Posture is the way our body holds itself, whether it is in still or in motion, and it depend highly on the coordination of muscles and the response to gravity. Good posture allows for enough movement with minimal stress on muscles and joints. To maintaining posture balance and stability are key to it and depend on factors like the base of support, center of mass, and the body's neuromuscular control. Obesity, is growing health problem, that affects posture by shifting the center of gravity often forward due to excess abdominal weight which increases stress on the musculoskeletal system and it contributes to postural sway. The sway can raise the risk of falls, particularly in older individual. Obesity is leads to muscular fatigue, joint stress, and altered the body alignment, that can lead to decrease in balance and mobility. This study aims to see how different levels of obesity based on BMI grades I, II, and III affect postural stability and sway.

**Objective:** To find out prevalence of postural sway in obese individuals, to find out prevalence of postural sway in BMI obese grade I, II and III.

**Methods:** An observation survey was conducted among 100. Obese individuals with BMI obese grade I, II and III. Inclusion criteria included both the gender male and female, with age between 40 to 60 years, BMI obese grade I, II and III. Exclusion criteria included Subjects with lower extremity conditions or injuries/surgeries, Pathological condition affecting balance.

**Results:** The total number of subject participated in these study was 100. These result shows that in grade I out of 82 participants 28 people have postural sway present with prevalence 34.1%. In grade II out of 14 participants 7 people have postural sway present with prevalence of 50%. In grade III out of 2 participants 2 people have postural sway present with prevalence of 100%. Out of 100 participants 37 people have postural sway present with total prevalence of 37%.

**Conclusion:** This study found that the prevalence of postural sway increased with obesity severity, with the highest proportions observed in Grade II and III individuals. These findings suggest the importance of balancing screening and fall prevention strategies in higher BMI categories. It also suggest importance of exercise for weight loss.

**Keywords:** Age, Balance, BMI Obesity grade I, II and III, Postural stability, Postural sway.

**How to cite this article:** Nikam PA, Durgawale A. Prevalence of Postural Sway in Obese Individuals. *Int J Drug Deliv Technol.* 2026;16(34s):663-668. DOI: 10.25258/ijddt.16.34s.83

### INTRODUCTION

Posture refers to the position in which the body holds itself, at rest or during movement. It is maintained either through muscular relaxation with support or by the coordinated action of various muscles working together to keep the body upright and stable.<sup>[1]</sup> Posture can be classified as static, such as standing or sitting still, or dynamic, such as walking or reaching for an object. A key aspect of posture is the body's alignment in relation to gravity. Ideally, posture is maintained in a way that requires minimal muscular effort and stress on joints and ligaments, allowing for minimal movement and balance. Maintaining balance and postural control relies on the body ability to manage its center of mass (CoM) in

relation to its base of support (BoS). Stability is compromised when the line of gravity moves beyond this base, increasing the risk of a fall. Enhancing stability often involves strategies like widening the BoS or lowering the CoM to maintain equilibrium. Both static and dynamic posture require complex neuromuscular coordination, with varying muscle activation patterns depending on the direction of movement or sway.<sup>[2]</sup>

The human body relies on numerous internal systems, including the musculoskeletal and nervous systems, to maintain proper posture and stability. Equally distributing body weight on both feet and aligning the CoM over the center of pressure (CoP)

## Prevalence of Postural Sway in Obese Individuals

minimizes unnecessary skeletal stress. However, several external and internal factors can disrupt this balance. Among the most significant is obesity, which has become a growing global health concern.<sup>[3]</sup> Obesity not only alters body composition but also affects posture and balance by shifting the body's center of gravity. Increased abdominal fat, for example, tends to push the CoM forward, closer to the front edge of the BoS. This shift increases the demands on the ankle and lower limb muscles to maintain an upright posture, leading to higher energy expenditure and muscle fatigue.<sup>[4]</sup> As the body adapts to excess weight, postural changes such as increased inward curvature of the lower back and anterior pelvic tilt are often observed. These deviations are not fixed but dynamic, reflecting the body's ongoing attempt to maintain balance. Therefore, obesity impacts multiple body systems, including biomechanics, posture, and functional movement.<sup>[5]</sup>

Body Mass Index (BMI) is commonly used to categorize individuals based on weight status. According to the World Health Organization, a BMI between 18.5 and 24.9 is considered normal, 25 to 29.9 is classified as overweight, 30 to 39.9 as obese, and 40 or above as extremely.<sup>[6]</sup> Higher BMI levels have been associated with increased postural instability, especially among older adults.<sup>[7]</sup> This instability manifests as greater postural sway and decreased ability to maintain balance, both of which raise the risk of falls. Falls in obese individuals can lead to serious injuries such as fractures, particularly in the hip and lower limbs, and may significantly affect quality of life.<sup>[8]</sup>

Moreover, prolonged standing, especially in occupational settings, can further challenge the postural control of overweight and obese individuals. Muscle fatigue, decreased endurance, and limited mobility are common complaints among this population. Some research suggests that obesity leads to increased postural sway and poor balance control, while other studies argue that it may not significantly impair musculoskeletal function.<sup>[9,10]</sup> However, what remains consistent across the literature is that losing weight leads to improvements in balance, postural control, and Now some researcher have shown evidence that body weight have strong effect on postural stability.<sup>[11,12]</sup> Some author have concluded that an displacement to anterior of the COM would would show obese individuals near to edge of their stability boundaries.<sup>[13]</sup> Given the growing prevalence of obesity and its impact on the stability, the present study aims to explore the extent to which different obesity grades based on BMI classifications influence postural sway. By identifying which obesity grades are most affected, the study seeks to raise awareness about the postural and balance-related consequences of excess weight and highlight the

importance of weight management in promoting physical health and reducing fall-related risks.

### **METHODOLOGY:**

Study site: Karad

Study design: Observational

Study population: obese individual

**Ethical approval:** The approval for this study is gained from the institutional ethics committee of Krishna Vishwa Vidhyapeeth (deemed to be university), karad. Respondents were given a detailed explanation about data collection sheet as well as the study which is to be conducted and informed consent was collected from each participant participating in this study. There was a volunteer involvement of all the respondents in this study whose confidentiality was thoroughly maintained.

Sample size: 100

### **INCLUSION CRITERIA:**

1. Both male and female.
2. Individuals with age 40 to 60.
3. BMI Obese grade I, II and III

### **EXCLUSION CRITERIA:**

1. Lower extremity conditions or injuries/surgeries
2. Pathological condition affecting Balance.

### **METHODS:**

A observational survey was conducted on BMI obese grade I, II and III individuals with age between 40 to 60 years. The 100 participants in the study was participated. Participants in this study was between age group of 40 to 60 years. Clinical assessment involves the use of Multidirectional Reach Out Test. This test is used to check the postural sway, three trials of each direction (forward, backward, lateral- right and left) and the best score was noted. The ethical approval was obtained from the ethical committee. Informed consent was obtained by collecting sheet from each participants.

### **STATISTICAL ANALYSIS:**

The observational study was carried out among 100 obese individuals . The study was carried out by taking assessment of the obese individuals, checking the postural sway. Data collection was been made which included name, age, gender, weight, height, BMI and the direction . The study duration was of 6 months. The random sampling method was used because of limited time. The collected data was analyzed by a statistician using an instat application. Chi square test was done to analyze. Data collection sheets have been filled up by the participants who aged between 40 to 60 years.

### **RESULT AND INTERPRETATION:**

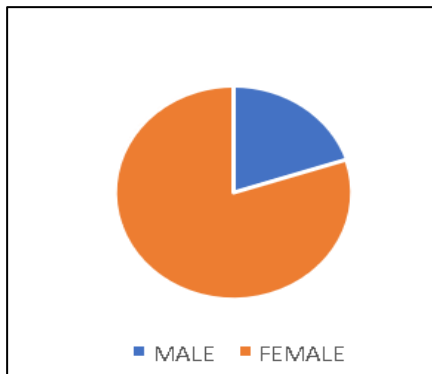
**THE PREVALENCE OF POSTURAL SWAY IN OBESE INDIVIDUAL IS DUE TO OBESITY.**

## Prevalence of Postural Sway in Obese Individuals

Arithmetic mean and standard deviation was calculated for each outcome measures. Arithmetic mean was derived from adding all the values together and dividing the total number of values. MS Excel was used for drawing various graphs with given frequencies and the various percentages that were calculated with the software

### DEMOGRAPHIC DATA:

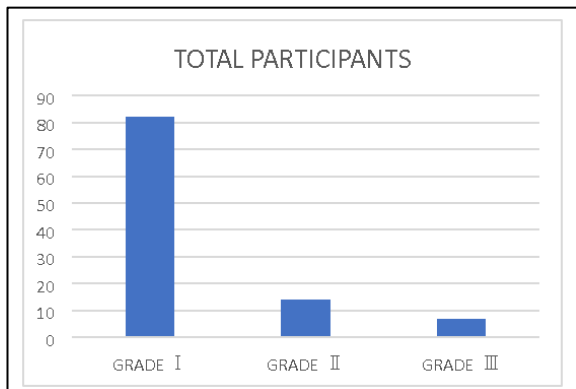
#### GENDER:-



**GRAPH 1.1**

**Interpretation:-**In these study there were total 100 participants who performed the multidirectional reach out test. Among them 80 female and 20 male were present. Hence, these interprets that Number of females were more than male participants.

#### BMI:-



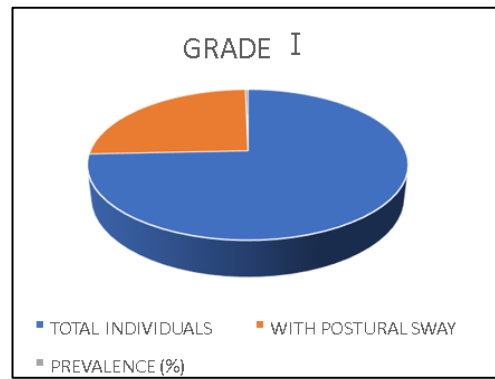
**GRAPH 2.1**

**Interpretation:-** Total 100 participants include in these where according to BMI obese grade III and III. Among them 82 were of grade I , 14 were of grade II and 7 were of grade III. These interprets that among these grade I were in more numbers.

#### BMI GRADE I

**TABLE 1**

BMI GRADE	Total Individuals	With Postural Sway	Prevalence (%)
GRADE I	82	28	34.1%



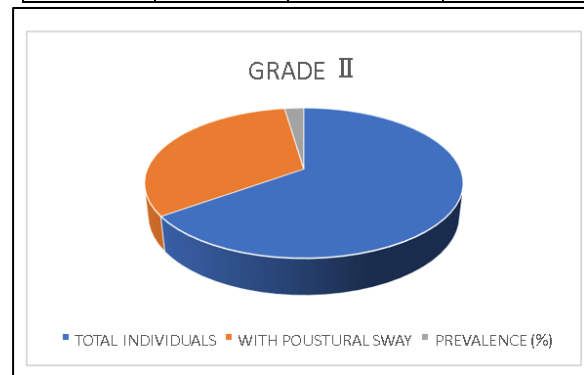
**GRAPH 1.2**

**Interpretation:** Total 100 participants performed the multidirectional reach out test. Among them 82 participants where of BMI grade I. Hence, these interprets that 28 participants have postural sway present and the prevalence is the 34.1%.

#### BMI GRADE II

**TABLE 2**

BMI Grade	Total Individuals	With Postural Sway	Prevalence (%)
Grade II	14	7	50%



**GRAPH 1.3**

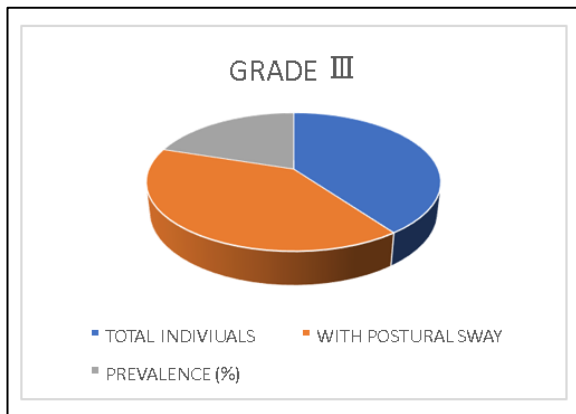
**Interpretation:** Total 100 participants performed the multidirectional reach out test. Among 14 participant 7 have postural sway present. Hence, this interprets that 50% of people have postural sway present in obese grade II.

#### BMI GRADE III

**TABLE 3**

BMI GRADE	Total Individuals	With Postural Sway	Prevalence (%)
GRADE III	2	2	100%

## Prevalence of Postural Sway in Obese Individuals



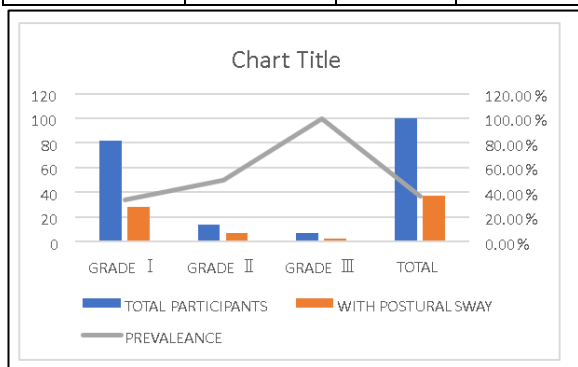
**GRAPH 1.4**

**Interpretation:** Total 100 participants performed the multidirectional reach out test. Among 2 participants were of BMI obese grade III. Hence, the interpretation is 2 of them have postural sway and prevalence is 100%.

## RESULT

**TABLE 4**

BMI GRADE	Total Individuals	With Postural Sway	Prevalence (%)
GRADE I		28	34.1%
GRADE II	14	7	50%
GRADE III	2	2	100%
TOTAL	100	37	37%



**GRAPH 1.5**

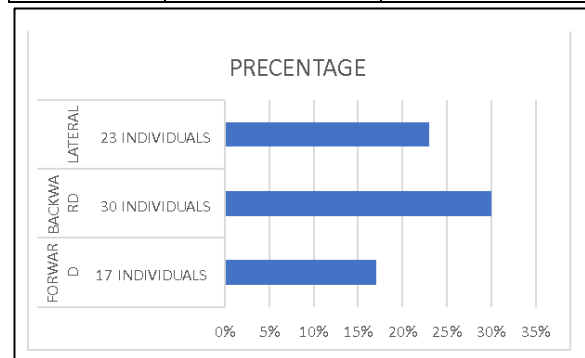
**Interpretation:-**In this study Multidirectional Reach Out Test were performed total 100 participants were taken. Among these 28 people of grade I had postural sway present, 14 people of grade II had postural sway present and 7 people of grade III had postural sway present. These interprets that among total 100 participants 37 people have postural sway present with prevalence of 37 %.

## ABNORMAL SWAY OBSERVATION :-

**TABLE 5**

DIRECTION	NO. OF ABNORMAL INDIVIDUALS	PERCENTAGE
FORWARD	17	17%
BACKWARD	30	30%
LATERAL	23	23%

FORWARD	17	17%
BACKWARD	30	30%
LATERAL	23	23%



**GRAPH 1.6**

**Interpretation :-** these diagram states that the backward direction has the highest frequency of abnormal postural sway, affecting 30% of individuals. Where lateral has 23% individuals and forward has 17% of individuals.

## DISCUSSION:

This is the survey study aimed to find the prevalence of the postural sway in obese individuals. In this study we aim to find which people are more affected by the postural sway and we also aim to find this according to BMI obese grades I II and III. Which BMI Obese grade people are more affected. For this study we got results using a Multidirectional Reach Out Test. We got hundred percentage of response. We conducted survey using.

Multidirectional Reach Out Test among 100 obese grades people. According to the results Grade I obese individuals were total 82 among them 28 people have postural sway present with the percentage of 34.1%. In, Grade II obese people were total 14 among them 7 people have postural sway present with prevalence percentage of 50%. In, Grade III obese people were 2 among them all 2 of them have postural sway present with prevalence of percentage of 100%. This shows a strong relation of obesity and postural instability .Overall, the 100 people participated in the survey among 37 people have postural sway present and 63 did not have postural sway. The prevalence of postural sway in obese individuals is of 37%. These shows that there are increase in risk of fall as the postural stability and balance control is weak among obese people. This highlights how increasing body mass index (BMI) negatively influences postural control. In particular, the rise in sway from Grade I to Grade III suggests a proportional relationship between adiposity and balance impairment. These findings shows the critical need for early balance assessments in obese populations, especially as they progress into

## Prevalence of Postural Sway in Obese Individuals

more severe grades of the obesity. In this study among 100 participants female participated were more than male. The 80 female participated whereas, male participated were 20. According to Shirley Aparecida Fabris de Souza there study says that people with extremely obesity the important postural alteration is present. This study says that postural stability depends on the obesity. As, the weight increase the postural stability is also impaired. For, the assessing the Multidirectional Reach Out Test was taken. The test was performed in all the four direction forward, backward and lateral right and left. The three trials were taken of each direction and after that the average of each direction was taken to consideration. According to these the study findan high prevalence in obese grade I and II. This study found that the prevalence of postural sway increase with the obesity severity. The age group of 40 to 60 years people were participated. Who did not have any lower extremity pathological condition or had any surgeries and injuries as this can affect the balance of people. Because of obesity people started having joint pain because as weight increases pressure on joint increases too. Losing as weight can improve the balance and postural stability in the people. Decrease in the pressure on the joint. It can also correct the postural alteration and body composition good. As, this study also create awareness of how obesity can affect people health and physical activities among the people. This study interprets that grade II and III people cannot reach to a particular normal distance and this may be due to change in the body composition. some of cannot reach to normal value distance of the backward and lateral reach to right or left. The Michael Hamilton, Lesley Strawderman, Brendon Hale, and Kari Babski-Reeves study says that postural sway does not get affected by gender difference. It may due to workstation it increase the postural. Because no proper and comfortable workstation designed. It also say postural sway is also a sign of the fatigue.

Obesity can impact postural stability through several mechanisms. First, the increased body mass alters the body center of gravity, often shifting it forward and upward, leading to a greater challenge in maintaining upright posture. Additionally, excess adipose tissue can impair proprioception, muscle function, and joint mobility, further compromising balance. Obese individuals often adopt compensatory movement patterns that may initially aid stability but eventually contribute to functional limitations. When broken down by direction, backward sway was most commonly impaired, with 30% of participants demonstrating reduced reach in this direction. This finding suggests that backward postural control is particularly vulnerable in obese individuals. From a biomechanical stand point, this could be due to poor

ankle and hip strategy activation, especially since backward movements require coordinated control against gravity without visual feedback. These relatively lower frequency of abnormal sway in the forward (17%) and lateral (23%) directions may indicate comparatively preserved anticipatory postural adjustments or habitual movements pattern that reinforce control in these directions. These result carry important clinical implications. Backward instability is a notable risk of factor for falls, which are leading cause of injury and reduced quality of life in individuals with obesity. This people have difficulty performing a movements like bending forward backwards. This study aims to make aware and make quality of life better. By doing a weight loss and perform daily exercises for it.

### CONCLUSION:

This study found that the prevalence of postural sway increased with obesity severity, with the highest proportions observed in Grade II and III individuals. These study also shows that the postural sway is present more in backward and lateral direction. These findings suggest the importance of balancing screening and fall prevention strategies in higher BMI categories. It also suggest importance of exercise for weight loss.

### REFERENCES

1. M. DENA GARDINER, F.C.S.P. Gardiner, M. Dena. Principles of exercise therapy. CBS Publishers & Distributors Pvt Ltd, 2017. Perveen, Wajida. "The Principles of Exercise Therapy M Dena Gardiner Delhi, India CBS Publishers & Distributor." *Global Journal of Addiction & Rehabilitation Medicine* 4.3 (2017): 73-74.
2. Cynthia C. Norkin, PT, EdD .Levangie, Pamela K., and Cynthia C. Norkin. Joint structure and function: a comprehensive analysis. FA Davis, 2011.
3. Ohlendorf, Daniela, et al. "Postural sway, working years and BMI in healthy truck drivers: an observational study." *BMJ open* 7.7 (2017): e013281.
4. Rezaeipour, Mohammadreza, and Gennady Leonovich Apanasenko. "Effects of overweight and obesity on postural stability of aging females." *Middle East J Rehabil Health Stud* 5.4 (2018): e81617.
5. Fabris de Souza, Shirley Aparecida, et al. "Postural changes in morbidly obese patients." *Obesity surgery* 15.7 (2005): 1013-1016.
6. Hamilton, Michael, et al. "Effects of BMI and task parameters on postural sway during simulated small parts assembly." *Ergonomics* 58.3 (2015): 504-512.
7. Zhou, Junhong, et al. "The complexity of standing postural sway associates with future falls in community-dwelling older adults: the

- MOBILIZE Boston Study." *Scientific reports* 7.1 (2017): 2924.
8. Menegoni, F., Galli, M., Tacchini, E., Vismara, L., Caviglioli, M., & Capodaglio, P. (2009). Gender-specific effect of obesity on balance. *Obesity*, 17(10), 1951-1956.
  9. Błaszczyk, Janusz W., et al. "Effects of excessive body weight on postural control." *Journal of biomechanics* 42.9 (2009): 1295-1300.
  10. Son, Sung Min. "Influence of obesity on postural stability in young adults." *Osong public health and research perspectives* 7.6 (2016): 378-381.
  11. Neri, Silvia Gonçalves Ricci, et al. "Obesity is associated with reduced postural control in community-dwelling older adults: a systematic review." *European Journal of Physiotherapy* 20.3 (2018): 178-186.
  12. Rossi-Izquierdo, Marcos, et al. "Impact of obesity in elderly patients with postural instability." *Aging clinical and experimental research* 28.3 (2016): 423-428.
  13. Alice, Alice, et al. "Effect of obesity on balance: A literature review." *International journal of health sciences* 6.S4 (2022): 32613279.
  14. Lockhart, Thurmon E., et al. "Effects of obesity and fall risk on gait and posture of community-dwelling older adults." *International journal of prognostics and health management* 10.1 (2019): 019.
  15. Cruz-Gómez, Nora S., et al. "Influence of obesity and gender on the postural stability during upright stance." *Obesity Facts* 4.3 (2011): 212-217.