Prevalence of stress urinary incontinence in obese versus non-obese nulligravida females.

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Abstract

Background: The etiology of UI is multifactorial, although many risk factors have been identified such as aging, obesity, pregnancy, parity, mode of delivery, hysterectomy, smoking, neurological or biochemical changes, presence of diseases (e.g., diabetes, cognitive impairment, depression, urinary tract infection), in addition to increased intra-abdominal pressure (IAP) and high-impact activities.

Objective: to assess the prevalence and risk factors of stress urinary incontinence in obese Versus lean Nulligravida females.

Methods: This comparative Cross-sectional study was conducted at a tertiary care hospital at Ain Shams University Maternity Hospital from June 2023 till May 2024 and performed on 100 Obese and 100 Lean Nulligravida Females with the following inclusion criteria.

Results: Stress urinary incontinence was significantly more frequent in the obese group than in the lean group. There were no significant statistical differences between the studied groups regarding age and comorbidities. The obese group had significantly more frequent and amount as well as unusual timings (asleep, physically active/exercising, finished urinating and are dressed, no obvious reason and all the time). The obese group had significantly higher interference with everyday life scores and total ICIQ-SF scores. BMI had significant positive correlations with frequency score, amount score, interference with everyday life score, and ICIQ score.

Conclusion: As evident from the current study, the study highlights the significant association between obesity and the prevalence, frequency, and severity of stress urinary incontinence in nulligravida females. The results suggest that addressing obesity may be a key factor in mitigating the burden of SUI and improving the quality of life for affected individuals.

Keywords: Stress Urinary Incontinence, Urinary Incontinence, and Obese.

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INTRODUCTION

Stress urinary incontinence (SUI) is the complaint of involuntary loss of urine on effort or physical exertion including sporting activities, or on sneezing or coughing, with a significant effect on health-related quality of life such as physical, and psychological well-being of the affected women (1).

Stress urinary incontinence is a major problem which affects the different financial, social, and private aspects of woman's life in the society; however, it is more prevalent in older women, particularly amongst those in institutionalized care (1).

The etiology of UI is multifactorial, although many risk factors have been identified such as: aging, obesity, pregnancy, parity, mode of delivery, hysterectomy, smoking, neurological or biochemical changes, presence of diseases (e.g., diabetes, cognitive impairment, depression, urinary tract infection), in addition to increased intra-abdominal pressure (IAP) and high-impact activities (2).

Obesity is an increasing health problem all over the world. In 2008, Hunskaar proposed that obesity causes SUI because increased body weight results in increased intra-abdominal pressure (IAP), which in turn leads to weakening of the pelvic floor innervation and musculature (3).

Other common established risk factors for SUI in women include pregnancy and childbirth. Parity, particularly giving birth via vaginal delivery, is relevant because pregnancy and childbirth by themselves may cause structural changes and nerve damage that result in urinary leakage (4).

In women aged 15 to 55 years, UI occurs 5-6 times more often than in men. Even if childbirth is the most important causal factor, UI has been reported to occur in about 10-20% of nulliparous women up to the age of 45. This shows that the pelvic floor of nulliparous women is prone to dysfunction (5).

Stress urinary incontinence affects the patients' daily activities, normal work and social interaction, seriously reduces the quality of life, and its severity is significantly related to the degree of anxiety and depression of the patients. If left untreated, the symptoms may be further aggravated. It has caused a huge medical and economic burden on the society (6). Accordingly, the aim of the study is to assess the prevalence and risk factors of stress urinary incontinence in obese Versus non-obese Nulligravida females.

PATIENTS AND METHODS

After ethical committee approval and written consents from the patients, this comparative Cross sectional study was conducted at tertiary care hospital at Ain Shams University Maternity hospital from June 2023 till May 2024 and performed on 100 Obese and 100 Lean Nulligravida Females with the following inclusion criteria:

Inclusion criteria: Women aged between18 and 45 years, Lean females with BMI <25kg/m2, Obese females with BMI ≥30kg/m2 and Nulligravida females.

Exclusion criteria: Multiparous Females, Patients with active urinary tract infection, Patients with respiratory or neurological diseases, Patients with communication problems, cognitive disorders & mental disturbance, Current treatment with drugs (benzodiazepines, diuretics) and Patients who underwent any previous abdominal or pelvic surgery.

Study Procedures: All participants were divided into the following:

- **Group A:** 100 Obese Nulligravida Females with BMI ≥30
- **Group B:** 100 Lean Nulligravida Females with BMI >25

Complete history taking: Personal history, Obstetric history, Past medical history, Past surgical history

Complete physical and general examination:

General examination: pulse, blood pressure, temperature, and BMI measured in Kg/m2. e.g.

Abdominal examination (presence of scar of previous operations and stretch marks).

Self-reported questionnaire: (ICIQUI-SF) (7)

The ICIQ-UI SF questionnaire seeks to detect UI in any care setting. The final version of the questionnaire, which has been translated. The final adapted to the culture of our country.

The Arabic ICIQ-UI SF was found to be valid, reliable and responsive, indicating that the psychometric properties of the questionnaire have remained constant throughout the adaptation process. Furthermore, the findings of the psychometric testing confirm those found for the UK-English ICIQ-UI SF (7).

The ICIQ-SF is a subjective measure of severity of urinary loss and quality of life for those with urinary incontinence. It's a Self-reported survey, screening tool for incontinence and 4 main items (of 6 total) that ask for rating of symptoms.

We take sum score items 3, 4, 5 (items 1 and 2 are demographic) for the actual score. The final item is a self. Diagnostic item that is un-scored.

The ICIQ-UI SF was divided into the following four severity categories; slight (1-5), moderate (6-12), severe (13-18) and very severe (19-21) (8).

The data and results from questionnaire responses and risk factors associated with obesity with SUI were analysed and tabulated. The diagnosis of new onset of SUI was based on symptoms. It was applied when a woman answers "yes" to the SUI question.

Sample Size: Zhang et al. (9) reported the prevalence of SUI in nulligravida to be 17.3%. A sample size of at least 100 participant per group -200 in two groups of BMI<25 and BMI = 30 and more – achieves a power of 80% to detect an effect size of 0.4 (small to medium effect size with comparable Odds Ratio of approximately 2.5- comparing the proportion of SUI in the two groups using two-sided two samples z test with level of significance of 0.05.

Outcome measures: The most frequently used objective outcome measure was frequency of urine leakage, approximated amount of urine leak, time and effect of urine leakage on normal life activities.

Ethical Considerations: The patient data were anonymous. Data presentation was not be by the patient's name but by diagnosis and patient confidentiality was protected. An informed consent was taken from all participants, it was in Arabic language and confirmed by date and time. confidentiality was preserved by assigning a number to patients initials and only the investigator knew it

Conflict of interest: the candidate declared that there is no conflict of interest and the cost of the study was paid by the candidate.

Statistical analysis: Analysis is to be performed using SPSS for windows v20.0, Data to be presented in terms of range, mean and standard deviation (for numeric parametric variables); range, median and inter-quartile range (for numeric non-parametric variables); or number and percentage (for categorical variables). Difference between two independent groups is to be analyzed using independent student's t-test as well as the mean difference and its 95% CI (for numeric parametric variables); or chi-squared test as well as the risk ratio and its 95% CI (for categorical variables). Binary logistic regression analysis is to be performed for estimating the association between good/poor response and the measured variables ROC curves are to be constructed for estimating the validity of measured variables as predictors of good or poor response validity is to be presented in terms of sensitivity, specificity, positive and negative predictive values and their corresponding 95% Cis significance level is set at 0.05.

Results

Table (1): Demographic characteristics and comorbidities between the two groups.

Variables		Obese group (Total=100)	Lean group (Total=100)	p-value
Age (years)	**Mean±SD**	30.4±6.8	29.1±6.6	^0.165
	Range	18.0–45.0	18.0–45.0	
BMI (kg/m^2)	**Mean±SD**	37.4±3.3	22.4±2.0	**^<0.001***
	Range	30.3–47.8	17.7–24.9	
Hypertension, (n, %)		4 (4.0%)	3 (3.0%)	§0.999
Diabetes mellitus, (n, %)		3 (3.0%)	2 (2.0%)	§0.999
Hypothyroidism, (n, %)		1 (1.0%)	1 (1.0%)	§0.999

Table (1) shows no significant statistical differences between the studied groups regarding age and comorbidities.

Table (2): Stress urinary incontinence between the two groups

Variables	Obese group (Total=100)	Lean group (Total=100)	p-value
Stress urinary incontinence	84 (84.0%)	26 (26.0%)	#<0.001*
95% Confidence interval	75.9%−90.2%	18.2%−35.2%	

Table (2) shows that Stress urinary incontinence was significantly more frequent in obese group than in lean group.

Table (3): ICIQUI-SF findings between the two groups

Variables		Obese group (Total=100)	Lean group (Total=100)	p-value
Frequency of leak	**Never**	16 (16.0%)	74 (74.0%)	**§ <0.001***
	About once a week or less often	6 (6.0%)	22 (22.0%)	
	Two or three times a week	59 (59.0%)	2 (2.0%)	
	About once a day	12 (12.0%)	1 (1.0%)	
	Several times a day	6 (6.0%)	1 (1.0%)	
	All the time	1 (1.0%)	0 (0.0%)	
Amount of leak	**None**	16 (16.0%)	74 (74.0%)	**# <0.001***
	Small	62 (62.0%)	24 (24.0%)	
	Moderate	22 (22.0%)	2 (2.0%)	
Interference with everyday life	**Median (1st−3rd IQ)**	4.0 (3.0−5.0)	0.0 (0.0−1.0)	**^ <0.001***
	Range	0.0–8.0	0.0–8.0	
ICIQ score	**Median (1st−3rd IQ)**	8.0 (6.0−9.0)	0.0 (0.0−4.0)	**^ <0.001***
	Range	0.0–17.0	0.0–16.0	

Timing of leak	**Never – urine does not leak**	16 (16.0%)	72 (72.0%)	**§ <0.001***
	Leaks before you can get to the toilet	7 (7.0%)	5 (5.0%)	
	Leaks when you cough or sneeze	26 (26.0%)	23 (23.0%)	
	Leaks when you are asleep	30 (30.0%)	0 (0.0%)	
	Leaks when you are physically active/exercising	14 (14.0%)	0 (0.0%)	
	Leaks when you have finished urinating and are dressed	2 (2.0%)	0 (0.0%)	
	Leaks for no obvious reason	3 (3.0%)	0 (0.0%)	
	Leaks all the time	2 (2.0%)	0 (0.0%)	

Table (3) shows that Obese group had significant more frequent and amount as well as unusual timings (asleep, physically active/exercising, finished urinating and are dressed, no obvious reason and all the time). Obese group had significant higher interference with everyday life score and total ICIQ-SF score.

Table (4): Correlation between BMI and ICIQUI-SF scores

Variables		**Obese group (Total=100)**	**Lean group (Total=100)**
Frequency score	**r**	0.767	0.557
	p-value	**<0.001***	**<0.001***
Amount score	**r**	0.777	0.554
	p-value	**<0.001***	**<0.001***
Interference with everyday life score	**r**	0.718	0.544
	p-value	**<0.001***	**<0.001***
ICIQ score	**r**	0.744	0.548
	p-value	**<0.001***	**<0.001***

Table (4) shows that BMI had significant positive correlations with frequency score, amount score, interference with everyday life score and ICIQ score.

DISCUSSION

This comparative Cross sectional study was conducted at tertiary care hospital at Ain Shams University Maternity hospital from June 2023 till May 2024 and performed on 100 Obese and 100 Lean Nulligravida Females and aimed to assess the prevalence and risk factors of stress urinary incontinence in obese Versus lean Nulligravida females.

During this study, 230 patients were assessed for eligibility and 200 patients were included in the study (100 in each group). Of all eligible patients, 22 patients were excluded from the study based on the inclusion criteria and 8 patients refused to participate in of the study. Ultimately, the analysis was based on the data of 100 Obese and 100 Lean Nulligravida Females.

As regards demographic and clinical characteristics, there were no significant differences in age or comorbidities (hypertension, diabetes mellitus, or hypothyroidism) between the obese and lean groups. The mean BMI for the obese group was 37.4 ± 3.3 kg/m², compared to 22.4 ± 2.0 kg/m² for the lean group, highlighting the sharp contrast between the two populations. This confirms

the study's focus on BMI as a potential risk factor for SUI, with minimal interference from other health conditions, as there were no significant differences in the prevalence of comorbidities between the two groups.

The studies analyzed involve varying populations, focusing on women between the ages of 18 to 79. our study, participants were aged 18-45, including both obese (BMI ≥30 kg/m²) and lean (BMI <25 kg/m²) women. Another study by Trotti et al. (10) evaluated older women, with a mean age of 62.8 years, while Phelan et al. (11) assessed a slightly younger cohort with a mean age of 58 years. In Wing et al. (12), the mean age of participants was 53 years, and the average BMI was 36 kg/m². Comparatively, Alsannan et al. (13) included a younger population with pre- and postmenopausal women, and Sawaqed et al. (14) had a mean participant age of 42 years, with a mean BMI of 27.73 kg/m².

Wing et al. (12) primarily focused on overweight and obese women, while Alsannan et al. (13) stratified BMI into categories and reported higher rates of UI among obese women (81.4%). Sawaqed et al. (14) found that BMI and age were positively correlated with SUI prevalence. Most of the studies emphasized the prevalence of urinary incontinence (UI) in women with obesity was highlighted as an influential demographic factor in determining the severity of UI.

As regards prevalence of stress urinary incontinence, SUI was significantly more prevalent in the obese group, with 84% of obese women experiencing this condition compared to only 26% of the lean group ($p < 0.001$). The 95% confidence interval revealed a much higher risk for SUI in obese women, emphasizing the strong association between higher BMI and the likelihood of developing SUI. These findings are in line with existing literature, which suggests that excess body weight increases intra-abdominal pressure, contributing to urinary leakage.

Across the studies, the prevalence of SUI varies significantly depending on factors like obesity and age. Similarly, Nygaard et al. (15) found a 53.4% prevalence of urinary incontinence (UI) among obese women undergoing bariatric surgery, with stress urinary incontinence (SUI) being the most common subtype Trotti et al. (10) reported a higher UI prevalence of 61.7%, with mixed UI (MUI) being the most prevalent type at 57.5%. The prevalence increased with age, and SUI was more common in younger participants. In diabetic populations, Phelan et al. (11) found that 27% of their cohort experienced weekly incontinence, with stress-predominant UI being the most common type at 52%. This study also identified significant racial/ethnic differences, with non-Hispanic white women showing the highest UI prevalence. Al Kiyumi et al. (1) reported a UI prevalence of 34.5%, with SUI being the most frequent type, followed by urgency UI (UUI) and MUI. In women who had given birth, the prevalence of UI increased to 41.5%,

In addition, Wing et al., (12) highlighted a significant reduction in SUI frequency following a weight-loss intervention, with the intervention group showing a greater decrease in stress incontinence episodes at 12 months compared to controls (66% vs. 45%). Alsannan et al., (13) reported that 67.9% of overweight and obese women experienced SUI, UUI, or MUI, with 81.4% of obese women having UI. Sawaqed et al., (14) found that 40% of women reported SUI, and this increased with age and BMI. Thus, SUI prevalence is higher among obese individuals in both general and specific populations like those with diabetes or obesity-related conditions.

As regards the Frequency and Severity of Symptoms, The International Consultation on Incontinence Questionnaire-Urinary Incontinence Short Form (ICIQ-UI SF) was used to assess the frequency and severity of SUI in both groups. Obese women were significantly more likely to experience frequent and severe episodes of urine leakage

compared to their lean counterparts. For example, 59% of obese women experienced leakage two to three times a week, compared to only 2% of the lean group. Additionally, 30% of the obese group experienced leakage during sleep, a condition absents in the lean group. This underscores the disproportionate burden of incontinence symptoms faced by obese women, which extend beyond the typical triggers like coughing or sneezing.

The frequency and severity of SUI symptoms were notably worse in obese women across all studies. In Nygaard et al. (15), the severity was moderate in 53.3% of UI patients, and most reported small quantities of urine leakage. The daily frequency of leaks was 6 to 8 times during the day and 2 to 3 times at night. The Trotti et al. (10) study used the International Consultation on Incontinence Questionnaire-Short Form (ICIQ-SF) to assess severity and highlighted that SUI was more common among younger obese women, with its prevalence decreasing as age increased, while MUI became more prevalent with advancing age. Phelan et al. (11) focused on weekly UI episodes, with 11% of women reporting daily symptoms. Stress-predominant UI was most common, and severity was linked to BMI and comorbid conditions such as asthma and depression. Al Kiyumi et al. (1) found that 90% of UI cases were mild to moderate, with 62% of women reporting that UI moderately affected their quality of life (QoL).

In contrast, the Wing et al. (12) study demonstrated significant reductions in SUI frequency following weight loss, with a 66% reduction in weekly episodes after 12 months, although the difference between intervention and control groups diminished after 18 months. Alsannan et al., (13) demonstrated a strong relationship between BMI and severity, showing that obese women were at greater risk for severe to very severe UI. Similarly, Sawaqed et al., (14) found that 47% of participants had mild SUI, while 37% experienced moderate symptoms, and 16% had severe symptoms, with higher BMI contributing to greater severity.

As regards impact on Quality of Life, the current study also found that the severity of SUI symptoms in obese women significantly interfered with their daily lives. The median interference score for obese women was 4.0, compared to 0.0 for the lean group ($p < 0.001$), demonstrating a marked decline in the quality of life for obese individuals. Moreover, the overall ICIQ score, reflecting both the frequency and severity of symptoms, was notably higher in the obese group, further highlighting the increased burden of SUI in this population.

SUI's impact on quality of life (QoL) is notable across the studies. In our study, obese women scored significantly higher on the ICIQ-SF, with a median score of 8, indicating a substantial interference with daily life. Similarly, Nygaard et al. (15) showed that the highest scores on the Kings Health Questionnaire were in the domains "Impact of Urinary Incontinence" and "General Perception of Health", indicating the negative impact of UI on QoL. Alsannan et al. (13) also emphasizes the severe impact on daily activities, with obese women reporting more frequent disruption due to UI, with 36.1% reporting poor QoL. Wing et al. (12) demonstrated that weight loss led to patient satisfaction improvements, suggesting that reducing obesity can significantly alleviate SUI's impact on QoL. Moreover, Sawaqed et al., (14) emphasized the cultural impact, particularly in Jordan, where UI interfered with prayer and other daily tasks, significantly affecting the participants' well-being.

In addition, Al Kiyumi et al. (1) noted that 62% of women with UI reported mild to moderate effects on their QoL. Phelan et al. (11) demonstrated that women with UI had poorer overall health, higher depression scores, and more frequent urinary tract infections, leading to a significant decline in QoL. All studies confirmed that SUI severely impacts the quality of life (QoL), with the ex-

tent of the impact being significantly higher in obese women.

As regards correlation between BMI and SUI Severity, A strong positive correlation was observed between BMI and the ICIQ-SF scores, including frequency, amount, and interference with daily life. The study found that as BMI increased, so did the severity of SUI symptoms. This is evident from the correlation coefficients ($r > 0.7$ for most parameters in the obese group), indicating that weight plays a crucial role in exacerbating urinary incontinence symptoms.

The relationship between BMI and UI severity varied among the studies. Nygaard et al. (15) found a strong positive correlation between BMI and UI severity, particularly for SUI and MUI, with higher BMIs leading to more severe symptoms. In Wing et al., (12) weight loss directly reduced the frequency of SUI. In addition, Alsannan et al. (13) also highlights that the risk of developing more severe UI increases dramatically with higher BMI. Phelan et al. (11) identified increasing BMI (≥ 35 kg/m^2) as the strongest modifiable risk factor for stress and overall incontinence. Higher waist circumference and poor fitness levels also contributed to increased UI severity.

Similarly, Al Kiyumi et al. (1) found that BMI was significantly associated with UI severity, with obese women more likely to experience severe symptoms. Higher BMI, along with other factors like hypertension and vaginal delivery, were key contributors to UI severity in this cohort, reinforcing the connection between BMI and incontinence. Sawaqed et al., (2020) also found a significant association between BMI and SUI, with higher BMI contributing to increased prevalence and severity of symptoms.

In Trotti et al. (10), despite no correlation found between BMI and incontinence severity, UI remained more prevalent in obese women.

Clinical Implications of our study:

This study has notable clinical implications. The strong correlation between BMI and SUI severity underscores the importance of weight management in the prevention and treatment of SUI. Clinicians should consider targeted weight reduction interventions as a first-line approach in managing obese patients with SUI symptoms. Additionally, the findings highlight the need for early screening for urinary incontinence, particularly in obese women, even in the absence of childbirth. Given the impact of SUI on the quality of life observed in this study, integrating SUI management into routine care for obese women could significantly enhance their well-being. Furthermore, the study provides evidence to support non-surgical interventions like lifestyle modification and pelvic floor exercises as primary strategies to mitigate SUI symptoms in obese patients.

The impact of SUI on Muslim females extends beyond the physical inconvenience of the condition. It affects their ability to engage in essential religious practices, leading to emotional and spiritual struggles. However, with proper medical support and religious accommodations, Muslim women can find ways to manage SUI and continue fulfilling their religious obligations without compromising their health or spiritual well-being (16).

The strength points of this study:

One of the major strengths of this study is its comparative cross-sectional design. By comparing obese and non-obese nulligravida females, the study captures direct associations between BMI and stress urinary incontinence (SUI). The study also benefits from its well-defined inclusion and exclusion criteria. Selecting participants based on specific BMI ranges and excluding those with confounding conditions (e.g., neurological diseases, prior surgeries) allows for more reliable results. Additionally, the use of standardized tools like the International Consultation on Incontinence Questionnaire - Short Form

(ICIQ-SF) enhances the validity of findings regarding the frequency and severity of SUI symptoms. The study's focus on a nulligravida population, excluding the confounding effect of childbirth, is a unique strength, offering a more precise understanding of how obesity influences SUI without the added variable of childbirth-related pelvic trauma.

The limitations of the study:

Despite its strengths, the study has several limitations. Firstly, the sample size, while adequate, is limited to 200 participants (100 in each group), which might not fully represent the general population. The study population consists exclusively of nulligravida females, which limits the generalizability of the findings to women who have given birth. Self-reported data on SUI and lifestyle factors could introduce bias, as participants may underreport or exaggerate symptoms. Additionally, the study does not account for other lifestyle factors, such as physical activity or dietary habits, which could influence both obesity and SUI. The cross-sectional design limits causal inferences; while associations between BMI and SUI are observed, it cannot definitively establish that obesity causes SUI.

CONCLUSION

In conclusion, the study highlights the significant association between obesity and the prevalence, frequency, and severity of stress urinary incontinence in nulligravida females. The results suggest that addressing obesity may be a key factor in mitigating the burden of SUI and improving the quality of life for affected individuals.

The study recommends that healthcare providers should incorporate regular screening for SUI in obese women, particularly during routine check-ups. Early intervention, including weight management programs, should be emphasized as a preventive measure to reduce the risk and severity of SUI.

Additional Information

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Confidentiality of Data: The authors declare that they have followed the protocols of their work center on the publication of data from patients.

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