

The Relationship Between Obesity, Depressive Symptoms and Sleep Duration in Children and Adolescents

Şişman Çocuk ve Ergenlerde Depresyonun Uyku Miktarı ve Şişmanlığın Derecesi ile İlişkisi

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ABSTRACT

Aim: In this study, we aimed to investigate the relationship between symptoms of depression and sleep duration with anthropometric measurements in obese children and adolescents.

Methods: Forty children and adolescents (25 girls) diagnosed with obesity were included. Sociodemographic and clinical data were obtained using the sociodemographic and clinical data form. Age, gender, height and weight values were recorded; body mass index (BMI), percentile and standard deviations (SDS) were calculated. Children's Depression Inventory (CDI) was used to assess depression. The degree of obesity was classified according to the BMI values of the cases, the cases in class 1 and 2 were grouped as "subgroup 1", and the cases in class 3 as "subgroup 2". Groups were compared in terms of sociodemographic features, depression and sleep duration.

Results: Mean age of the group was 12.8±2.6 years. There was a significant difference in patients with depression in terms of body weight, BMI, BMI-SDS and sleep duration compared to those without depression. CDI scores in subgroup 2 were significantly higher than subgroup 1. CDI scores were positively correlated with body weight, BMI and BMI-SDS and negatively correlated with sleep duration. Sleep duration was negatively correlated with body weight and BMI. **Conclusion:** Depressive symptoms and sleep duration may be associated with the severity of obesity in children. We consider that the assessment of depression and sleep disorders by a pediatric psychiatrist is important and useful in children with obesity.

Keywords: Obesity, depressive symptoms, body mass index, sleep

ÖZ

Amaç: Bu çalışmada amacımız şişman çocuk ve ergenlerde şişmanlık ile ilişkili antropometrik ölçümler ile depresyon ve uyku süresi arasındaki ilişkiyi araştırmaktır.

Yöntemler: Çalışmaya kırk şişman çocuk ve ergen dahil edildi. Vücut kitle indeksi yaş ve cinsiyete göre 95 persentil ve üstünde olanlar şişman olarak tanımlandı. Sosyodemografik ve klinik veriler yazarlar tarafından oluşturulan sosyodemografik ve klinik veri formu kullanılarak elde edildi. Çalışmaya katılan çocuk ve gençlere "Çocuklar için depresyon ölçeği (ÇDÖ)" doldurtuldu. Katılımcıların boy ve kilosu kaydedildi, vücut kitle indeksi (VKİ) ve vücut kitle indeksi standart sapması (VKİ-SDS) hesaplandı. Çalışmaya katılanlar VKİ değerine göre şişmanlık şiddeti açısından Sınıf 1 ve sınıf 2 olanlar 1.grup ve sınıf 3 olanlar 2. grup olarak gruplandırıldı. Gruplar sosyodemografik özellikler, depresyon ve uyku süresi açısından karşılaştırıldı.

Bulgular: Çalışmaya katılan 40 olgunun 25'i kızdı ve ortalama yaş 12.8±2.6 idi. Depresyonu olanlarda vücut ağırlığı, VKİ, VKİ-SDS ve uyku süresi depresyonu olmayanlara göre anlamlı olarak farklıydı. 2.grupta (Sınıf 3) ÇDÖ puanları anlamlı olarak daha yüksekti. ÇDÖ skorları vücut ağırlığı, VKİ, VKİ-SDS ile pozitif, uyku süresi ile negatif korelasyon göstermekteydi.

Sonuç: Şişman çocuk ve gençlerde yüksek depresyon skorları şişmanlık şiddeti ve azalmış uyku süresi ile ilişkili olabilir. Şişman çocuk ve ergenlerin depresyon ve uyku bozuklukları açısından bir çocuk ergen psikiyatrisi uzmanı ile birlikte takip edilmesinin önemli ve gerekli olduğu düşünülmektedir.

Anahtar Kelimeler: Şişmanlık, Depresif belirtiler, vücut kitle indeksi, uyku

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INTRODUCTION

Obesity has recently become an increasingly common public health problem with a rising prevalence among children and adolescents across the world.[1,2] So far, many different methods have been used for identifying and grading obesity in childhood. According to a consensus published in 2017, a child over 2 years of age with a body mass index (BMI) \geq 95th percentile for age and sex is defined as “obese”. [3] Severe obesity was found to be more common in girls prior to adolescence and following the onset of puberty in boys.[5] It has been suggested that children with a BMI value less than 120% of the 95th percentile value could be classified as “class 1”, whereas those with a BMI value between 120% and 140% of the 95th percentile for age and sex defined as class 2, and those with a BMI value over 140% of the 95th percentile for age and sex classified as “class 3”. [4]

It is well known that obesity leads to various metabolic problems such as atherosclerosis, diabetes and cardiovascular diseases [2], and is associated with psychosocial difficulties as well. Obese children, who have difficulties in relationships with peers due to their physical appearance may face bullying.[6] Moreover, obesity can negatively affect the development of self-esteem and affect quality of life by causing physical difficulties in children and adolescents. [7]

In addition to the physical and psychosocial difficulties, obesity in children and young adults can also provide a basis for psychiatric disorders. In a review and meta-analysis study, Luppiano et al. concluded that obesity increased the risk of depression and that depression increased the risk for obesity.[8] It has also been reported that depression and obesity might have common clinical features such as sleep disorders.[9] It has been suggested that obesity decreases sleep duration in children and as a result, the feeling of hunger increased, in addition to a decline in insulin sensitivity. Thus, a decrease in sleep time seems to be associated with the appearance or/ and the persistence of obesity.[9-11] Children under the age of 5 are recommended to sleep at least 11 hours a day, whereas those aged 5 to 10

years of age are recommended to sleep at least 10 hours a day and children over 10 years old are recommended to sleep at least 9 hours a day.[10] It has been observed that the presence of short sleep time (<10.5 hours) in children aged 3 years is associated with obesity at the age of 7 years. [12] Another report suggests that every single hour increase in sleep time decreases the risk of obesity by an average of 9%, and as a result, that children and adolescents should sleep longer to prevent excessive weight gain and obesity.[13] Similarly, sleep duration has been reported to be reduced in children and adolescents who were diagnosed with depression and that insomnia in depression, was found to be associated with an increased risk of suicide.[9] It was stated that untreated sleep problems could make it difficult to get rid of both depression and obesity and might increase the risk of suicide in obese children and adolescents with depression.[9] The treatment of sleep problems might thus be considered to be a target for the treatment of obesity and depression.

Taken together, evaluating obese children and adolescents in terms of depression and the amount of sleep they get, may be helpful to reduce complications and be a more effective treatment and follow-up process. To assess the impact of depression and sleep duration in the severity of obesity, we aimed to investigate the relationship between anthropometric measurements, such as body weight, BMI, BMI standard deviation (SDS), and percentiles that have been used in defining and grading obesity with depression and sleep duration in obese children and adolescents.

PATIENTS AND METHOD

Forty children and adolescents who applied to the outpatient pediatric endocrinology clinic of our hospital and were diagnosed with obesity, were included in our study. Patients with a BMI \geq 95% based on age and gender, were defined as “obese”. [14] The subjects with endocrinopathies such as hypothyroidism, hypercortisolism and syndromes leading to obesity, were excluded. The study group consisted of children and adolescents without a diagnosis of mental retardation, autism spectrum disorder or psychotic disorder. Parents of all patients gave their informed consent for their child to participate in the study after its protocols

had been fully explained. This study was approved by the Local Ethics Committee of the HSU, Zeynep Kamil Women and Children's Diseases Training and Research Hospital on 19.12.2018 (approval number:160) and adhered to the Declaration of Helsinki.

Clinical interviews were conducted with children and their families who agreed to participate in the study and the scales were applied. Sociodemographic and clinical data, including sleep duration, were obtained using the sociodemographic and clinical data form created by the authors. Sleep duration was calculated by the data provided by parents, which was based on the sleep and wake up time of the children. Psychological examination of the patients was performed by experienced pediatric endocrinologists (A.G and B.Ö) and rating scales were applied by a nurse in the clinic, just after the clinical evaluation. Age, gender, height and weight values were recorded and the body mass index (BMI) was calculated with the $(\text{BMI}) = \text{weight (kg)} / \text{height}^2 (\text{m}^2)$ formula; percentile and standard deviations (SDS) were calculated by using the ÇEDD Çözüm software (TPEDS Metrics) and evaluated according to the age and gender-appropriate charts.[15] The degree of obesity was classified according to the BMI values of the cases. Obese children with a BMI value less than 120% of the 95th percentile value were classified as "class 1", whereas those with a BMI value between 120% and 140% of the 95th percentile for age and sex were defined as class 2, and those with a BMI value over 140% of the 95th percentile for age and sex as "class 3". Cases in class 1 and 2 were grouped as "subgroup 1", and the cases in class 3 as "subgroup 2".[4]

Socioeconomic level (SEL) was established using the Hollingshead-Redlich scale.[16] Five different socioeconomic levels are defined in the scale: the highest socioeconomic level is stated as 1 and the lowest as 5.

The Turkish version of the "Children's Depression Inventory (CDI)" [17] was used to assess depression. This scale is a 27 item self-report scale consisting of 3 options, where each item is scored between 0-2. The highest score that can be obtained on this scale is 54 and 19 is the cut-off value for depression. Higher scores indicate

greater severity of depression.

Obesity subgroups were compared in terms of sociodemographic features, depression and sleep duration. Children and adolescents with depression (CDI score ≥ 19) were compared to patients without depression (CDI <19) in terms of sociodemographic and clinical features, as well as sleep duration. Correlation analysis were performed in terms of potential relationships between the severity of depression, anthropometric measurements and sleep duration in obesity.

Statistics

All the analysis were performed using the Statistical Package for the Social Sciences 22. The Shapiro-Wilk method was used to determine whether the data was normally distributed. Descriptive statistics were presented as numbers and percentages for categorical variables, mean \pm standard deviation or median (interquartile range) for continuous variables depending on normal distribution. The Chi-square test was used to compare ratio of gender. The Student t test or Mann-Whitney test was used compare continuous variables according to CDI and sociodemographic status, depending on parametric test assumptions. The Spearman rank correlation coefficient was calculated for the relationships between CDI score, anthropometric measurements and sleep duration. For all tests, a p-value of less than 0.05 was accepted as statistically significant.

RESULTS

Of the 40 obese children and adolescents in our study, 25 were girls (62.5%) and 15 (37.5%) were boys. The mean age of the subjects was 12.8 ± 2.6 years. When analyzed in terms of socioeconomic level (SEL), 14 cases (35%) were at the 4th socioeconomic level (SEL). The sociodemographic and clinical characteristics of the participants are summarized in Table 1.

The number of patients with a CDI score of ≥ 19 was eight. When the study group was divided into two groups as CDI score <19 and CDI score ≥ 19 , there was no significant difference between the groups in terms of age, gender and SEL (Table 1). There was a significant difference between patients with depression in terms of body weight

(p = 0.006), body weight SDS (p <0.001), BMI (p <0.001), BMI-SDS (p <0.001) and sleep duration (p = 0.002), compared to the patients without depression.

Table 1: Sociodemographic and clinical features of the whole group and comparisons in terms of CDI

	Whole Group n=40 Means (SD)	CDI<19 n=32 (80%) Means (SD)	CDI≥19 n=8 (20%) Means (SD)	p
Mean age (years)	12.8±2.6	12.6±2.8	13.5±2	0.376
Gender				0.052
Female	25 (62.5%)	17 (42.5%)	8 (20%)	
Male	15 (37.5%)	14 (35%)	1 (2.5%)	
SEL				0.159
1	2 (5%)	1 (2.5%)	1 (2.5%)	
2	5 (12.5%)	4 (10%)	1 (2.5%)	
3	11 (27.5%)	7 (17.5%)	4 (10%)	
4	14 (35%)	14 (35%)	-	
5	8 (20%)	6 (15%)	2 (5%)	
BW (kg)	81.4±24.9	76.3±21.3	101.7±29.3	0.006
BW-SDS	3.22±1.34	2.87±1	4.6±1.68	<0.001
Height (cm)	157.2±12.7	155.4±12.8	164.6±9.7	0.267
Height-SDS	0.65±1.3	0.51±1.3	1.19±1.2	0.108
BMI (kg/m2)	31.23±5.9	31±4.6	37.1±8.1	<0.001
BMI-SDS	2.86±0.69	2.69±0.53	3.5±0.9	<0.001
BMI %	99.31±1	99.2±1.08	99.78±0.34	0.141
Sleep Duration (minutes)	509±79	527±61	436±105	0.002

SEL: Socioeconomic level, BW: Body Weight, BW-SDS: Body Weight Standard Deviations, BMI: Body Mass Index, BMI-SDS: Body Mass Index Standard Deviation, SD: Standard deviation, CDI: Children's depression inventory

When the obesity subgroup analysis were performed, there was no significant difference found between the groups in terms of age, gender and SEL. However, CDI scores in subgroup 2 (Class 3) were significantly higher than subgroup 1 (Class1+Class2) (p = 0.003). There were no significant differences found between subgroup 2 and subgroup 1 in terms of sleep duration (p = 0.251) (Table 2).

According to the correlation analyses, CDI scores were positively correlated with body weight (r=0.445; p=0.004), body weight SDS (r=0.475; p=0.002), BMI (r=0.497; p=0.001) and BMI-SDS (r=0.523; p=0.001) and negatively correlated with sleep duration (r=-0.363; p=0.021). Moreover, sleep duration was negatively correlated with body weight (r=-0.619, p<0.001) and BMI (r=-

0.607, p<0.001).

Table 2: Sociodemographic and clinical features of Subgroups 1 and 2

	Subgroup 1 (Class1 + Class 2)	Subgroup 2 (Class 3)	p
Mean age (years)	12.5±2.67	13.3±2.6	0.372
Gender			0.522
Female	19 (47.5%)	6 (15%)	
Male	10 (25%)	5 (12.5%)	
SEL			0.205
1	-	2 (5%)	
2	4 (10%)	1 (2.5%)	
3	9 (22.5%)	2 (5%)	
4	10 (25%)	4 (10%)	
5	6 (15%)	2 (5%)	
CDI score	10.6±6.7	18.6±8.5	0.003
Sleep Duration (minutes)	518±64	485±109	0.251

SEL: Socioeconomic level, CDI: Children's Depression Inventory

DISCUSSION

Our study investigated the relationship between the anthropometric features related to obesity, symptoms of depression and sleep duration, in children and adolescents who were diagnosed with exogenous obesity. The rate of depression according to the CDI in our group was 20%. In comparison, it has been reported that the prevalence of depression in children and adolescents was around 2% and 4-8%, respectively [18], whereas Sutura et al. detected depression in 10.4% of the obese children and reported that the risk of depression was higher in obese children compared to non-obese children.[19] Obesity has been suggested to be a risk factor for the development of depression and similarly, depression might be a risk factor for the development of obesity.[8] The relationship between obesity and depression may be due to the influence of the shared environment, common physiological or genetic factors.[20] Depression in obese individuals has been thought to be associated with the chronic inflammatory process of obesity, dysregulation of the hypothalamic-pituitary adrenal axis, psychosocial effects, neuroendocrine changes and negative effects of insulin resistance on the brain. [8,21-25] Similarly, depression has been found to play a role in the development of obesity due to psychosocial and neuroendocrine changes, in addition to the unhealthy lifestyle features such as decreased physical exercise, poor eating

patterns and irregular sleep, observed in patients diagnosed with depression [8]. Furthermore, the same researchers reported that the relationship between overweight and depression was weaker than the relationship between severe obesity and depression. [8] This data is compatible with our results: in our cases, it was concluded that the severity of depression increased in line with the increasing severity of obesity. Physical strain, pain and disruption of the body image due to the increasing severity of obesity might affect the development and severity of depression. In clinical settings, it is important to evaluate children and adolescents with severe obesity in terms of comorbid depression. Accompanying depression in obese children may complicate the lifestyle arrangements and as a result, may affect the treatment response. In particular, physicians in pediatric clinics should keep in mind the diagnosis of depression in obese children and adolescents, and refer them for a child and adolescent psychiatry evaluation.

Studies that were focused on the relationship between sleep duration and obesity suggested that there might be a relationship between decreased sleep time and obesity, and that increasing sleep duration could prevent children from the development of obesity. In addition, it has been proposed that when sleep duration decreased in those with depression, that duration of sleep might therefore be a risk factor for both obesity and depression. [10] Reeves and colleagues [9] reported that treatment of depression became complicated, and the risk of suicide increased in children and adolescents who slept less. It was stated that reduced amount of sleep in children with obesity might make treatment of obesity difficult and that providing adequate sleep could be an important factor to prevent obesity in children.[10] In our study, it was concluded that the amount of sleep decreased in obese children and adolescents with depression, compared to those without depression. Moreover, it was observed that duration of sleep decreased as body weight and body mass index increased. Our study supports the view that the amount of sleep might be associated with the severity of obesity and symptoms of depression. Assessment of sleep duration during follow-up and, if inadequate, adjusting the amount of sleep accordingly, may

increase the success of the treatment in obese children and adolescents. Providing adequate sleep may help to increase the quality of life and lead to a healthier life for obese children and adolescents, by improving the symptoms of obesity and depression.

Limitations: There were some limitations in our study, namely that the data stems from a cross-sectional evaluation and does not allow for the establishment of a causal relationship. In addition, since the patients included in our study were selected from a clinical sample, it makes it difficult to generalize our results; the absence of a control group might also be considered as a limitation. Additionally, diagnosis of depression was made by CDI, the data about sleep duration was primarily based on information from parents and there we had a greater number of female than male participants in our study. Finally, the low number of patients enrolled in the study and the low number of patients with depression and severe obesity may be another limitation, and as a result of this low number, the effect of adolescence itself on depression was not be investigated.

Conclusion: Our study revealed that the severity of depression and parameters of obesity were positively associated in children and adolescents. In addition, a reduced amount of sleep was associated with both depression and severity of obesity. Clinicians should keep in mind that assessment of depression and sleep are therefore important factors in the evaluation and the intervention of obesity, in children and adolescents. A comprehensive multidisciplinary approach, including a child and adolescent psychiatrist, may also be beneficial in these cases, and those with severe obesity in particular should be evaluated for depression. Recognition and treatment of accompanying depression and sleep deprivation are thought to be important for the effective treatment of obesity. Further prospective studies with larger groups of obese children from clinical and non-clinical samples are needed to investigate the association between sleep duration, psychiatric symptoms and features of obesity.

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