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Lower Urinary Tract Symptoms in Obese Children

Obez Çocuklarda Alt Üriner Sistem Semptomları

[1]Nuran Cetin, [2]Nadide Melike Sav, [3]Gonca Kilic Yildirim

[1]Department of Pediatric Nephrology, Faculty of Medicine, Eskisehir Osmangazi University, Eskisehir, Turkey.

[2]Department of Pediatric Nephrology, Faculty of Medicine, Düzce University, Düzce, Turkey.

[3]Department of Pediatric Nutrition and Metabolism, Faculty of Medicine, Eskisehir Osmangazi University, Eskisehir, Turkey

Abstract

Lower urinary tract symptoms (LUTS) is very common in childhood. We aimed to investigate the frequency of LUTS in obese, overweight and normal children using voiding dysfunction symptom score validated for Turkish children by Akbal and et al. The children older than five-years-old who were followed in Pediatric Nutrition and Metabolism Outpatient Clinic were included. Children with a body mass index above the 95th percentile were classified as obese. The symptom score was administered face to face to each child and their mothers together. A score ≥9 was defined as lower urinary tract dysfunction (LUTD). A 164 children (62 obese, 52 overweight, 50 normal) were included. Symptom score was significantly higher in obese children than in overweight and normal weight children. (p=0.004, p=000, respectively). Overweight children had higher symptom score than in normal weight children (p=0.037). The frequency of daily urinary incontinence was higher in obese than overweight and normal weight children (p=0.041, p=0.000, respectively). The both obese and overweight children had higher frequencies of urgency and increased urinary frequency than in children with normal weight (p=0.002, p=0.021 for urgency, p=0.000, p=0.037 for increased urinary frequency, respectively). The frequencies of voiding postponement and constipation were higher in the obese children than those of overweight and normal weight (p=0.000, p=0.000 for voiding postponement, p=0.031, p=0.028 for constipation respectively). Obesity is a significant risk factor for LUTD. The questioning LUTS using questionnaire validated by Akbal et al in obese children can help in the early diagnosis of LUTD.

Keywords: Children, lower urinary tract symptoms, obesity, voiding dysfunction symptom score

Özet

Alt üriner sistem semptomları (AÜSS) çocukluk çağında oldukça yaygındır. Biz Akbal ve arkadaşları tarafından Türk çocukları için valide edilmiş işeme disfonksiyonu semptom skorunu kullanarak obez, fazla ve normal kilolu çocuklarda AÜSS sıklığını araştırmayı amaçladık. Çocuk Beslenme ve Metabolizma Polikliniği'nde takip edilen beş yaş üstü çocuklar çalışmaya dahil edildi. Vücut kitle indeksi 95 persentilin üzerinde olan çocuklar obez olarak sınıflandırıldı. Semptom skoru her çocuğa ve annesine yüz yüze birlikte uygulandı. Semptom skoru ≥9 olması alt üriner sistem disfonksiyonu (AÜSD) olarak tanımlandı. Çalışmaya 164 çocuk (62 obez, 52 kilolu, 50 normal) dahil edildi. Obez çocuklarda semptom skoru, aşırı kilolu ve normal kilolu çocuklara göre anlamlı olarak daha yüksekti (sırasıyla p=0,004, p=000). Fazla kilolu çocukların semptom skoru normal kilolu çocuklara göre daha fazla idi (p=0.037). Obezlerde günlük idrar kaçırma sıklığı fazla kilolu ve normal kilolu çocuklara göre daha yaygındı (sırasıyla p=0,041, p=0,000). Hem obez hem de fazla kilolu çocuklarda normal kilolu çocuklara göre daha yüksek aciliyet sıklığı ve artmış idrar sıklığı vardı (sırasıyla, aciliyet için p=0,002, p=0,021, idrar sıklığı artışı için p=0,000, p=0,037). İşemeyi erteleme ve kabızlık sıklıkları obez çocuklarda fazla kilolu ve normal kilolu çocuklara göre daha yüksek bulundu (sırasıyla p=0.000, p=0.000 işemeyi erteleme, p=0.031, p=0.028 kabızlık). Obezite AÜSD için önemli bir risk faktörüdür. Obez çocuklarda Akbal ve arkadaşları tarafından doğrulanan anket kullanılarak AÜSS'nin sorgulanması AÜSD'nin erken teşhisine yardımcı olabilir.

Anahtar Kelimeler: Çocukluk, alt üriner sistem semptomları, obezite, işeme disfonksiyonu semptom skoru.

Correspondence:
Nuran ÇETİN
Department of Pediatric Nephrology, Faculty of Medicine, Eskisehir Osmangazi University, Eskisehir, Turkey.
e-mail: nurancetin17@hotmail.com

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1. Introduction

Lower urinary tract symptoms are common in childhood. Children with lower urinary tract symptoms may develop emotional and behavioral problems, and their quality of life may be reduced[1]. The disorders associated with voiding behavior can lead to an increased risk of recurrent urinary tract infection[2]. Using scoring systems in children with voiding problems is highly useful for both diagnosing and monitoring the response to treatment. Akbal et al. (2005) validated the voiding dysfunction symptom score (VDSS) for Turkish children. A score of more than 8.5 points had a sensitivity and specificity of 90% in detecting lower urinary tract dysfunction (LUTD)[3].

Obesity and being overweight are common and growing social health problems in children. In recent years, a relationship has been found between obesity and lower urinary tract symptoms [4]. In this study, we investigated the frequency of lower urinary tract symptoms in obese, overweight, and normal-weight children using the VDSS validated by Akbal et al.

2. Materials and Methods

This work is a cross-sectional study investigating lower urinary tract symptoms in obese, overweight, and normal-weight children. Consecutive children older than five years old who were followed up at our Pediatric Nutrition and Metabolism Outpatient Clinic between January 2011 and May 2016 were eligible to enroll in this study. Patient information was accessed from electronic records. Children who previously did not consult a doctor about their urinary symptoms and who were not tested for this purpose were included in this study. Children with congenital anomalies of the kidney and urinary tract, as well as neurological, endocrinological, and gastrointestinal anomalies, were excluded.

The mothers of the children were called and invited to participate in the study. They were informed about a voiding diary and asked to make a three-day voiding diary for their children during their first visit. A detailed physical examination, urinalysis, and urine culture were conducted on the children. Patients with abnormal urinalysis or those who were unable to complete their three-day voiding diary were excluded.

Height measurements were taken, with the child standing barefoot. Body weights were measured using a digital scale. Body mass index (BMI) was calculated by dividing weight (kg) by height (m^2) squared. BMI percentiles were determined based on the reference values of Turkish children[5]. Children with a BMI of 85^{th}–95^{th} percentile on gender and age were classified as overweight. Children with a BMI above the 95^{th} percentile were classified as obese.

The VDSS was administered face-to-face to each child and his/her mother together at the second visit. The VDSS developed for Turkish children by Akbal et al. is shown in Figure 1[3]. The scoring system consisted of 13 items. Items 1 and 2 are related to daytime incontinence, items 3 and 4 to nocturnal enuresis, items 5–9 to daytime urination characteristics, item 10 to urgency, item 11 to holding maneuver, item 12 to urine leakage before reaching the toilet, and constipation to item 13. In our study, 13 items were used for scoring. A score ≥ 9 was defined as LUTD. Urination of > 7 times per day was considered increased urinary frequency, and urination < 4 times per day and habitual delay of micturition were defined as urinary incontinence with voiding postponement. Painful and interrupted urination was considered a sign of dysfunctional voiding[6]. Nocturnal enuresis was defined as bedwetting while asleep in children older than five years. Monosymptomatic enuresis was defined as enuresis without any other lower urinary tract symptoms. Patients with secondary nocturnal enuresis were not included. Constipation was defined using the Rome III questionnaire[7].

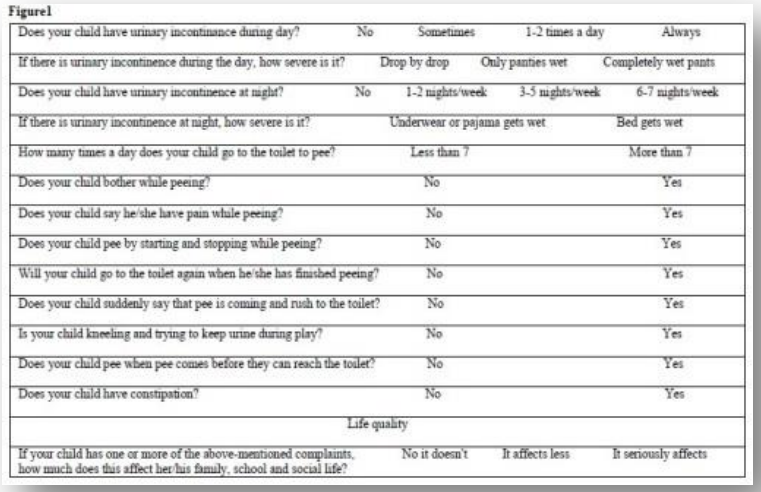


Figure1

Does your child have urinary incontinance during day?	No	Sometimes	1-2 times a day	Always
If there is urinary incontinence during the day, how severe is it?		Drop by drop	Only panties wet	Completely wet pants
Does your child have urinary incontinence at night?	No	1-2 nights/week	3-5 nights/week	6-7 nights/week
If there is urinary incontinence at night, how severe is it?		Underwear or pajama gets wet		Bed gets wet
How many times a day does your child go to the toilet to pee?		Less than 7		More than 7
Does your child bother while peeing?		No		Yes
Does your child say he/she have pain while peeing?		No		Yes
Does your child pee by starting and stopping while peeing?		No		Yes
Will your child go to the toilet again when he/she has finished peeing?		No		Yes
Does your child suddenly say that pee is coming and rush to the toilet?		No		Yes
Is your child kneeling and trying to keep urine during play?		No		Yes
Does your child pee when pee comes before they can reach the toilet?		No		Yes
Does your child have constipation?		No		Yes
Life quality				
If your child has one or more of the above-mentioned complaints, how much does this affect her/his family, school and social life?		No it doesn't	It affects less	It seriously affects

Figure 1. The Voiding Dysfunction Symptom Score which was developed for Turkish children by Akbal et al.

In addition, the following questions about how the existing complaints affect the family, school, and social life of the child were asked: 1) To what extent do bladder problems affect parents and children in their choice of sport or activity?, 2) Does waking up due to bedwetting during sleep tire parents and children, or does it affect their daily activities?, 3) Is the child's friendships and participation in group activities affected?, 4) Is the child teased in class when he/she asks for permission to go to the toilet?, and 5) Do the child's complaints lead to learning difficulties or academic failure? The answers to the quality of life items were grouped under four headings: 0–it has no effect, 1–it has a slight effect, 2–it has a moderate effect, and 3–it has a serious effect.

The study was approved by the institutional research ethics committee and was conducted in accordance with the principles set forth in the Helsinki Declaration (protocol number: 80558721/g-179; date of approval: 05.30.2016). Written informed consent was obtained from the mothers of the children.

Statistical analysis

Statistical analysis was performed using SPSS 11.0 (SPSS Inc., Chicago, IL, USA). The values were expressed as the mean and standard deviation for continuous variables and as the median (interquartile range) for non-normally distributed variables. The Kolmogorov–Smirnov test was used to determine the normality of data. The means were compared using a one-way analysis of variance for the normally distributed data and the Kruskal–Wallis test for the non-normally distributed data. The categorical variables were compared using the chi-square test. A binary logistic regression analysis was performed to determine the association between obesity and lower urinary tract symptoms. A p value < 0.05 was considered statistically significant.

3. Results

Data from 369 patients older than 5 years of age were analyzed based on electronic records. Fifty-six patients had previously been examined for urinary symptoms. The mothers of seventy-nine patients indicated their refusal to participate in the study when spoken to by phone. Thirty-eight children had neurological, endocrinological, or gastrointestinal anomalies.

A total of 196 patients and their mothers were interviewed face-to-face. Twelve of the

patients interviewed face-to-face were excluded due to abnormal urinalysis at the first visit. Twenty of the remaining 184 patients did not complete their voiding diaries.

A total of 164 children who met the inclusion criteria (62 obese, 52 overweight, and 50 normal) were included in this study. No difference was found in gender or age between the groups (p = 0.253, p = 0.586, respectively). The symptom score was significantly higher in obese children than in overweight and normal-weight children (p = 0.004, p = 000, respectively, Figure 2). Overweight children had a higher symptom score than normal-weight children (p = 0.037). Based on the VDSS validated by Akbal et al., 36 (21.9%) patients had LUTD. The frequency of LUTD was more common in obese children than in overweight and normal-weight children (p = 0.001, p = 0.000, respectively). Although the frequency of LUTD was higher in overweight children than in normal-weight children, no statistically significant difference was found (p = 0.051). The frequency of urinary incontinence during daytime was higher in obese children than in overweight and normal-weight children and also in overweight children than in normal-weight children (p = 0.041, p = 0.000, p = 0.001, respectively). The findings on the severity of urinary incontinence during daytime are shown in Table 1. Both obese and overweight children had a higher frequency of urgency and an increased urinary frequency than normal-weight children (p = 0.002, p = 0.021 for urgency, p = 0.000, p = 0.037 for increased urinary frequency, respectively). Increased urinary frequency was higher in obese children than in overweight children (p = 0.045). The frequencies of voiding postponement and constipation were higher in obese children than in overweight and normal-weight children (p = 0.000, p = 0. 0.000 for voiding postponement, p = 0.031, p = 0.028 for constipation, respectively, Table 1). No statistically significant differences were found in the frequencies of voiding postponement and constipation between overweight and normal-weight children (p = 0.072, p = 0.296, respectively).

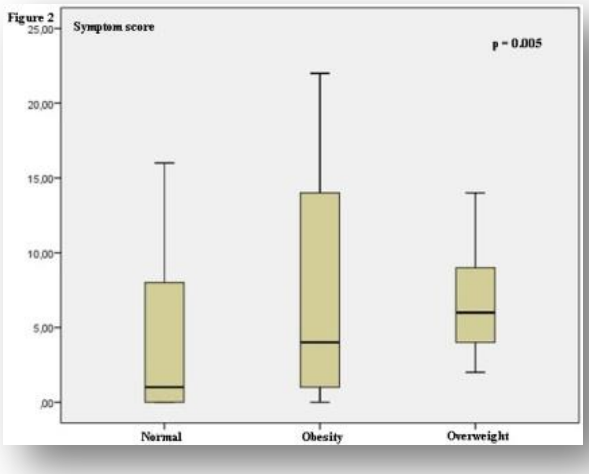


Figure 2. Symptom score was significantly higher in obese children than in overweight and normal weight children (p = 0.005).

Table 1. The features of the study groups.

	Obesity (n=62)	Overweight (n=52)	Normal (n=50)	p
Gender (female)	34 (54.8)	22 (42.3)	26 (52)	p1 = 0.153 p2 = 0.365 p3 = 0.098
Age (years)	11.67±3.17	10.48±3.38	12.2±1.86	p1 = 0.321 p2 = 0.439 p3 = 0.248
Weight (kg)	59.2±18.81	44.3±15.17	34.9±12.41	p1 = 0.031 p2 = 0.002 p3 = 0.008
Height (cm)	150.2±16.07	152.4±14.56	141.3±18.16	p1 = 0.387 p2 = 0.283 p3 = 0.402
Body mass index (kgm-2)	25.6±3.38	20.5±2.76	16.2±1.37	p1 = 0.036 p2 = 0.000 p3 = 0.043
Urinary incontinence during the day	19 (30.6)	9 (17.3)	4 (8)	p1 = 0.041 p2 = 0.000 p3 = 0.001
Urinary incontinence during the day severity				
Drop by drop	8 (12.9)	4 (7.7)	3 (6)	p1 = 0.048 p2 = 0.036 p3 = 0.098
Only panties wet	10 (16.1)	5 (9.6)	1 (2)	p1 = 0.034 p2 = 0.005 p3 = 0.000
Completely wet pants	1 (1.6)	-	-	
Urgency	28 (45.2)	19 (36.5)	8 (16)	p1 = 0.058 p2 = 0.002 p3 = 0.021
Increased urinary frequency	21 (33.9)	12 (23.1)	5 (10)	p1 = 0.045 p2 = 0.000 p3 = 0.037
Voiding postponement	33 (53.2)	9 (17.3)	7 (14)	p1 = 0.000 p2 = 0.000 p3 = 0.072
Painful and interrupted urination	6 (9.7)	4 (7.7)	2 (4)	p1 = 0.309 p2 = 0.097 p3 = 0.237
Symptom score	11 (4-18)	6 (3-9)	1 (0-8)	p1 = 0.004 p2 = 0.000 p3 = 0.037
Constipation	18 (29)	7 (13.5)	8 (16)	p1 = 0.031 p2 = 0.028 p3 = 0.296
Lower urinary tract dysfunction	20 (32.3)	9 (17.3)	7 (14)	p1 = 0.001 p2 = 0.000 p3 = 0.051
Monosymptomatic enuresis	7 (12.9)	4 (7.7)	4 (8)	p1 = 0.097 p2 = 0.165 p3 = 0.235

Values were expressed as mean ± SD or median (interquartile range) and number (percentage). UTI; urinary tract infection. A p value <0.05 was considered significant. P1; between obese and overweight patients, P2; between obese and normal weight patients, P3; between overweight and normal weight patients.

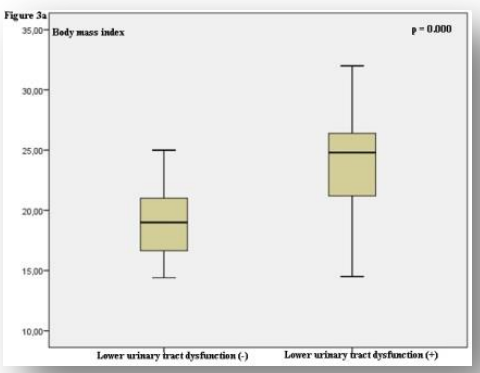
The results of the logistic regression analysis showing the association between lower urinary tract symptoms and obesity are shown in Table 2. Obesity was significantly associated with urgency, increased urinary frequency, voiding postponement, and constipation (p = 0.024, p = 0.031, p = 0.001, p = 0.024, respectively).

Table 2. The results of logistic regression analysis showing associations between obesity and lower urinary tract symptoms

	Odds ratio	%95 confidental interval	p
Urgency	1.352	1.141-3.910	0.024
Increased urinary frequency	1.226	1.219-1.769	0.031
Voiding postponement	1.726	1.387-2.918	0.001
Painful and interrupted urination	0.389	0.243-0.912	0.714
Constipation	1.551	1.112-2.151	0.024

A p value <0.05 was considered significant

Children with LUTD had a higher BMI than those with a symptom score < 9 (23.9 ± 4.06/20.2 ± 4.45 kgm-2, respectively, p = 0.000, Figure 3a). The BMI showed a sensitivity of 71.8% and a specificity of 64.9% for LUTD, with a cut-off of 23.7 kgm-2 (area under the curve [AUC ± SE]: 0.741 ± 0.049, confidence interval [CI]: 0.644–0.838, p = 0.000, Figure 3b).



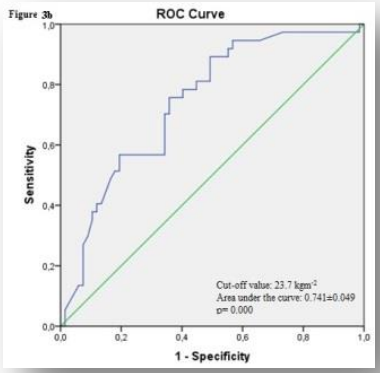


Figure 3a. The children with lower urinary tract dysfunction had higher body mass index than those of symptom score <9 (p = 0.000), **3b**. Body mass index showed a sensitivity of 71.8% and specificity of 64.9% for lower urinary tract dysfunction with a cut-off of 23.7 kgm-2 (area under the curve [AUC ± SE]: 0.741 ± 0.049, p = 0.000).

The answers to the quality of life items were compared among obese, overweight, and normal-weight children. The mothers of 29 (46.8%) obese children stated that lower urinary tract symptoms had no effect on their children's social and school lives, 12 (19.4%) had a slight effect, 16 (25.8%) had a moderate effect, and 5 (8%) had a serious effect. The mothers of 32 (61.5%) overweight children with LUTD stated that their complaints had no effect on their children's social and school lives, 10 (19.2%) had a slight effect, 8

(15.5%) had a moderate effect, and 2 (3.8%) had a serious effect. The mothers of 35 (70%) normal-weight children with LUTD revealed that their complaints had no effect on their children's social and school lives, 10 (20%) had a slight effect, and 5 (10%) had a moderate effect. The "it has a serious effect" response was greater in obese children than in overweight children ($p = 0.041$). The "it has no effect" response was less in obese children than in overweight and normal-weight children ($p = 0.036$, $p = 0.029$, respectively).

4. Discussion

We investigated the frequency of lower urinary tract symptoms using the VDSS validated by Akbal et al. in obese and overweight children who previously did not consult a doctor for urinary symptoms and were not tested for this purpose. The results of the study revealed that symptom scores were significantly higher in obese children than in overweight and normal-weight children. The frequencies of urgency and increased urinary frequency were higher in obese and overweight children than in children of normal weight. Obese children had higher frequencies of voiding postponement and constipation.

Children with lower urinary tract symptoms have an increased risk of recurrent urinary tract infections and permanent renal damage. Therefore, the early recognition of these symptoms and the planning of treatment are of great importance[8]. Several questionnaire forms have been developed to determine the presence and severity of lower urinary tract symptoms and to evaluate the response to treatment[3, 9]. Many studies have been conducted on symptom scoring associated with voiding problems in children. The Pediatric Lower Urinary Tract Scoring System is superior to the bladder volume wall index in distinguishing children with lower urinary tract symptoms from those without lower urinary tract symptoms[1]. The VDSS validated by Akbal et al. is significantly associated with doctors' clinical impressions about lower urinary tract symptom severity[10]. Using Akbal's questionnaire, the frequency of LUTD in schoolchildren was 9.3% in this study[11]. The frequency of LUTD was found to be 21.8% in healthy schoolchildren from Brazil using modified voiding symptom scores[8]. In our study, the frequency of LUTD was 21.9%. This high frequency may be due to the fact that our study included obese and overweight children.

Recently, obesity and being overweight have been considered risk factors for LUTD. One-third of children with daytime urinary incontinence are found to be obese[12]. Obesity leads to a decrease in functional bladder capacity by increasing intravesical and intra-abdominal pressure[13]. To date, only a few studies have investigated scoring systems for obese children. A study examining the presence and severity of LUTD using a modified version of the Dysfunctional Voiding Scoring System questionnaire (Brazilian Portuguese) showed higher median scores in obese children[14]. Another study found that obese children had higher symptom scores than normal-weight children with non-neurogenic LUTD [4]. In the present study, which used the VDSS validated by Akbal et al., the results showed that obese children had the highest symptom scores and that obesity was a risk factor for LUTD.

Urinary incontinence during the day is common in childhood. The prevalence of daytime urinary incontinence varies from 2.1% to 30.7%[15–18]. Urinary incontinence may be caused by increased intra-abdominal pressure in obese children[19]. Our study revealed that the frequency of urinary incontinence during daytime was 19.5%. Obese and overweight children had a higher frequency of urinary incontinence than normal-weight children.

Overactive bladder (OAB) is defined as urgency and increased daytime frequency, with or without urinary incontinence, in the absence of urinary tract infection or other pathological or neurological factors. Urinary urgency is the main sign of the OAB[20]. Obesity has been noted to increase OAB symptoms and to be an independent risk factor for OAB[21]. Although the relationship between obesity and disease is not clear, it is considered that the negative effects on bladder functions and the pressure on the pelvic organs due to changes in body structure are

responsible[22]. The risk of urgency was higher in obese children than in non-obese children[23]. In a study of Taiwanese children, urgency symptom scores were higher in obese children, and obesity was found to be a significant risk factor for OAB[24]. In this study, obesity was a significant risk factor for increased urinary frequency and urgency, which are symptoms of OAB. Our results highlighted the importance of questioning OAB symptoms in obese children.

Voiding postponement is observed by parents or carers as a urine-holding maneuver and delayed micturition[25]. Children with voiding postponement have an increased risk of recurrent urinary tract infections due to poor fluid intake, decreased voiding frequency, and urine stasis[26]. Behavior disorders and attention deficits are common among children with voiding postponement[27]. We found a significant association between obesity and voiding postponement. Obesity can lead to changes in children's psychological, emotional, and behavioral characteristics[28]. In addition, watching television may be the cause of obesity, leading to reduced activity and, therefore, reduced energy consumption[29]. Accordingly, we considered that obesity could be a risk factor for voiding postponement due to prolonged watching of TV, playing computer games, or accompanying behavioral disorders.

Constipation is a common complaint in childhood. The frequency of constipation and chronic diseases, such as hypertension and type 2 diabetes mellitus, have increased in obese children[30, 31]. Several studies have reported that obese children have a higher prevalence of functional constipation[32, 33]. Similar to the literature, our results demonstrate that obesity is a significant risk factor for constipation. This significant relationship may be due to poor nutrition, less physical activity, impaired production of hormones, such as motilin and pancreatic polypeptide, and autonomic dysfunction in obese children[34–36].

Urinary incontinence negatively affects children's social activities, behaviors, and emotions[37]. Children who are allowed to leave the classroom because of incontinence problems are often considered "different" or are ridiculed[38]. LUTD is also associated with a lower self-image and a lower quality of life in children[39, 40] The vast majority of children with symptoms have learning difficulties in school[41]. In our study, quality of life was affected at different degrees in more than half of the obese children and nearly half of the overweight children.

This study has several limitations. First, this study had a small sample size. Second, symptom scoring was performed based on the mothers' memories and answers. Third, lower urinary tract symptoms were evaluated in obese, overweight, and normal-weight children, and radiological findings and urodynamic results were not included in the assessment.

In conclusion, children who were not taken to the doctor because of urinary problems were included in the study. One-fifth of the children were found to have LUTD. This indicates that children who come to the outpatient clinic should be questioned about lower urinary tract symptoms, even if they do not report complaints about urination. According to the results of our study, obesity is a significant risk factor for LUTD. Lower urinary tract symptoms can be detected in obese children using the VDSS questionnaire validated by Akbal et al. Our results can serve as a basis for further investigations of obese children.

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