

# Correlation of BMI with Core Muscle Endurance, Urge Incontinence, Severity and Quality of Life in Middle Aged Diabetic Women

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## ABSTRACT

**BACKGROUND:** Urinary incontinence (UI) affects nearly 50% of middle-aged women, with microvascular damage in diabetes being a likely cause. Higher BMI levels increase diabetes prevalence, which may show highest association with obesity.

**NEED OF RESEARCH:** BMI can be linked to both UI prevalence and severity due to increased bladder pressure and muscle strain. A strong association may exist between BMI and core muscle endurance as deposition of fat is commonly found around the abdomen due to sedentary lifestyle.

**AIMS AND OBJECTIVE:** This study aims to examine correlation of BMI (Body Mass Index) with core muscle endurance, urge incontinence, severity and quality of life in the middle-aged diabetic women.

**METHOD:** A correlation study was conducted with 39 diabetic women of middle aged 40 to 60 were included. The participants across various BMI categories completed Patient Perception of Intensity of Urgency Scale, International Consultation on Incontinence Questionnaire-Urinary Incontinence Short Form, Incontinence Impact Questionnaire 7 to assess urge incontinence, severity, quality of life respectively. Core muscle endurance was assessed using Prone Plank Test.

**RESULTS:** Data of study shows non-normal distribution hence Spearman rho test was used. Result shows strong correlation between BMI with urge incontinence ( $r=0.721$ ,  $p<0.05$ ) and severity ( $r=0.707$ ,  $p<0.05$ ) and moderate correlation between BMI with quality of life ( $r=0.624$ ,  $p<0.05$ ) and core muscle endurance ( $r=-0.603$ ,  $p<0.05$ ).

**CONCLUSION:** As BMI increases; core muscle endurance decreases, urge incontinence and severity increases and decrease in quality of life in diabetic population was observed.

**Keywords:** Correlation, BMI, Urge incontinence, core muscle endurance, quality of life, diabetic women.

## INTRODUCTION

Obesity is defined as “abnormal or excessive fat accumulation that presents a risk to health”.<sup>[1]</sup> The epidemic of obesity has become a serious problem in modern society, especially in developed countries.

Obesity is characterized by an imbalance between energy intake and expenditure. There are some indicators for degrees of obesity. For example, body mass index (BMI), as a common indicator, was used to evaluate the whole status of a person's body

weight.<sup>[2]</sup> Endurance (a measure of fitness) is the ability to work for prolonged periods of time and the ability to resist fatigue. Muscular endurance is defined as the ability to perform repeated contractions over a period of time for an isolated group of muscles.<sup>[3]</sup> In fact, most of our daily activities require some muscle endurance. Being a part of sedentary lifestyle is a vicious habit that tends to accumulate fat deposition in the body specifically in the visceral area which further compromises the musculoskeletal efficiency.<sup>[4]</sup> Obesity is an increasing health problem all over the world, and may be a contributing factor for an increased incidence of urinary incontinence. A common statement is that obesity acts through the added weight, like pregnancy, that bear down on pelvic tissues, causing chronic strain, stretching and weakening of the muscles, nerves, and other structures of the pelvic floor. Increased abdominal wall weight should in turn increase intraabdominal pressure and also intravesical pressure in addition to inducing changes of urethral mobility. The US Surgeon General also states that overweight and obesity are associated with increased risks of incontinence, but adequate references to the risk of incontinence are not found.<sup>[5]</sup> Urinary incontinence is a highly prevalent condition affecting nearly 50% of middle-aged and older women. It can result in psychological stress and social isolation and can also have a profound effect on quality of life.<sup>[6][7]</sup> One group at high risk for developing urinary incontinence is women with type 2 diabetes. Recent epidemiological evidence suggests that incontinence is associated with type 2 diabetes and is 50–200% more common among women with type 2 diabetes than among women with normal glucose levels.<sup>[8][9]</sup> A likely etiology for incontinence in diabetes is microvascular damage, similar to the disease process involved in development of retinopathy, nephropathy, and neuropathy.<sup>[10]</sup> Accordingly, duration of diabetes<sup>[11]</sup>, insulin treatment<sup>[8]</sup>, peripheral neuropathy, and retinopathy<sup>[11]</sup> have been

suggested as risk factors for incontinence among women with diabetes. However, there are limited data on the impact of obesity on patient oriented and urodynamic parameters, and on the mechanistic factors that may underlie UI in obese and normal weight women.

**AIM:** To find the correlation of BMI with core muscle endurance, urge incontinence, severity and quality of life in middle aged diabetic women.

#### **OBJECTIVE:**

To evaluate correlation between BMI and core muscle endurance in middle aged diabetic women.

To evaluate correlation between BMI and urge incontinence in middle aged diabetic women.

To evaluate correlation between BMI and severity in middle aged diabetic women.

To evaluate correlation between BMI and quality of life in middle aged diabetic women.

#### **MATERIALS & METHODS**

The conducted study was correlation with 39 subjects that were from Ahmedabad city. Ethical approval was taken from the institute's Ethical committee. Participants selection was done according to the inclusion and exclusion criteria. Inclusion criteria for participants: [1] Middle aged women (40-60 age). [2] Women with different BMI class. [3] Women with  $\geq 6$  years duration of diabetes. [4] Women with 6.5% to 8% HbA1c level. [5] Women clinically diagnosed with urinary incontinence. [6] Women with only G2 P2 A0. Exclusion criteria for participants: [1] Participant having any neurological or psychological condition. [2] Participant having history of any abdominal surgery. [3] Participants on insulin therapy.

#### **OUTCOME MEASURE**

##### **[1] BODY MASS INDEX:**

Body Mass Index (BMI) is a commonly used, simple measurement that relates

weight to height in order to classify individuals as underweight, normal weight, overweight, or obese. The standardized categories for BMI are as follows:

Categories	BMI (kg/m <sup>2</sup> )
Underweight	<18.5
Normal	18.5-24.5
Overweight	25-29.9
Obese Category I	30-34.9
Obese Category II	35-39.9
Obese Category III	>40

Body Mass Index (BMI) is considered the most practical and widely used measure at the population level for assessing overweight and obesity.<sup>[12]</sup>

### [2] PLANK PRONE TEST:

Plank Prone Test requires participants to start by lying face down with their elbows flexed 90degrees, positioned directly under their shoulders, and their hands together. They then lift their body off the ground, maintaining a neutral head position. Once they achieve the correct posture, the assistant physiotherapist starts the stopwatch. Participants must hold this position for as long as possible while the time is recorded in seconds. The test ends when they can no longer keep their back straight and their hips begin to lower toward the floor. Individual who was unable to maintain the required position were excluded.<sup>[13]</sup>

### [3] PPIUS: PATIENT PERCEPTION OF INTENSITY OF URGENCY SCALE

The PPIUS is a component of a daily micturition diary that participants were required to complete over a span of three days within a specified week. Participants were instructed to document each urinary event they experienced throughout the day, including: The time of urination, whether the episode involved normal urination (defined as voluntary passage of urine into the toilet) or urinary incontinence (defined as the involuntary loss of urine) and the degree of urgency they felt at the time, based on predefined criteria. To assess

urgency and urge incontinence, the PPIUS employs a five-point rating scale. Participants were required to rate their urgency level according to the following categories:

- 0 – No Urgency: No sensation of needing to urinate; voided voluntarily for reasons other than bladder pressure.
- 1 – Mild Urgency: Felt the need to urinate but could delay as long as necessary without concern of leakage.
- 2 – Moderate Urgency: Felt an increased need to urinate but could still postpone for a short duration without risk of leaking.
- 3 – Severe Urgency: Could not delay urination and had to rush to the toilet to avoid involuntary leakage.
- 4 – Urge Incontinence: Experienced involuntary urine leakage before reaching the toilet.<sup>[14]</sup>

### [4] INTERNATIONAL CONSULTATION ON INCONTINENCE QUESTIONNAIRE- URINARY INCONTINENCE SHORT FORM:

The ICIQ-UI SF is a tool created by the International Consultation on Incontinence Modular Questionnaire (ICIQ) study group to measure the prevalence, severity, and impact of urinary incontinence on an individual's quality of life. It consists of three key items. The first question assesses how frequently urine leakage happens, with the response options ranging from 0 (none) to 5 (all the time). The second question determines the amount of urine lost during leakage, with scores varying from 0 (none) to 6 (a large amount), regardless of whether protective measures are used. The third item evaluates the extent to which incontinence affects daily life, using a visual analog scale where 0 represents no impact and 10 signifies a significant disruption. The final score is obtained by summing the responses, with possible values ranging from 0 (indicating no incontinence) to 21 (representing severe incontinence). According to preliminary guidelines, a score

above 1 suggests the presence of urinary incontinence. The ICIQ-UI SF includes an additional self-diagnostic question that is not scored. This item was incorporated by the expert committee as it was considered valuable for clinical use. Its purpose is to help gain insight into patients' understanding of the cause and nature of their urinary leakage, aiding in better assessment and management.<sup>[15]</sup>

**[5] INCONTINENCE IMPACT QUESTIONNAIRE:**

The Incontinence Impact Questionnaire (IIQ) is widely recognized, self-reported tool designed to assess the impact of urinary incontinence (UI) on the quality of life in women. It is available in two versions: the full IIQ-30 and the shorter IIQ-7. The IIQ-30 consists of 30 questions divided into four key domains: physical activity, travel, social relationships, and emotional health. These domains help evaluate how UI affects mobility, daily activities, psychological well-being, and social interactions. To provide a more concise assessment, the IIQ-7 was developed as an alternative, containing only seven questions while still covering the same four domains. In this version, physical activity is assessed by item 1 and 2, travel by items 3 and 4, social relationships by item 5, and emotional health by item 6 and 7. This shorter format

allows for a quicker evaluation while maintaining the effectiveness of the questionnaire in measuring the overall impact of UI on daily life.<sup>[16]</sup>

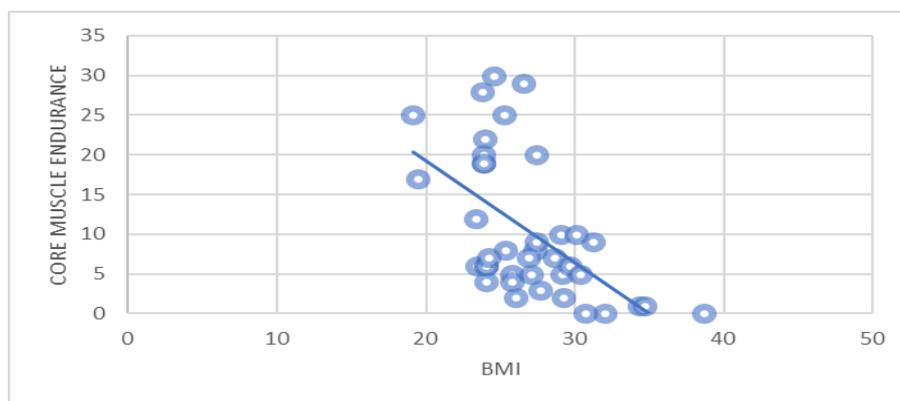
**STATISTICAL ANALYSIS**

Data analysis was conducted using SPSS version 20. Information was gathered from 39 different participants by measuring BMI and by performing Plank Prone Test and various scales, including the PPIUS (Patient Perception of Intensity of Urgency Scale) for urge incontinence, the ICIQ UI SF (International Consultation on Incontinence Questionnaire Urinary Incontinence Short Form) for severity, and the IIQ 7 (Incontinence Impact Questionnaire 7) for quality of life. The analysis revealed that the data did not follow a normal distribution, necessitating the use of non-parametric statistical methods. Sperman's rank correlation coefficient was applied to examine the connection between BMI and core muscle endurance, urge incontinence, severity and quality of life.

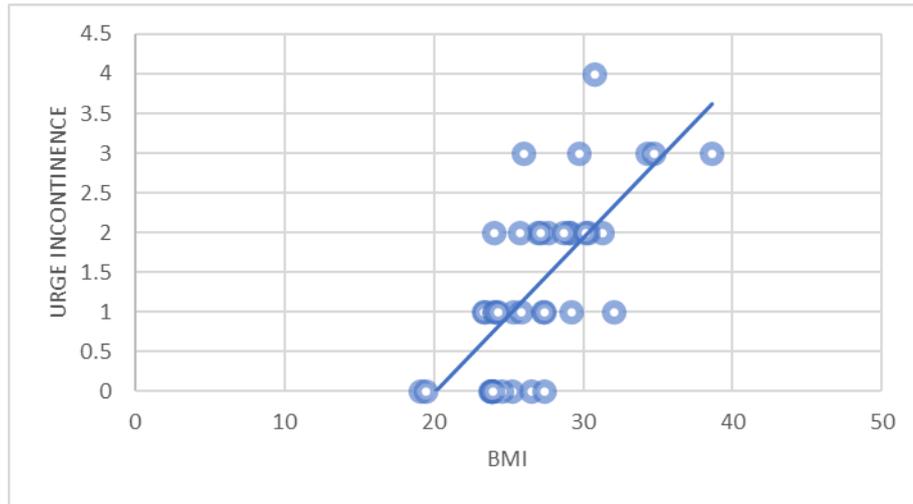
**RESULT**

Result shows moderate negative correlation between BMI and core muscle endurance (Graph 1), strong positive between BMI and urge incontinence (Graph 2), severity (Graph 3) and moderate positive between BMI and quality of life (Graph 4).

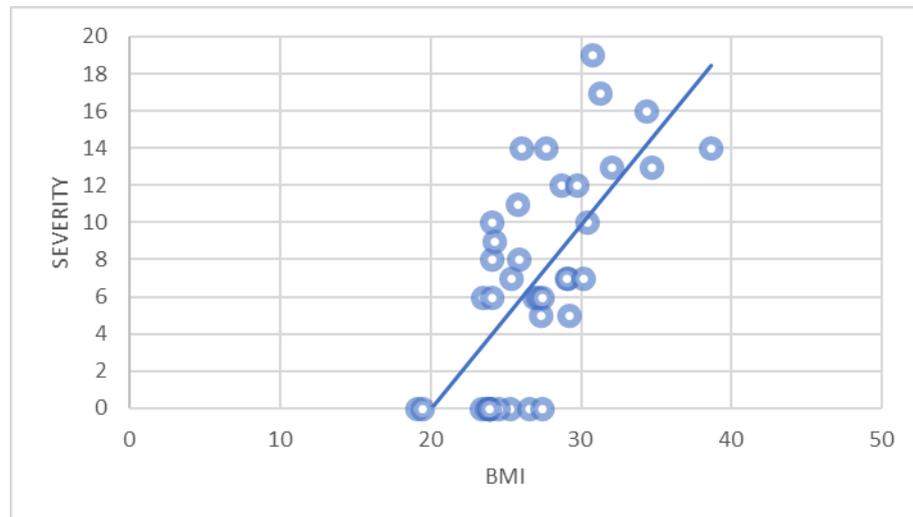
BODY MASS INDEX (BMI)	CORE MUSCLE ENDURANCE	URGE INCONTINENCE	SEVERITY	QUALITY OF LIFE
	r=-0.603 p<0.01	r=0.721 p<0.01	r=0.707 p<0.01	r=0.624 p<0.01



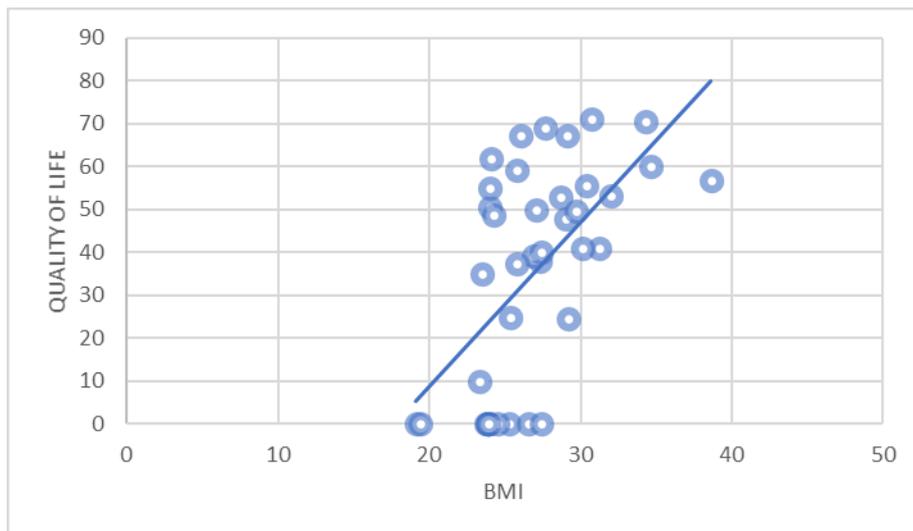
**Graph 1: BMI and core muscle endurance.**



**Graph 2: BMI and urge incontinence.**



**Graph 3: BMI and severity.**



**Graph 4: BMI and quality of life.**

## DISCUSSION

The present study revealed significant correlations between Body Mass Index

(BMI) and multiple health-related outcomes in middle-aged diabetic women, particularly in relation to core muscle endurance, urge

incontinence, severity of incontinence, and quality of life. These findings are in alignment with earlier research and underscore the multifactorial role of obesity in urological and musculoskeletal health among diabetic women.

This finding is consistent with prior studies which have demonstrated that excess adiposity, especially visceral fat, leads to compromised trunk muscle performance and postural control due to increased mechanical load and reduced muscle quality. Additionally, sedentary lifestyles common in individuals with higher BMI contribute to muscle deconditioning and diminished endurance.

Brown et al. (2005) highlighted that urinary incontinence in diabetic women often coexists with other microvascular complications such as retinopathy and neuropathy, pointing to a systemic origin of dysfunction.<sup>[10]</sup>

Hunnskaar (2008) noted that even modest weight reduction in overweight women led to significant improvements in incontinence, indicating a causal relationship.<sup>[5]</sup>

S. Phelan et al. (2009) showed that among overweight and obese women with type 2 diabetes, urinary incontinence is highly prevalent.<sup>[17]</sup>

Studies by Selvaganapathy et al. (2017) and Patel and Chitte (2022) support the present findings, emphasizing that higher BMI is significantly associated with reduced trunk muscle endurance, particularly in individuals with sedentary lifestyles.<sup>[3][4]</sup>

Martina (2019) also demonstrated that school children with higher BMI exhibited reduced core strength, highlighting that the impact of excessive weight on muscular performance begins early and may persist into adulthood.<sup>[1]</sup>

GK Medhi et al. (2021) highlights that obesity is a key parameter associated with diabetes mellitus in rural populations in India.<sup>[18]</sup>

K Aydogan et al. (2024) shows increased BMI can negatively affect trunk muscle endurance.<sup>[19]</sup>

While the study findings are significant, the relatively small sample size (n=39) and the use of cross-sectional design limit the ability to infer causality. Future studies with larger cohorts, longitudinal designs, and objective urodynamic measurement are recommended to confirm these correlations and explore underlying pathophysiological mechanisms by using other outcome measures.

## CONCLUSION

The present study indicates that as BMI increases, the core muscle endurance decreases and increase in urge incontinence and severity leading to decline in quality of life among middle aged diabetic women. Therefore, implementing targeted core strengthening and pelvic floor muscle training programs can help improve endurance, reduce the severity of incontinence, and enhance overall quality of life.

### *Declaration by Authors*

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**Conflict of Interest:** The authors declare no conflict of interest.

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