*Psychiatria Danubina, 2020; Vol. 32, Suppl. 4, pp S562-567*
*Medicina Academica Mostariensia, 2020; Vol. 8, No. 1-2, pp 164-169* *Original paper*


# LOWER URINARY TRACT SYMPTOMS IN CROATIAN OBESE PATIENTS

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received: 2.3.2020; revised: 1.4.2020; accepted: 3.4.2020

## *SUMMARY*

***Background:*** *Patients with obesity may experience lower urinary tract symptoms (LUTS). Little is known about these symptoms in obese patients in Croatia. The aim of this study was to asses LUTS in this group of patients.*

***Subjects and methods:*** *This cross-sectional study was carried out in a tertiary healthcare centre. 111 participants were included (81 women and 30 men, age 23-78 years), with BMI>30 kg/m$^2$. LUTS were evaluated using International consultation on incontinence questionnaires (ICIQ) investigating symptoms of overactive bladder (OAB) and urinary incontinence (UI): ICIQ-OAB and ICIQ-UI Short Form (SF). We evaluated also some of the questions on the EQ-5D-5L questionnaire.*

***Results:*** *On ICIQ-OAB patients most often reported:UI (46.85% (N=52)), nocturia (42.34% (N=47)) and increased frequency of urination (34.23% (N=38)), and on ICIQ-UI SF: UI when coughing and sneezing (44.44% (N=32)), urgency UI (43.06% (N=31)) and UI during exercise/physical activity (22.22% (N=16)). Women were found to be more significantly affected by OAB symptoms ($p<0.05$). Significant correlations were found between the overall results on ICIQ-OAB and hypertension ($r=0.32$).*

***Conclusions:*** *The results of this study confirm that obese patients in Croatia experience LUTS as well. A higher incidence of LUTS was found among women and gender-independent among hypertensive obese patients.*

***Key words:*** *obesity - lower urinary tract symptoms – LUTS - urinary incontinence - overactive bladder*

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## INTRODUCTION

Obesity is a global public health challenge with the worldwide prevalence increasing exponentially over time (Montan et al. 2019).The World Health Organization (WHO) estimates that the worldwide prevalence of obesity nearly tripled between 1975 and 2016 when about 13% of the world's adult population (11% of men and 15% of women) were estimated to be obese (WHO). Similar situation is recorded in Croatia, where the prevalence of overweight and obese in the population increased during recent years, with more than half of both men and women being overweight (Dzakula et al. 2014). The prevalence of overweight and obese population in Croatia was estimated at 38.11% and 20.34%. There is also a gender difference in the prevalence of overweight with a higher prevalence in men 43.2% than in women 33.6% and almost similar prevalence of obesity 20% regardless of gender (Fister et al. 2009).

Earlier studies found that lower urinary tract symptoms (LUTS) may be present in obese patients, with different mechanisms proposed and obesity itself affecting the lower urinary tract (Daneshgari et al. 2017). Specifically, studies, addressing the topic of LUTS in obese patients, focus most often on stress urinary incontinence (SUI) in female patients and LUTS/ benign prostatic hyperplasia (BPH) in male patients, with evidence suggesting that obesity is a risk factor for overactive bladder (OAB) as well (Bunn et al. 2015, Calogero et al. 2019, Contreras Ortiz 2004, Fuselier et al. 2018, Milne 2008, Mongiu & McVary 2009, Moul & McVary 2010, Parsons 2011, Pomian et al. 2016, Raheem & Parsons 2014, Vignozzi et al. 2016). Increased intra-abdominal pressure, as well as neurogenic and metabolic pathways have been proposed as a possible pathophysiologic link between obesity and SUI (Cummings & Rodning 2000, Fuselier et al. 2018). Recently published studies have highlighted the need for future investigation of connection between obesity and LUTS and potential connection to other comorbidities and its associated conditions, such as diabetes (Abler & Vezina 2018, Daneshgari et al. 2017). Since LUTS in obese patients in Croatia have not been investigated yet, the objective of this study was to assess the presence of LUTS and their pattern in our group of patients.

## SUBJECTS AND METHODS

This cross-sectional study was carried out in a tertiary healthcare centre at the Referral center for obesity. The study was approved by the Ethics Committee of our institution. All of the participants signed an informed consent form.

Patients' weight (kg) and height (m), waist and hip circumference (cm) were measured and body mass index (BMI) (weight/height(2)) was calculated. To asses gender-specific BMI Welch t-test was used. Inclusion criterion was BMI>30 kg/m$^2$.

LUTS were evaluated using two standardised International consultation on incontinence questionnaires (ICIQ) investigating symptoms of OAB and urinary incontinence (UI): ICIQ-OAB (Donovan et al. 1996, Jackson et al. 1996) and ICIQ-UI Short Form (SF) (Avery et al. 2004). Both questionnaires have been previously translated and validated for Croatian language with permission.

We evaluated also some of the questions on the EQ-5D-5L questionnaire (EuroQol) (Buchholz et al. 2018) and questions about consumption of fresh fruit, spirit drinks, coffee, tea and various non-alcoholic beverages, as well as, smoking related habits. This questionnaire had also has been previously translated and validated for Croatian language with permission.

111 participants with obesity were included (72.97% (N=81) women, and 27.03% (N=30) men; mean age 49.03±12.21 (23-78) years. Overall mean BMI was 43.78±8.45 (range 30.06-68.20) kg/m$^2$, with mean BMI in women 41.75±7.18 (range 30.06-65.56) kg/m$^2$ and mean BMI in men 49.27±9.28 (35.94-68.20) kg/m$^2$ (Table 1).

### Statistical Analysis

Statistical analysis included t-test, chi-squared test and bivariate Pearson's correlations. All the above statistical methods were performed in the R program (version 3.6.1). Significant values are considered $p<0.05$.

## RESULTS

On ICIQ-OAB patients reported most often following symptoms: urgency urinary incontinence was reported by 46.85% (N=52, 51.85% (N=42) women, 33.33% (N=10) men); nocturia by 42.34%(N=47, 48.15% (N=39) women, 26.67% (N=8) men); increased frequency of urination by 34.23% (N=38, 38.27% (N=31) women, 23.33% (N=7) men); and urgency by 25.23% (N=28, 28.4% (N=23) women, 16.67% (N=5) men) (Figure 1).

**Table 1.** Anthropometric measurements

| | Overall | Female | Male |
|---|---|---|---|
| Number of patients | 111 | 81 (73%) | 30 (27%) |
| Age (year) mean ± SD (range) | 49.03±2.21 | 49.14±12.44 | 48.73 ± 11.76 |
| BMI (kg/m$^2$) mean ± SD (range) | 43.78±8.45 | 41.75±7.18 | 49.27±9.28 |
| BMI min. (kg/m$^2$) | 30.06 | 30.06 | 35.94 |
| BMI max. (kg/m$^2$) | 68.2 | 65.59 | 68.2 |
| BMI median (kg/m$^2$) | 42.59 | 40.16 | 46.59 |
| Body mass (kg) mean ± SD (range) | 124.31±29.12 | 112.32±18.84 | 156.67±27.45 |
| Body mass min. (kg) | 76.3 | 76.3 | 112.6 |
| Body mass max. (kg) | 207 | 176 | 207 |
| Body mass median (kg) | 117 | 109 | 152.4 |

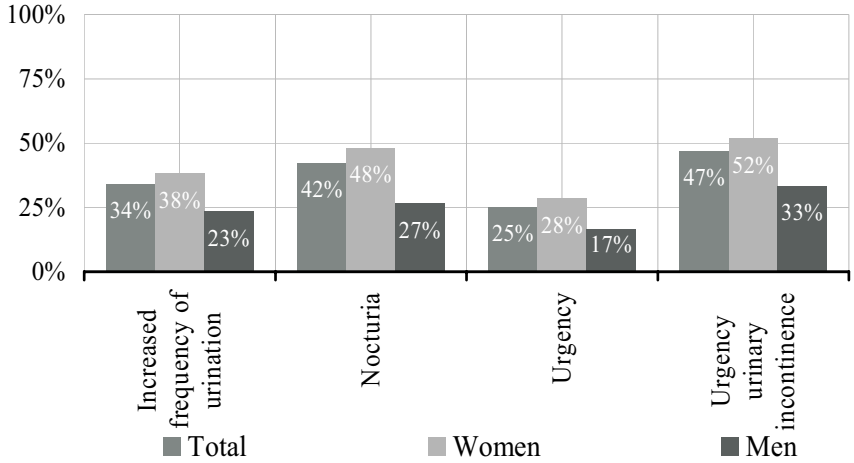


**Figure 1.** The column chart shows the results of ICIQ OAB on study participants (showing overall results and gender-specific)

A statistically significant correlation was found between the total score on the ICIQ-OAB questionnaire and hypertension ($r(100) = 0.32$, $p<0.001$ with CI =0.14-0.49) with 64 (62.7%) subjects having hypertension (45 (61.6%) female and 19 (65.5%) male). No statistically significant correlation was found between the total score on the ICIQ-OAB questionnaire and diabetes mellitus ($r(100) = 0.19$, $p=0.05$ with CI =0-0.37), with 21 (20.6%) subjects having diabetes mellitus (10 (13.7%) female and 11 (37.9%) male).

We found no statistically significant correlation between the results on ICIQ-OAB and the anthropometric parameters – body mass ($r(109) =-0.09$, $p=0.37$), BMI ($r(109) =0.06$, $p=0.52$), waist circumference ($r(79) =0.09$, $p=0.43$), hip circumference ($r(70) =0.02$, $p=0.87$). However, we found statistical significant correlation between an overall score on ICIQ-OAB and age ($r(109) =0.35$, $p<0.001$). Our results did not show a connection between an overall score on ICIQ-OAB and smoking-related habits. According to our results, fresh fruit consumption is correlated to an overall ICIQ-OAB score ($r(102) =0.24$, $p=0.02$). Our results showed negative statistical significant correlation between spirit drinks consumption and ICIQ-OAB score ($r(93) =-0.21$, $p=0.04$). There was no association with the consumption of coffee, tea and various non-alcoholic beverages as well as the amount of sugar in them. (Table 2).

The total score on the ICIQ-OAB was found to be related to some of the questions on the EQ-5D-5L questionnaire. Precisely, with mobility ($r(107) =0.29$, $p<0.001$), self-care ($r(109) =0.28$, $p<0.001$) and pain/discomfort ($r(106) =0.37$, $p<0.001$). EQ-5D-5L anxiety/depression question did not show statistical significant connection ($r(107)=0.16$, $p=0.1$). Significant correlations were found between overall results on the ICIQ-OAB and arterial hypertension ($r(100) =0.32$, $p<0.001$). (Table 2).

**Table 2.** Correlations between an overall score on ICIQ OAB questionnaire and following variables (measures, habits and comorbidities)

| | r-value | p-value | Confidence interval CI 95% |
|---|---|---|---|
| Body mass | r (109) = - 0.09 | 0.37 | -0.27-0.10 |
| BMI | r (109) = 0.06 | 0.52 | -0.13-0.25 |
| Waist circumference | r (79) = 0.09 | 0.43 | -0.13-0.30 |
| Hip circumference | r (70) = 0.02 | 0.87 | -0.21-0.25 |
| Age | r (109) = 0.35 | <0.001 | 0.17-0.50 |
| Smoking cigarettes | r (98) = 0.08 | 0.45 | -0.12-0.27 |
| An average number of smoked cigarettes | r (22) = 0.12 | 0.59 | -0.30-0.50 |
| Years of smoking | r (24) = 0.24 | 0.24 | -0.16-0.57 |
| Smoking history | r (41) = -0.14 | 0.38 | -0.42-0.17 |
| Years since quitting smoking | r (32) = 0.1 | 0.57 | -0.24-0.43 |
| The number of cigarettes smoked daily before quitting smoking | r (32) = 0.21 | 0.23 | -0.14-0.51 |
| Living with cigarette smoking inmate/s | r (99) = -0.14 | 0.17 | -0.32-0.06 |
| Natural juices consumption | r (102) = 0.08 | 0.43 | -0.12-0.27 |
| Sugar drinks consumption | r (71) = -0.16 | 0.18 | -0.38-0.07 |
| Fresh fruit consumption | r (102) = 0.24 | 0.02 | 0.05-0.41 |
| Coffee consumtion | r (105) = 0.07 | 0.47 | -0.12-0.26 |
| The amount of sugar put into the coffee | r (104) = -0.06 | 0.57 | -0.24-0.14 |
| Tea consumption | r (103) = 0.05 | 0.64 | -0.15-0.24 |
| The amount of sugar put into the tea | r (102) = -0.11 | 0.27 | -0.30-0.09 |
| Alcohol consumption (spirit drinks) | r (93) = -0.21 | 0.04 | -0.40-0.01 |
| Mobility | r (107) = 0.29 | <0.001 | 0.11-0.45 |
| Self-care | r (109) = 0.28 | <0.001 | 0.10-0.44 |
| Pain/uneasiness | r (106) = 0.37 | <0.001 | 0.19-0.52 |
| Anxiety/melancholy | r (107) = 0.16 | 0.10 | -0.03-0.34 |
| Diabetes mellitus | r (100) = 0.19 | 0.05 | 0.00-0.37 |
| High blood sugar | r (11) = -0.15 | 0.62 | -0.65-0.44 |
| Feeling bloated | r (85) = 0.04 | 0.74 | -0.18-0.25 |
| Hypertension | r (100) = 0.32 | <0.001 | 0.14-0.49 |
| Depression | r (100) = 0.12 | 0.22 | -0.07-0.31 |

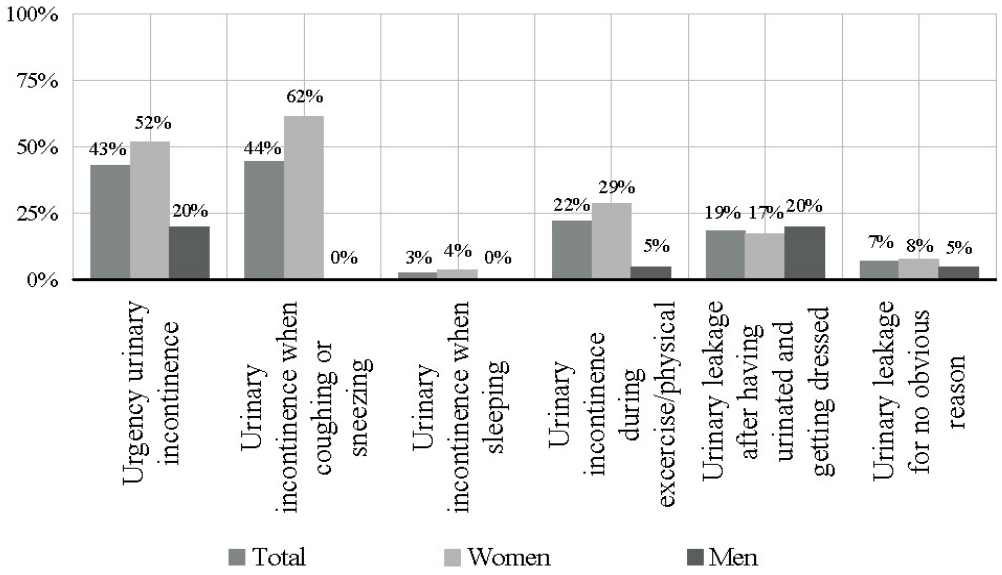


**Figure 2.** The column chart shows the results of ICIQ-UI on study participants (showing overall results and gender-specific)

On ICIQ-UI SF patients most often reported following symptoms: urinary incontinence when coughing and sneezing was reported by 44.44% (N=32, 61.54% (N=32) women, 0 men); urgency urinary incontinence by 43.06% (N=31, 51.92% (N=27) women, 20% (N=4) men); urinary incontinence during exercise/physical activity by 22.22% (N=16, 28.85% (N=15) women, 5% (N=1) men); urinary leakage after having urinated and getting dressed by 18.06% (N=13, 17.31%(N=9) women, 20% (N=4) men); urinary leakage for no obvious reasons by 6.94% (N=5, 7.69% (N=4) women, 5% (N=1) men); and urinary incontinence when sleeping by 2.78% (N=2, 3.85% (N=2) women, 0 men) (Figure 2).

Women were found to be more significantly affected by increased incidence of urinary frequency and mixed urinary incontinence on ICIQ-OAB than men ($p<0.05$).

## DISCUSSION

Earlier, Croatian Adult Health Study (CAHS) found that 20.1% of men and 20.6% of women were obese. A follow-up study, the Croatian Adult Cohort Study (CroHort) recorded an increasing trend in prevalence of obesity 25.3% more men and 34.1% more women (Dzakula et al. 2014, Fister et al. 2009, Milanovic et al. 2009, Poljicanin et al. 2012).

Our group of obese patients mainly consisted of women. One of the reasons behind this possibly lies in the fact that socially it is less acceptable to be a fat woman, and that women perceive themselves as being overweight more often than men. Unlike women, men usually get referred to our center. This is consistent with results of previous studies on prevalence of obesity in Croatia and worlwide (Dzakula et al. 2014, WHO).

In our study mean overall BMI was 43.78±8.45 kg/m$^2$, ranging from 30.06 to 68.20 kg/m$^2$. Mean BMI was found to be lower in women 41.75±7.18 (range 30.06-65.56) kg/m$^2$ compared to mean BMI in men 49.27±9.28 (35.94-68.20) kg/m$^2$. Earlier studies have found healthy men to have higher BMI compared to women (Flegal 2006). Nevertheless, recent study assessing prevalence of obesity and its associated comorbidities in US, found that higher BMI ≥40 kg/m$^2$ was more likely to be found in female patients compared to male patients (Pantalone et al. 2017).

Different questionnaires (including also both ICIQ questionnaires that we used) have been previously used to investigate LUTS in connection to BMI and obesity (Anglim et al. 2018, Bunn et al. 2015, Nygaard et al. 2018, Nygaard et al. 2019, Palma et al. 2014, Slavin et al. 2019). Although studies investigating LUTS in Croatia have been conducted in the past, studies addressing LUTS in obese patients in Croatia are lacking. This study recorded presence of LUTS and their pattern in patients with obesity in Croatia. Obesity was recently found to be the only independent significant predictor for OAB and detrusor overactivity (DO) among other aspects of metabolic syndrome (diabetes, hypertension and dyslipidaemia) (Zacche et al. 2017). Our study found significant correlations between overall results on the ICIQ-OAB and arterial hypertension with medium strength of association. Our results showed a positive association between diabetes and LUTS but not a statistically significant one ($p=0.05$). In accordance with our results, some of relatively recently published papers (Abler & Vezina 2018, Daneshgari et al. 2017) show positive association between diabetes and LUTS as well. This is also interesting in connection to previously suggested connection between cerebral white matter lesions (WMLs) and OAB (Sakakibara et al. 2014). Interestingly enough it is important to emphasise that results of this

study found that around half of patients experience mixed urinary incontinence, around 40% nocturia, around one third increased frequency of urination, with urgency present in 25%. This shows how present this issue is and that it should not be disregarded. Results of our study are consistent with previous research. In study by Anglim et al. 44% of female patients undergoing bariatric surgery reported UI on ICIQ-UI SF preoperatively (Anglim et al. 2018). Study by Nygaard et al. found UI in 53.3% of female patients on ICIQ-UI SF who underwent surgery for obesity and weight-related diseases (Nygaard et al. 2019), while Bulbuller et al. reported the figure of 60% of UI preoperatively in female patients (Bulbuller et al. 2017) and O'Boyle et al. the figure of 45% women (O'Boyle et al. 2016).

There are investigations of women patients with UI, one of them showed that LUTS were common among overweight and obese women with UI but they did not found statistically influence of weight loss in decreasing LUTS between intervention and control groups (Breyer et al. 2018).

In published literature, studies investigating men, predominately focused on prostatic symptoms (Kim et al. 2016, Xie et al. 2019). Recently published paper by Aslan et al. did not found association between obesity and LUTS except to post-void residual urine volume (PVR) in men (Aslan et al. 2019). In comparison to women, in our study male patients (20% vs. 17.31%) in just one domain experienced more often LUTS, and that is in regard to urinary leakage after having urinated and getting dressed i.e. post-void dribbling, which could potentially be related to weak pelvic floor. That being said, approach to patients in our institution is multidisciplinary, including different specialties, of course both urologists and gynaecologists. We also administered questionnaire International Prostate Symptom Score (IPSS) to male patients, and we intend to present these results in future studies. In all other domains, women more often experienced OAB symptoms and were found to be more significantly affected by increased incidence of urinary frequency and mixed urinary incontinence than men on ICIQ-OAB and ICIQ-UI SF.

## CONCLUSIONS

The results of this study confirm that obese patients in Croatia experience LUTS. This is consistent with previously published results on this topic from other countries. Patients most often report mixed urinary incontinence, nocturia and increased frequency of urination. Women were found to be more significantly affected by increased incidence of urinary frequency and mixed urinary incontinence than men. A higher incidence of LUTS was (gender-independent) found among hypertensive obese patients.

### *Acknowledgements:*

The authors are immensely grateful to Bristol Urological Institute for the permission to use ICIQ questionnaires and EuroQol for the permission to use of EQ-5D-5L questionnaire.

Dr Tudor would also like to thank her mentor in uroneurology Dr Jalesh N. Panicker.

### *Conflict of interest:* None to declare.

### *Contribution of individual authors:*

Martina Matovinović - conceived and designed the study, collected the data and contributed data or analysis tools, first draft, interpretation of the results, approval of the final version.

Tudor Katarina Ivana - helped design the study, collected the data and contributed data or analysis tools, first draft, interpretation of the results, approval of the final version.

Filip Mustač, Andrej Kovačević & Zrinka Vuksan-Ćusa - collected the data and contributed data or analysis tools.

Maja Baretić & Ervina Bilić - interpretation of the results, approval of the final version.

## References

1. *Abler LL & Vezina CM: Links between lower urinary tract symptoms, intermittent hypoxia and diabetes: Causes or cures? Respir Physiol Neurobiol 2018; 256:87-96*
2. *Anglim B, O'Boyle CJ, O'Sullivan OE & O'Reilly BA: The long-term effects of bariatric surgery on female urinary incontinence. Eur J Obstet Gynecol Reprod Biol 2018; 231:15-18*
3. *Aslan A, Çirakoğlu A & Kaşko arici Y: The Relationship Between Body Mass Index and Lower Urinary Tract Symptoms in Men. MBSJHS 2019; 5:138-44*
4. *Avery K, Donovan J, Peters TJ, Shaw C, Gotoh M & Abrams P: ICIQ: a brief and robust measure for evaluating the symptoms and impact of urinary incontinence. Neurourol Urodyn 2004; 23:322-30*
5. *Breyer BN, Creasman JM, Richter HE, Myers D, Burgio KL, Wing RR et al: A Behavioral Weight Loss Program and Nonurinary Incontinence Lower Urinary Tract Symptoms in Overweight and Obese Women with Urinary Incontinence: A Secondary Data Analysis of PRIDE. J Urol 2018; 199:215-22*
6. *Buchholz I, Janssen MF, Kohlmann T & Feng YS: A Systematic Review of Studies Comparing the Measurement Properties of the Three-Level and Five-Level Versions of the EQ-5D. Pharmacoeconomics 2018; 36:645-61*
7. *Bulbuller N, Habibi M, Yuksel M, Ozener O, Oruc MT, Oner OZ et al: Effects of bariatric surgery on urinary incontinence. Ther Clin Risk Manag 2017; 13:95-100*
8. *Bunn F, Kirby M, Pinkney E, Cardozo L, Chapple C, Chester K et al: Is there a link between overactive bladder and the metabolic syndrome in women? A systematic review of observational studies. Int J Clin Pract 2015; 69:199-217*
9. *Calogero AE, Burgio G, Condorelli RA, Cannarella R & La Vignera S. Epidemiology and risk factors of lower*

*urinary tract symptoms/benign prostatic hyperplasia and erectile dysfunction. Aging Male 2019; 22:12-9*

10. *Contreras Ortiz O: Stress urinary incontinence in the gynecological practice. Int J Gynaecol Obstet 2004; 86(Suppl 1):6-16*
11. *Cummings JM & Rodning CB: Urinary stress incontinence among obese women: review of pathophysiology therapy. Int Urogynecol J Pelvic Floor Dysfunct 2000; 11:41-4*
12. *Daneshgari F, Liu G & Hanna-Mitchell AT: Path of translational discovery of urological complications of obesity and diabetes. Am J Physiol Renal Physiol 2017; 312:F887-F96*
13. *Donovan JL, Abrams P, Peters TJ, Kay HE, Reynard J, Chapple C et al.: The ICS-'BPH' Study: the psychometric validity and reliability of the ICSmale questionnaire. Br J Urol 1996; 77:554-62*
14. *Dzakula A, Sagan A, Pavic N, Lonccarek K & Sekelj-Kauzlaric K: Croatia: health system review. Health Syst Transit 2014; 16:xvii-xviii, 1-162*
15. *Fister K, Kolcic I, Milanovic SM & Kern J: The prevalence of overweight, obesity and central obesity in six regions of Croatia: results from the Croatian Adult Health Survey. Coll Antropol 2009; 33(Suppl 1):25-9*
16. *Flegal KM: Body mass index of healthy men compared with healthy women in the United States. Int J Obes (Lond) 2006; 30:374–379*
17. *Fuselier A, Hanberry J, Lovin MJ & Gomelsky A: Obesity and stress urinary incontinence: impact on pathophysiology and treatment. Curr Urol Rep 2018; 19:10*
18. *Jackson S, Donovan J, Brookes S, Eckford S, Swithinbank L & Abrams P: The Bristol Female Lower Urinary Tract Symptoms questionnaire: development and psychometric testing. Br J Urol 1996; 77:805-12*
19. *Kim JH, Sun HY, Park SY, Soh MJ, Kim YJ & Song YS: Association between obesity and lower urinary tract symptoms: propensity score matching study between healthy controls and obese patients seeking bariatric surgery. Surg Obes Relat Dis 2016; 12:1585-93*
20. *Milanovic SM, Uhernik AI, Mihel S & Strnad M: Trends and regional disparities in ischemic heart disease and cerebrovascular disease in Croatia, 1997-2006. Coll Antropol 2009; 33(Suppl 1):47-60*
21. *Milne JL: Behavioral therapies for overactive bladder: making sense of the evidence. J Wound Ostomy Continence Nurs 2008; 35:93-101*
22. *Mongiu AK & McVary KT: Lower urinary tract symptoms, benign prostatic hyperplasia, and obesity. Curr Urol Rep 2009; 10:247-53*
23. *Montan PD, Sourlas A, Olivero J, Silverio D, Guzman E & Kosmas CE: Pharmacologic therapy of obesity: mechanisms of action and cardiometabolic effects. Ann Transl Med 2019; 7:393*
24. *Moul S & McVary KT: Lower urinary tract symptoms, obesity and the metabolic syndrome. Curr Opin Urol 2010; 20:7-12*
25. *Nygaard CC, Schreiner L, Morsch TP, Saadi RP, Figueiredo MF & Padoin AV: Urinary incontinence and quality of life in female patients with obesity. Rev Bras Ginecol Obstet 2018; 40:534-9*
26. *Nygaard CC, Schreiner L, Morsch TP, Saadi RP, Figueiredo MF & Padoin AV: Urinary incontinence and surgery for obesity and weight-related diseases: are there predictors of improvement? Obes Surg 2019; 29:109-13*
27. *O'Boyle CJ, O'Sullivan OE, Shabana H, Boyce M & O'Reilly BA: The effect of bariatric surgery on urinary incontinence in women. Obes Surg 2016; 26:1471-8*
28. *Palma T, Raimondi M, Souto S, Fozzatti C, Palma P & Riccetto C: Correlation between body mass index and overactive bladder symptoms in pre-menopausal women. Rev Assoc Med Bras (1992) 2014; 60:111-7*
29. *Pantalone KM, Hobbs TM, Chagin KM, Kong SX, Wells BJ, Kattan MW, et al.: Prevalence and recognition of obesity and its associated comorbidities: cross-sectional analysis of electronic health record data from a large US integrated health system. BMJ Open 2017; 7:e017583*
30. *Parsons JK: Lifestyle factors, benign prostatic hyperplasia, and lower urinary tract symptoms. Curr Opin Urol 2011; 21:1-4*
31. *Poljicanin T, Dzakula A, Milanovic SM, Sekerija M, Ivankovic D & Vuletic S: The changing pattern of cardiovascular risk factors: the CroHort study. Coll Antropol 2012; 36(Suppl 1):9-13*
32. *Pomian A, Lisik W, Kosieradzki M & Barcz E: Obesity and pelvic floor disorders: a review of the literature. Med Sci Monit 2016; 22:1880-6*
33. *Raheem OA & Parsons JK: Associations of obesity, physical activity and diet with benign prostatic hyperplasia and lower urinary tract symptoms. Curr Opin Urol 2014; 24:10-4*
34. *Sakakibara R, Panicker J, Fowler CJ, Tateno F, Kishi M, Tsuyusaki Y, et al.: Is overactive bladder a brain disease? The pathophysiological role of cerebral white matter in the elderly. Int J Urol 2014; 21:33-8*
35. *Slavin V, Gamble J, Creedy DK & Fenwick J: Perinatal incontinence: Psychometric evaluation of the International Consultation on Incontinence Questionnaire-Urinary Incontinence Short Form and Wexner Scale. Neurourol Urodyn 2019; 38:2209–23*
36. *Vignozzi L, Gacci M & Maggi M: Lower urinary tract symptoms, benign prostatic hyperplasia and metabolic syndrome. Nat Rev Urol 2016; 13:108-19*
37. *WHO: Obesity and overweight [Online]. Available: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight [Accessed 29.09. 2019]*
38. *Xie L, Chen Y, Tan A, Gao Y, Yang X, Mo Z, et al.: Central obesity indicating a higher prevalence of lower urinary tract symptoms: A case-control matching analysis from a Chinese cross-sectional study in males. Low Urin Tract Symptoms 2019; 11:O135-O140*
39. *Zacche MM, Giarenis I, Thiagamoorthy G, Robinson D & Cardozo L: Is there an association between aspects of the metabolic syndrome and overactive bladder? A prospective cohort study in women with lower urinary tract symptoms. Eur J Obstet Gynecol Reprod Biol 2017; 217:1-5*

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