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Comparison of body composition and overactive bladder symptoms in overweight female university students

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ABSTRACT

Objectives: To compare body composition in young overweight women with OAB compared to women without OAB, and to determine the severity of the symptoms of OAB, as well as to investigate the impact of OAB on quality of life.

Study Design: Cross-sectional study. The sample consisted of 1932 enrolled women classed as overweight (BMI:25–29.9).From this sample, 276 women were recruited. Of these, 206 women with an average age of 30.6 ± 20.4 years and an average BMI of 25.8 ± 3.0 were confirmed to be overweight. We used the Voiding Diary, the Overactive Bladder Questionnaire(OAB-q),and the Incontinence Quality of Life (I-QoL) scale. Body composition was measured using direct segmental multi-frequency bioelectrical impedance analysis, with assessment of: skeletal muscle mass(kg)(SMM), body fat mass (kg)(BFM), body fat percentage (%)(BFP), visceral fat area (cm^2/level)(VFA), and waist to hip ratio(WHR).

Results: The voiding diary and OAB-q results confirmed OAB in 102 women. There was no significant difference in BMI between groups. The body composition analysis showed significant differences in BFP, VFA, and WHR, with higher values in the OAB group($p < 0.01$). SMM, however, was higher in the group without OAB($p < 0.01$). Recorded I-QoL scores showed worse parameters in the OAB group($p < 0.001$). Women with a body fat percentage above 32% have a 1.95 times greater chance of developing OAB. Odds ratio [OR] = 1.95,(95%CI:1.09–3.52,$p < 0.02$).

Conclusion: Body fat percentage, visceral fat area, and waist to hip ratio were significantly higher in overweight women with OAB, compared with women without OAB and a comparable BMI.

Introduction

According to the International Continence Society (ICS), overactive bladder (OAB) is characterized by urinary urgency, usually with frequency and nocturia, with or without urgent urinary incontinence, with absence of any urinary tract infection or any other obvious pathology [1]. The causes of OAB are multiple. These include age, infection, pregnancy, diabetes mellitus and overweight and obesity [2,3].

According to epidemiological studies, the prevalence of OAB in general population is 5–10%. In young woman aged from 18 to 35 years, the prevalence of overweight was 16% in Europe [4].

Being overweight is the precursor to obesity. It is referred to as the first stage of obesity and brings an increased risk of health complications [5]. According to World Health Organization (WHO) criteria, for the European population, overweight is defined by a body mass index (BMI) between 25 and 29.9. Since 2008, the prevalence of obesity has doubled in both men and women worldwide, and alarmingly continues to increase. Overweight has increased by 50% and obesity by 23%. In Europe, overweight affects 30–70% and obesity 10–30% of adults [6].

BMI as a body weight indicator is considered as an indicative indicator only. The main drawback of BMI is that it does not distinguish between fat and muscle mass and can therefore lead to incorrect classification of overweight [7]. At present, there are a number of methods of measuring body composition and thus the proportion of fat in the body. The direct segmental multi-frequency bioelectrical impedance analysis is often used. It uses the statistical relationship between the electrical properties of the tissues and

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the target variable, which means that it is a predictive technique [8,9].

An indicative overweight indicator is also the waist circumference. A circumference of over 94 cm for men and over 80 cm for women indicates overweight. Obesity is considered to be a belt circumference of more than 102 cm in men and 88 cm in women. There are other indicators (the ratio of the circumference of the waist to the hip circumference, the measurement of skinfold thickness, etc.). Several factors, including gender, age and level of physical activity, determine the proportion of fat in the body. The American Council on Exercise (ACE) describes excess weight in terms of a percentage of body fat of 32–39% in women and 23–29% in men [10]. The regional distribution of fat is also of great importance. Fat distribution is indicated by the waist to hip ratio (WHR). The American Institute of Diabetes, Digestive and Kidney Diseases (NIDDK) has determined overweight values by WHR as being 0.80–0.84 for women and 0.90–0.99 for men [10].

Several epidemiological studies have confirmed the relationship between overweight and obesity (BMI above 25 kg/m^2) and an increasing incidence of incontinence and OAB [11–14]. However, there is not enough data to investigate the impact of overweight by means of a direct segmental multi-frequency bioelectrical impedance analysis of the body composition in relation to the occurrence of OAB, and its impact on various aspects of quality of life [15].

The aim of this study was to compare body composition in young overweight women with OAB compared to women without OAB, and to determine the severity of the symptoms of OAB, as well as to investigate the impact of OAB on quality of life.

Methodology

The cross-sectional study was approved by the local ethics committee. All the participants signed an informed consent.

The study population consisted of university students. They were randomly selected from two universities. A total of 7943 women completed a screening questionnaire with demographic data such as age, weight and height. BMI was calculated (BMI = m/h^2, where m = body weight in kg and h = body height in m). All women with overweight (BMI 25–29.9) were enrolled in the study (1932 in total).

From this sample 276 women were screened by random sampling. Random sampling was performed in Microsoft Office Excel 2010 by an independent person who did not participate in the next stage of the study. All data collection was anonymous. The individuals who participated in the data collection did not participate in the statistical processing of the questionnaires or the interpretation of the study results. Out of the above number, after completing the questionnaires and voiding diary, 206 probands met the inclusion criteria, as described in Fig. 1.

The diagnosis of overactive bladder (OAB) interpreted by urologist was determined according to the voiding diary and the Overactive Bladder Questionnaire. The OAB was assigned when the women had urinary urgency, daytime frequency eight or more times and nighttime frequency (nocturia) two or more times with or without urgency urinary incontinence [2].

Inclusion criteria: Women aged 18–35; BMI 25–29.9, no previous OAB treatment.

Exclusion criteria: Women with stress urinary incontinence (SUI), surgical treatment of gynecological and urological diseases, urinary tract infection, oncological and neurological urinary tract disease, incomplete questionnaires, refusal to participate in the study.

We used the following to collect information on OAB: Voiding diary, Overactive Bladder Questionnaire (OAB-q), Incontinence Quality of Life (I-QoL) scale.

The Voiding diary evaluated: voided volume during 24 h (mL), number of voiding's per 24 h, voided volume during the day (mL), daytime frequency, voided volume during the night (mL), nighttime frequency (nocturia). The diary was kept for 3 days and average values were calculated [1,16].

The Overactive Bladder Questionnaire (OAB-q) was used to determine symptoms of urgency urinary incontinence (UUI). It comprises six questions with symptom scores that range from 0 (no symptoms) to 100 (most symptoms), and 13 questions that assess life quality, with scores ranging from 0 (worst life quality) to 100 (best life quality) [17,18]. Cronbach's alpha for OAB-q is 0.90 [19].

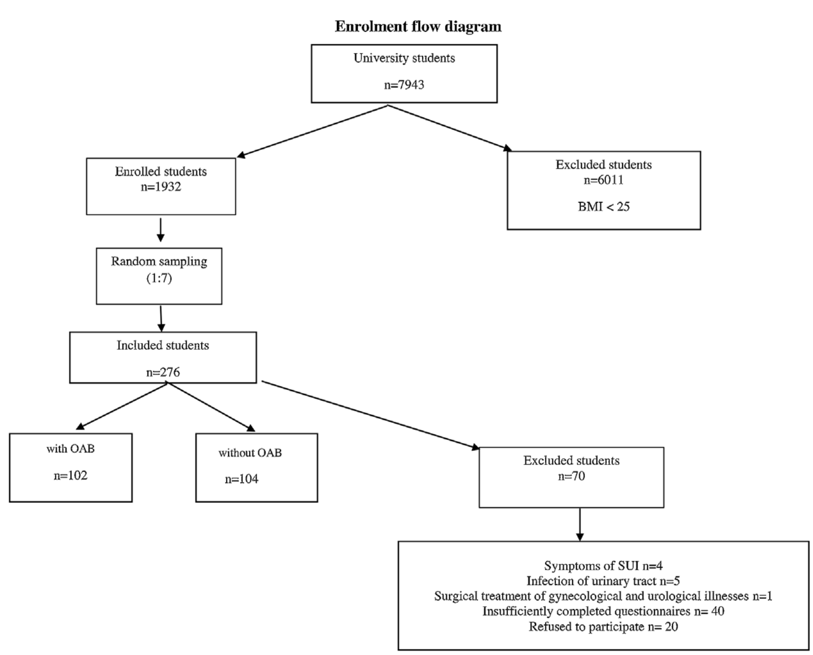

Fig. 1. Enrolment flow diagram.

The Urinary Incontinence Quality of Life scale (I-QoL) is composed of three subscales: avoidance and limiting behaviour score; psychosocial impacts score; social embarrassment score. The I-QoL comprises 22 questions, with a total score in the range from 0 (worst life quality) to 100 (best life quality). The Cronbach's alpha reliability of I – QoL is 0.91–0.96· [20,21].

Body composition was measured using a direct segmented multi-frequency bioelectric impedance analysis performed using a body composition analyser with assessment of: skeletal muscle mass (kg), body fat mass (kg), body fat percentage (%), visceral fat area (cm^2/level), and WHR index (waist circumference (cm) / hip circumference (cm)). We used the InBody Body composition analyser 230 BioSpace [3,8].

Statistical analysis

The number of women was determined according to the prevalence of overweight [22], $n = Z^2 P (1 - P)/d^2$, where n = sample size, Z = 1.96 (confidence level 95%), P = expected prevalence of overweight is 16%, P = 0.16, and d = 0.05 (Confidence Interval (CI), CI = 10%). Based on the above calculation, the minimum number required for the study was n = 195 participants.

Descriptive and analytical statistics were calculated. The data are presented as mean values and standard deviation (SD). Percentages were evaluated for the incidence of incontinence in the observed population of women. Since the data had a normal distribution, p-values were obtained by *t*-test to compare the proband groups with OAB and no OAB. The significance level was $p < .05$. The calculations were performed in IBM SPSS, Version 22.0. Armonk, NY.

Results

The sample consisted of 206 out of 276 women with an average age of 30.6 ± 20.4 years (74.6%) and an average BMI of 25.8 ± 3.0 who were confirmed to be overweight. Of these, according to the OAB definition, the voiding diary and the OAB-q, 102 women had OAB and 104 did not have OAB. There were no significant differences in BMI between the two groups. Body composition analysis confirmed significant differences in body fat percentage, visceral fat area, and the WHR index, with significantly higher values in the OAB group ($p < 0.01$). However, skeletal muscle mass was significantly higher in the non-OAB group ($p < 0.01$). I-QoL recorded a significantly worse parameter (avoidance and limiting behaviour score; psychosocial impacts score; social embarrassment score), in the OAB group ($p < 0.001$). Women with a body fat percentage of over 32% have a 1.95 times greater chance of developing OAB: Odds ratio [OR] = 1.95, (95% CI: 1.09–3.52, p = 0.024). The results are shown in Tables 1,2, 3.

Discussion

The aim of this study was to compare body composition in young overweight women with OAB compared to women without OAB, and to determine the severity of the symptoms of OAB, as well as to investigate the impact of OAB on quality of life.

Our study examined a population of women with an average age of 30.6 years and overweight confirmed by increased BMI. The Voiding diary and OAB-q confirmed mild symptoms of OAB in 102 women, and 104 women were free of OAB symptoms.

In our work, we wanted to highlight the importance of measuring body fat percentage as an important parameter for overweight classification. The percentage of body fat is the total fat mass divided by total body mass multiplied by 100. It includes basic fat and stored body fat. Basic body fat is important for maintaining reproductive functions. Stored body fat is the accumulation of fat in fatty tissues, part of which protects the internal organs in the chest and abdominal cavity.

BMI was comparable in both groups of women. However, the body composition analysis confirmed significant differences in the body fat percentage, visceral fat area, and WHR index, with significantly higher values in the OAB group. However, skeletal muscle mass was significantly higher in the non-OAB group. We found that women with a body fat percentage of over 32% had a 1.95 times greater chance of developing OAB. Elevated percentages of body fat are considered values higher than 28% [23]. Overweight

Table 1
Statistical comparison of voiding diary parameters in women with and without OAB.

Parameter	Women with OAB mean ± SD n = 102	Women without OAB mean ± SD n = 104	P t-test
Age	30.6 ± 20.1	30.3 ± 20.7	0.517
Body mass index (kg/m^2)	25.8 ± 3.0	25.3 ± 2.8	0.613
Voiding diary			
Voided volume during 24 hours (mL)	1288.3 ± 534.5	1330.2 ± 463.6	0.508
Number of voidings per 24 hours	9.1 ± 2.1	5.6 ± 0.9	<0.001
Voided volume during day (mL)	1063.5 ± 521.0	1299.2 ± 470.3	0.965
Daytime frequency	7.0 ± 1.9	5.4 ± 0.9	<0.001
Voided volume during night (mL)	224.8 ± 111.0	28.1 ± 65.7	<0.001
Nighttime frequency (nocturia)	2.1 ± 0.4	0.4 ± 0.3	<0.001
Mean voided volume per 24 hours (mL)	142.3 ± 54.1	212.7 ± 69.7	<0.001
Mean voided volume during day (mL)	153.7 ± 66.1	236.9 ± 71.0	<0.001
Mean voided volume during night (mL)	105.8 ± 47.9	161.0 ± 52.7	<0.001

Table 2
Statistical comparison of OAB-q and I-QoL in women with and without OAB.

Parameter	Women with OAB mean ± SD n = 102	Women without OAB mean ± SD n = 104	P t-test
OAB-q and I-QoL			
SS-symptom score OAB-q	15.7 ± 9.8	4.0 ± 4.3	<0.001
HR-quality of life OAB-q	92.0 ± 6.1	97.8 ± 2.8	<0.001
I-QoL Total Score	95.2 ± 5.8	99.1 ± 1.3	<0.001
I-QoL Avoidance and limiting behaviour score	92.9 ± 8.7	98.4 ± 2.8	<0.001
I-QoL Psychosocial impact score	96.5 ± 5.7	100.0 ± 0.0	<0.001
I-QoL Social embarrassment score	96.5 ± 6.5	98.9 ± 2.8	<0.001

Table 3
Statistical comparison of body composition analysis in women with and without OAB.

Parameter	Women with OAB mean ± SD n = 102	Women without OAB mean ± SD n = 104	P t-test
Body Composition Analysis			
Skeletal muscle mass (kg)	24.6 ± 2.9	25.4 ± 4.0	<0.002
Body fat mass (kg)	21.8 ± 8.4	21.9 ± 7.6	0.329
Body fat percentage (%)	32.6 ± 8.0	29.4 ± 5.9	<0.019
Visceral fat area (cm^2/level)	92.3 ± 35.9	84.9 ± 25.3	<0.012
WHR circumference index (cm)/hips (cm)	2.6 ± 11.8	0.9 ± 0.1	<0.004

in women is characterized by a body fat percentage over 32%, and obesity by a percentage over 40%. Normal values range from 26 to 28% and low values from 21 to 25% [10].

Significantly worse parameters were observed in the OAB group in the Urinary Incontinence Quality of Life scale (I-QoL), in the total score, and in the three sub-scales: avoidance and limiting behaviour score, psychosocial impacts score and social embarrassment score. It follows that even mild OAB symptoms can have a negative impact on several aspects of quality of life. Thais et al [24] evaluated the quality of life in premenopausal women with obesity, overweight and normal weight with symptoms of overactive bladder using a visual analogue scale. In overweight women (BMI 25–29.9), UUI significantly impeded the quality of life compared to women with normal weight (BMI 18.5–24.9) However, we used the I-QoL, which also recorded significant worsening in the OAB group.

There has been much discussion about the impact of obesity and overweight on OAB [25–27]. Thais et al [24] monitored the symptoms of the lower urinary tract and OAB in 521 women aged 20–45 years with obesity. Nocturia occurred more frequently in women with obesity (BMI over 30) than in overweight women (BMI to 25–29.9). Women with overweight (BMI 25–29.9) had more frequent symptoms of urgency and UUI compared to women with normal weight (BMI 18.5–25.9). However, in this study, body composition analysis was not used for the evaluation of weight, just BMI alone. Nevertheless, we used a body composition analysis and found that, in the assessment of body fat percentage, visceral fat area, and WHR index, there were significant differences between women with and without OAB, with a comparable BMI.

Khullar et al [13] examined the relationships between BMI and urinary incontinence and found that women with overweight (BMI 25–29.9) have SUI and MUI more frequently than women with normal weight. However, the average age of women in their study was 53.8 years, so they were much older than the women in our study. Furthermore, their weight was again evaluated by BMI only, and the method of body composition analysis was not used.

Ko et al [28] measured the body composition of 21 older women with an average age of 71.76 years. He found a relationship between obesity and overweight confirmed by an increased body fat percentage and OAB. However, he did not assess other parameters such as visceral fat area or skeletal muscle mass. He had a small number of probands and significantly older women. He only used the Kings Health questionnaire and self-rating scales for OAB assessment, and he did not use the voiding diary that objectively confirms OAB, as used in our research.

Strengths and weaknesses, recommendations for further research

The strong point in our work is the use of bioelectric impedance analysis for the objective measurement of body composition. However, a limitation of the study is the problem of objective measurement of the distribution of body fat. We used bioelectric impedance analysis, but more precise methods are CT and MRI. Bioelectric impedance analysis does not differentiate subcutaneous and visceral fat.

It would be advisable to monitor the impact of different types of exercise in order to achieve normal weight and prevent the progression of overweight into obesity.

The implication of the study for clinical practice is that healthcare professionals should inform the young overweight population about the potential risks of developing OAB as well as other health risks and about the opportunities to complete exercise programmes in order to achieve normal weight and prevent the progression of overweight into obesity.

Conclusion

Body fat percentage, visceral fat area and WHR index were significantly higher in the OAB group than those without OAB, despite a comparable BMI. Body fat percentage of more than 32% correlated with OAB symptoms. Women with a body fat percentage of more than 32% are 1.95 times more likely to develop OAB. Young overweight women should also be made aware of the risks of developing OAB, in addition to many other health risks that are caused by being overweight. In addition to dieting, appropriate physical activity should be an integral part of lifestyle adjustments.

Authors' contribution

Protocol/project development – Hagovska M, Svihra *J* ; data collection or management Bukova A, Horbacz A, Drackova D; data analysis – Svihra *J*, Svihrova V; manuscript writing/editing - Hagovska M, Svihra *J*.

Compliance with ethical standards

The study was approved by the Ethics Committee at University Hospital, Martin, Slovakia. The research involving human participants. All probands enrolled signed an informed consent. Our study had been conducted in accordance with recognized ethical standards and national/international laws. Funding – NONE.

Conflict of interest

All authors have no conflicts of interest to declare.

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