# Body Weight Parameters at the Initial Visit for Eating Disorders in Adolescents: Are These the Markers of Serious Complications?

## Yeme Bozukluğu Tanılı Ergenlerin İlk Başvurularında Vücut Ağırlığı Parametreleri: Bunlar Ciddi Komplikasyonların Belirteçleri midir?

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## ABSTRACT

**Objective:** Eating disorders (ED) are psychiatric disorders often accompanied by medical complications. This study aimed to identify the complications in ED patients during hospital admission and their relationship with body weight (BW).

**Material and Methods:** Patients diagnosed with ED per DSM-5 criteria seen at least once in the adolescent department were included. Digital medical records were used to obtain patient information. Body mass index (BMI), BMI percentile, and percentage of BW by height (IBW%) were calculated to analyze their association with medical complications.

**Results:** Our study included 144 patients, 140 (97.2%) females and 4 (2.8%) males. Of the patients; 94 were analysed as Anorexia Nervosa (AN), 28 as Atypical AN and 17 as Bulimia Nervosa (BN). At least one cardiac complication was detected in 29.3% (39), gastrointestinal complications in 54.2% (78), hypoglycaemia in 18.2% (26), secondary amenorrhoea in 34.5% (48) and 45.8% (66) received inpatient treatment. Patients with IBW%<75 exhibited significantly higher rates of hypoglycemia, bradycardia, low sT3, amenorrhea, and hospitalization compared to those with IBW% ≥ 75 (p<0.001). Bone mineral density (BMD) was significantly inversely associated with Z-score, time to ED diagnosis and duration of amenorrhoea (p=0.006; p=0.044; p=0.032, respectively).

**Conclusion:** Our findings show that at least one medical complication frequently develops in ED patients at the initial evaluation. Patients with AN and BN, which usually start in adolescence, may frequently present to paediatric outpatient clinics with medical complaints. The role of internal physicians in the early diagnosis of ED is important to prevent serious complications in these patients.

**Key Words:** Adolescent, Anorexia nervosa, Bulimia nervosa, Eating disorder, Medical complication

## ÖZ

**Amaç:** Yeme bozuklukları (YB), sıklıkla tıbbi komplikasyonların eşlik ettiği psikiyatrik hastalıklardır. Bu çalışmada, YB hastalarının hastaneye başvuru sırasındaki komplikasyonları ve ilk tanısal başvuru değerlendirmesindeki vücut ağırlığı (VA) ile ilişkisi değerlendirilmiştir.

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**Gereç ve Yöntemler:** Adolesan Sağlığı ve Çocuk Psikiyatrisi değerlendirilmesi ile DSM-5 tanı kriterlerine göre YB tanısı almış hastalar çalışmaya dahil edilmiştir. Hastaların bulguları dijital tıbbi kayıt sisteminden elde edilmiştir. Tıbbi komplikasyonlarla VA ilişkilerini analiz etmek için vücut kitle indeksi (VKİ), VKİ persentili ve boya göre ideal VA yüzdesi (%İVA) hesaplanmıştır.

**Bulgular:** Çalışmamıza 140'ı (%97.2) kız, 4'ü (%2.8) erkek olmak üzere 144 hasta dahil edildi. Hastaların; 94'ü Anoreksiya Nervoza (AN), 28'i Atipik AN ve 17'si Bulimia Nervoza (BN) olarak değerlendirildi. Hastaların %29.3'ünde (39) en az bir kardiyak, %54.2'sinde (78) gastrointestinal komplikasyon, %18.2'sinde (26) hipoglisemi ve %34.5'inde (48) sekonder amenore saptandı ve %45.8'i (66) ise hastaneye yatırıldı. İVA<%75 olan hastalarda hipoglisemi, bradikardi, düşük serbest triiodotironin (sT3), amenore ve hastaneye yatış oranları İVA≥ %75 olanlara göre istatistiksel anlamlı fazlaydı (p<0.001). Kemik mineral yoğunluğu (KMD) Z-skoru, YB tanısına kadar geçen süre ve amenore süresi ile ters ilişki olduğu saptandı (sırasıyla p=0.006; p=0.044; p=0.032).

**Sonuç:** Bulgularımız, YB hastalarında ilk değerlendirmede sıklıkla en az bir tıbbi komplikasyonun geliştiğini göstermektedir. Genellikle ergenlik döneminde başlayan AN ve BN hastaları sıklıkla medikal şikayet ile pediatri polikliniklerine başvurabilirler. Bu hastalarda ciddi komplikasyonların önlenmesi için dahili hekimlerin YB erken tanısında rolü önemlidir.

**Anahtar Sözcükler:** Ergen, Anoreksiya nevroza, Bulimia nevroza, Yeme bozukluğu, Medikal komplikasyon

## INTRODUCTION

Anorexia nervosa (AN) and bulimia nervosa (BN) are types of ED that often onset in adolescence and progress with significant complications involving all body systems (1). According to DSM-5 diagnostic criteria, lifetime AN was reported by 0.8-6.3%, BN by 0.8-2.6%, and binge eating disorder (BED) by 0.6-6.1% of young women. Avoidant/Restrictive Food Intake Disorder (ARFID) is the new definition in DSM-5 of the type formerly called "Feeding Disorder in Infancy or Early Childhood". Its incidence in children and adults varies between 0.5%-5% (2). AN is the most common cause of death among psychiatric disorders. Although some of the deaths are suicides, half of them are caused by medical complications (3).

Although the body weight (BW) of AN patients is very low compared to their peers, they are constantly preoccupied with the thought and behavior of losing weight. AN patients are dissatisfied with their weight and/or their body, sometimes part of their body. They usually have a restricted diet, some of them also have a one-way diet. BN and AN binge-purge subtype engage in compensatory behaviors such as vomiting and excessive exercise after consuming inappropriate food (4). Inappropriate restricted feeding, compensatory behaviors and rapid weight loss can lead to serious morbidity. Electrolyte disturbances, metabolic disorders, bradycardia and other cardiovascular pathologies are serious acute complications that should be closely monitored in patients with eating disorders (5). Common endocrine complications in patients with AN include amenorrhoea, oligomenorrhea, cessation of puberty, hypothyroidism, and hypercortisolism. In patients with amenorrhoea, osteopenia and osteoporosis are long-term complications leading to clinically significant fractures and increased risk of fractures throughout life (6).

In a review, it was stated that the degree of low BW or rapid loss of BW predicts medical complications (7). Although ED is a psychiatric disorder, patients often present to health centers due to medical complications. Adolescents with EDs may present to the pediatrician with symptoms related to weight loss, malnutrition or vomiting behaviors. Symptoms such as constipation, early feeling of satiety, oesophagitis due to vomiting may be the first reason for presentation (8). They may also present with common symptoms such as fatigue, hair loss, chills and menstrual irregularities. Life-threatening complications such as bradycardia, hypotension and hypoglycemia may be detected on examination (9).

Patients with AN and BN with onset in adolescence are more likely to present to the pediatric outpatient clinic with one of the above symptoms. Recognising and early management of medical complications accompanying eating disorders is critical for the treatment and recovery of EDs (10). This study aimed to determine the complications in eating disorder patients at first presentation and how they were related to BW.

## MATERIAL and METHODS

Between April 2019 and January 2023, 144 adolescents aged 12-18 years who were diagnosed with eating disorders (AN, BN and ARFID) according to DSM-5, and admitted to Adolescent Health Department of Ankara Bilkent City Children's Hospital were included. The study was approved by Ankara Bilkent City Hospital, Ethics Committee (23.11.2022-2860). In this retrospective cross-sectional study, the symptoms and findings of the patients at the time of admission were taken from the medical records. A digital patient file containing detailed information of all systemic examination findings, water consumption and systemic symptoms such as constipation, vomiting and bowel movements characteristics was examined. Constipation was determined by using Rome-III criteria (11).

Some medical complications were evaluated in relation to BW at the time of diagnosis; BMI (weight (kg)/height$^2$ (m$^2$)); BMI-percentile, percentage of ideal body weight (%IBW) (weight (kg)/weight-for-height in the 50% percentile (kg)x100) (12).

Orthostatic blood pressure, pulse rate and body temperature (°C) were evaluated. A peak heart rate <60 beats/sec was considered bradycardia (13).

Patients' daily water intake was assessed according to the Turkey 2015 Dietary Guidelines (14). Urine density between 1007 and 1030 was considered normal. Leukocyturia was

considered as 5 leukocytes per Hpf (high power field) (X40) and more in complete urine examination.

Patients who did not menstruate between 21-45 days despite 2 years after menarche, whose menstruation period lasted less than 3 days and more than 10 days, and whose daily number of pads was less than 1-2 and more than 7 were considered as irregular menstruation. Those who did not menstruate for at least 3 consecutive cycles were considered as secondary amenorrhoea (15).

Electrocardiography (ECG) was performed and pulse rate and QTc values were calculated. Echocardiographic findings (mitral valve prolapse (MVP), mitral regurgitation (MR), pericardial effusion were obtained from echocardiography and cardiological evaluation. The results of the lumbar spine BMD measurements were assessed. Normal values of complete blood count were considered according to the guidelines of the Turkish Society of Haematology for the diagnosis and treatment of erythrocyte diseases and hemoglobin disorders (16).

According to the 2022 guidelines of the International Pediatric and Adolescent Diabetes Association, blood sugar levels below 70 mg/dL are considered hypoglycemia (17).

Other disease-specific biochemistry and hormone results were evaluated on the basis of the hospital laboratory references according to the age of the patients.

**Statistical Analysis**

The IBM Statistical Package for Social Sciences (SPSS), Windows version 23.0 (SPSS Inc. Chicago, USA) was used for the statistical analysis of the research data. In the descriptive statistics section, categorical variables were presented as numbers and percentages; continuous variables were presented as mean ± standard deviation and median (minimum-maximum value). The conformity of continuous variables to normal distribution was assessed using visual (histogram and probability plots) and analytical methods (Kolmogorov-Smirnov/Shapiro-Wilk tests).

As a result of the normality analyses, the paired sample t-test was used for comparison analyses between two dependent groups for data of continuous variables that were found to be normally distributed between groups.

For comparison analyses of categorical variables between independent groups, the Pearson chi-square test, continuity correction test and Fisher's exact test were used.

The relationship between BMD values and independent predictors was assessed using Pearson correlation analysis for normally distributed data and Spearman correlation analysis for non-normally distributed data. When the absolute value of the correlation coefficient (rho) is $r \leq 0.30$, there is a weak relationship, 0.30-0.50 is a moderate relationship, and $r \geq 0.50$ is a strong relationship. In this study, the level of statistical significance was accepted as $p < 0.050$.

## RESULTS

A total of 144 patients were included in our study, of whom 4 (2.8%) were male and 140 (97.2%) were female. Patient diagnoses were as follows: 65.3% (94) AN (restrictive and binge types), 19.4% (28) atypical AN, 11.8% (17) BN and 3.5% (5) ARFID. Hospitalisation was an indication in 45.8% (66) of the patients.

Of the hospitalised patients, 80.3% (53) were diagnosed with AN, 9.1% (6) with atypical AN, 9.1% (6) with BN and one patient with ARFID.

At admission, 81.9% (118) of the patients had lost weight, 13.9% (20) had vomited, 3.5% (5) had lost their appetite, and 0.7% (1) had binge eating. The mean age at presentation was 14.96±1.52 (11.0-18.0) years. The mean difference between age at presentation and age at diagnosis was 11.75±9.18 (6.0-48.0) months. The mean BW and IBW at presentation were 47.2±9.4 (28.0-82.0) and 88.4±17.3% (56.0-150.0), respectively. Details of the patients' height, BMI, BMI(p), blood pressure (BP), pulse parameters are shown in Table I.

Orthostatic pulse difference was found in 6.1% (8) of patients, orthostatic systolic blood pressure difference in 3.8% (5) and orthostatic diastolic blood pressure difference in 9.2% (12).

Secondary amenorrhoea was found in 34.5% (48) and primary amenorrhoea in 2.9% (4) of the 139 patients whose menstruation was evaluated. Irregular menstruation was found in 38.8% (33) of the patients. The mean duration of amenorrhoea was 7.9±3.4 (4.0-18.0) months.

Of the four patients with primary amenorrhoea, three were AN restrictive and one was ARFID. Of the 48 patients with secondary amenorrhoea, 40 were AN (restrictive), two were AN (restrictive and binge type), two were BN and four were AN (atypical). The mean value of BMD Z score was -0.88±1.31.

It was found that 47.2% (67) of the patients had dry skin, 43% (61) had hair loss and 33.8% (48) had lanugo hair growth. A total of 45 patients (31.3%) consumed less than one litre of water per day.

**Table I: Height and Body Weight Characteristics of the Patients at Admission**

| Parameters | (n=144) |
|---|---|
| Body Weight, kg* | 47.2 (28.0-82.0) |
| Height, cm† | 161.2±6.9 |
| BMI, kg/m²* | 18.1 (12.78-31.63) |
| BMI-Percentile* | 20.1 (0.02-99.8) |
| IBW %* | 88.4 (56.0-150.0) |
| Body Temperature °C† | 36.46±0.21 |
| Pulse (n=133)* | 80.7 (45.0-120.0) |
| Systolic Blood Pressure, mmHg* | 101.6 (80.0-130.0) |
| Diastolic Blood Pressure, mmHg* | 65.7 (40.0-90.0) |

*: median ( min-max), †: mean±SD

## Table II: Laboratory Parameters of Patients

| Parametreler | n (%) |
|---|---|
| Creatinin, mg/dL (n=144) | |
| Low | 4 (2.8) |
| High | 16 (11.1) |
| Ure, mg/dL (n=140) | |
| Low | 1 (0.7) |
| High | 10 (7.1) |
| Uric Acid, mg/dL (n=140) | |
| Low | 1 (0.7) |
| High | 29 (20.7) |
| Total Protein, g/L (n=139) | |
| Low | 15 (10.8) |
| High | 1 (0.7) |
| Albumin, g/dL (n=141) | |
| Low | 2 (1.4) |
| High | 56 (39.7) |
| Aspartate aminotransferase (AST), U/L (n=143) | |
| High | 16 (11.2) |
| Alanine aminotransferase (ALT), U/L (n=139) | |
| High | 18 (12.9) |
| TSH, mU/L (n=139) | |
| Low | 4 (2.9) |
| High | 2 (1.4) |
| rT4, ng/dl (n=139) | |
| Low | 5 (3.6) |
| High | 4 (2.9) |
| rT3, ng/L (n=102) | |
| Low | 65 (62.5) |
| High | 1 (1.0) |
| Leucocyte, x $10^9$/L (n=144) | |
| Low | 23 (16.0) |
| High | 2 (1.4) |
| Hemoglobin, g/dL (n=144) | |
| Low | 13 (9.0) |
| High | 5 (3.5) |
| Neutrophile, x $10^9$/L (n=144) | |
| Low | 16 (11.1) |
| High | 1 (0.7) |
| Trombocyte, x $10^9$/L (n=141) | |
| Low | 4 (2.8) |
| High | 2 (1.4) |

In total, 29.3% (39) of patients presented with at least one cardiac complication. Bradycardia was found in 23.1% (30), mitral regurgitation in 21.1% (15), pericardial effusion in 8.5% (6) and MVP in 7% (5) of all patients. The mean heart rate was 69.2±14.5 (41.0-124.0)/min and the mean corrected QT interval (QTc) was 0.39±0.05 (0-0.44)ms. None of the patients had a pathologically long QTc interval.

Of the participants, 54.2% (78) had at least one gastrointestinal complication. Vomiting was observed in 29.9% (43) and constipation in 51.4% (74) of the patients. Three patients had oesophagitis, two had rectal bleeding and one had hemorrhoids. At least one endocrinological complication was found with 68.1% (98) of the patients. Hypoglycemia occurred in 18.2% (26) of the patients and the mean glucose level was 79.06±13.95 (47.0-152.0) mg/dl.

The creatinine level was found to be high in 11.1% (16), the urea level in 7.1% (10) and the uric acid level in 20.7% (29) of the patients. Albumin level was found to be low in 1.4% (2) and high in 39.7% (56) of patients (Table II).

In our study, AST levels were found to be high in 11.2% (16) and ALT levels were found to be high in 12.9% (18) of patients. White blood cell count was low in 16% (23), hemoglobin was low in 9% (13), high in 3.5% (5) and neutrophil count was low in 11.1% (16) of the patients. Among the patients' thyroid function tests, TSH levels were low in 2.9% (4) and high in 1.4% (2); sT4 levels were low in 3.6% (5) and high in 2.9% (4); sT3 levels were low in 62.5% (62) and high in 1% (1) (Table II).

When the electrolytes of the patients were evaluated: Serum chlorine level was low in 2.9% (4) and high in 8.8% (12), potassium level was low in 4.3% (6), calcium level was low in 5.7% (8) and high in 12.9% (18), phosphorus level was low in 3.6% (5) and magnesium level was normal in all patients.

It was found that 31.3% (44) of all participants drank less water and the mean urine density was 1017.3±9.54 (1000-1042). Urine density was low in 15.6% (22), high in 7% (10) and 77.3% (109) normal range of these patients. Sterile pyuria was found in 31.4% (44) of the patients.

Thirty three (41.3%) of patients with restrictive type AN drank less water, and urine density was low in 18.7% (15) and high in

## Table III: Body Weight parameters according to the presence of hypoglycaemia and bradycardia in patients

| | Hypoglycemia | | | Bradycardia | | |
|---|---|---|---|---|---|---|
| | Yes n=26 (%) | No n=117(%) | p | Yes n=30 (%) | No n=100 (%) | p |
| BMI, kg/m² | | | | | | |
| ≥18 | 6 (9.1) | 60 (90.9) | 0.017* | 9 (15.3) | 50 (84.7) | 0.085* |
| <18 | 20 (26.0) | 57 (74.0) | | 21 (29.6) | 50 (70.4) | |
| BMI-p | | | | | | |
| ≥5 | 10 (13.2) | 66 (86.8) | 0.149* | 10 (15.2) | 56 (84.8) | 0.049* |
| <5 | 16 (23.9) | 51 (76.1) | | 20 (31.2) | 44 (68.8) | |
| IBW | | | | | | |
| ≥ %75 | 14 (13.1) | 93 (86.9) | 0.008* | 15 (16.0) | 79 (84.0) | 0.006* |
| < %75 | 12 (35.3) | 22 (64.7) | | 14 (41.2) | 20 (58.8) | |

*: Continuity Correction test

**Tablo IV: BMI, BMI-p and IBW % according to the presence of amenorrhea and sT3 levels in patients**

| Parameters | Amenorrhea (Primer and Seconder) | | | sT3 | | |
|---|---|---|---|---|---|---|
| | Yes n=52 (%) | No n=87 (%) | p | Normal n=38 (%) | Low n=65 (%) | p |
| BMI, kg/m² | | | | | | |
| ≥18 | 11 (21.2) | 55 (63.2) | <0.001* | 29 (65.9) | 15 (34.1) | <0.001* |
| <18 | 41 (78.8) | 32 (36.8) | | 9 (15.3) | 50 (84.7) | |
| BMI-p | | | | | | |
| ≥5 | 17 (32.7) | 59 (67.8) | <0.001† | 28 (54.9) | 23 (45.1) | <0.001* |
| <5 | 35 (67.3) | 28 (32.2) | | 10 (19.2) | 42 (80.8) | |
| IBW | | | | | | |
| ≥%75 | 29 (55.8) | 77 (88.5) | <0.001† | 36 (49.3) | 37 (50.7) | <0.001* |
| < %75 | 23 (44.2) | 10 (11.5) | | 2 (7.1) | 26 (92.9) | |

*: Pearson Ki-kare test, †: Continuity Correction test

**Table V: Body Weight parameters according to patients' hospitalisation status**

| Parameters | Hospitilazition | | |
|---|---|---|---|
| | Yes n=66 (%) | No n=78 (%) | p |
| BMI, kg/m² | | | |
| ≥18 | 17 (25.4) | 50 (74.6) | <0.001* |
| <18 | 49 (63.6) | 28 (36.4) | |
| BMI-p | | | |
| ≥5 | 24 (31.2) | 53 (68.8) | <0.001* |
| <5 | 42 (62.7) | 25 (37.3) | |
| IBW | | | |
| ≥ %75 | 42 (38.9) | 66 (61.1) | 0.015† |
| < %75 | 22 (64.7) | 12 (35.3) | |

*: Pearson Ki-kare test, †: Continuity Correction test

**Table VI: Relationship between mean BMD Z-score and BW**

| | r | p |
|---|---|---|
| BMD Z score*Age of diagnosis | -0.401† | 0.006 |
| BMD Z score*IBW % | 0.302‡ | 0.044 |
| BMD Z score* BMI | 0.054‡ | 0.726 |
| BMD Z score*BMI-Percentil | 0.183‡ | 0.228 |
| BMD Z score*Amenorrhea Time | -0.363‡ | 0.032 |

**BMD:** *Bone Mineral Dansity,* **r:** *Correlation coefficient,* †: *Pearson correlation* ‡: *Spearman's correlation*

10% (10) of these patients.

The rate of sterile pyuria was not significantly higher in patients with BMI <18, BMI-p<5 and IBW <75% (p=0.227; p=0.999; p=0.221, respectively).

A statistically significant increase in the incidence of hypoglycaemia was observed in patients with a BMI of less than 18 and an IBW of less than 75% (p=0.049; p=0.006, respectively). Bradycardia was statistically significantly more common in patients with BMI-p<5 and IBW <75% and (p=0.049; p=0.006, respectively) (Table III).

Patients with BMI<18, BMI-p<5 and IBW≥75% had statistically significantly more amenorrhoea (p<0.001). The statistical analysis yielded significant results, indicating a higher prevalence of low sT3 levels among patients with a BMI less than 18, a BMI-p less than 5, and an IBW less than 75% (p<0.001) (Table IV).

There was a statistically significant higher number of hospitalisations in patients with BMI <18, BMI-p <5 and IBW <75% (p<0.001; p<0.001; p=0.015, respectively). (Table V).

The relationship between urea, creatinine and uric acid levels and body weight parameters was evaluated using Fisher's exact test. In patients with BMI <18, BMI-p<5 and IBW<75%, no significant increases or decreases in creatinine, urea and uric acid levels were observed (for urea, p=0.751; p=0.999;

p=0.451, for creatinine, p=0.301; p=0.274; p=0.535, for uric acid, p=137; p=498; p=0.511, respectively).

A significant negative correlation was found between BMD Z-score values and time to disease diagnosis (p<0.006). A moderately significant relationship was found between BMD Z score values and IBW% (p<0.044). A significant negative correlation was found between BMD values and duration of amenorrhoea (p<0.032) (Table VI).

## DISCUSSION

This study investigated the relationship between the presenting signs, symptoms and complications of ED patients and their BW at the time of presentation. A total of 144 patients, of whom 4 (2.8%) male and 140 (97.2%) female were included in our study. Among the male patients, three patients were identified as AN (restrictive) type and one patient was identified as ARFID.

Anorexia nervosa represented the majority of patients followed in adolescence. This, predictably, was due to a high rate of weight loss and associated medical complications in patients with AN. The mean age at diagnosis was 14.6 years and was similar in boys and girls; however, we could not compare the ages at diagnosis because the number of male patients was very small. The peak age for ED diagnosis was 15 years for girls and 16 years for boys in a study conducted in the UK (18).

In our study, the mean difference between the ages of diagnosis and first symptoms was 11.75 months. In another study, the difference between the onset of symptoms and admission

to the clinic was 11 months (19). In a long-term study, 48% of adolescents with AN were found to have growth curve abnormalities on average 9.7 months before the onset of AN-related symptoms on retrospective observation (20). These studies show that there is a delay in diagnosis in patients with AN, resulting in serious long-term morbidity. These data suggest that there may be some reasons why patients with ED are diagnosed with an average delay of 1 year. Due to the distorted body image of ED patients, they do not see themselves as sick. Diagnosis may be delayed because it takes time for parents to notice the changed eating behaviour and for medical signs to appear. As with other chronic diseases, one of these reasons may be that their access to health centers was disrupted during the Covid-19 pandemic (21).

It was observed that about half of our patients were hospitalized and the majority of the hospitalized patients were AN patients. This is because, as expected, more medical complications developed with increased BW loss. One study reported that 55% of patients with AN had at least one hospital admission (19).

In our study, significantly more hypoglycaemia was observed in patients with low BW. This finding suggests that we should be more cautious about hypoglycemia in patients with low BW because of the decrease in glycogen stores due to weight loss. A published case study reported that clinically severe hypoglycaemia may be a fatal complication of AN, although it is not very common (22). We found hypoglycaemia in 18.2% of our patients.

Elevated blood creatinine levels were found in 11.1%, urea in 7.1% and uric acid in 20.7% of our patients. In patients with anorexia nervosa, urea and creatinine levels are expected to be low due to malnutrition and low muscle tissue. However, elevated levels are a sign of severe kidney damage or dehydration. Impaired renal function was found to be more predictive of disease severity than low BMI in eating disorder patients (23).

Although the mechanism is not well understood, studies have shown that albumin levels are normal in patients with eating disorders. It has been suggested that this may be due to increased albumin transfer from the extravascular to the intravascular space by adaptive mechanisms (24). Mehler et al. (25) explain that one reason for the preservation of serum albumin levels in patients with anorexia nervosa is the absence of inflammation in these patients, and that it is not a good marker in the follow-up of patients. In our study, 39.7% of patients had a mildly elevated albumin level.

Liver transaminase levels have been found to be elevated in approximately 10% of patients, and all of these patients had a diagnosis of restrictive AN. One study showed that BMI and transaminase elevation were inversely proportional in AN patients (26).

Iron deficiency anemia is not expected in patients with AN. The main cause of anemia and other blood cell deficiencies in patients with AN is bone marrow suppression. However, abnormalities in the complete blood count are common. In our study, 16% of patients had a low white blood cell count and 11.1% had neutropenia. Hemoglobin was found to be low in 9% of patients. As expected, iron deficiency anemia was not found. A review reported that the rate of anemia was 21-39%, leucopenia 29-39% and thrombocytopenia 5-11% (27). In a study of 60 adolescent girls diagnosed with AN, the rate of neutropenia and anemia was 22% (28). Compared to the literature, blood cell disorders were detected less frequently in our patients.

Although 41% of adolescents with AN drank less water, only 7% were found to have increased urine density. It is well known that osmoregulation is impaired in patients with AN (29). Sterile pyuria was found in 31.4% of patients.

Three of the 6 patients with hypokalemia on admission were diagnosed with AN, two with atypical AN and one with BN. Four of the five patients with hypophosphatemia were diagnosed with AN and one with atypical AN. Electrolyte imbalances are a serious complication of eating disorders. One study drew attention to this issue and recommended caution regarding undiagnosed eating disorders in patients presenting to a health center with electrolyte imbalances (30).

Secondary amenorrhoea and irregular menstruation were observed in approximately one third and one quarter of our patients, respectively. It is well known that low BW is associated with amenorrhoea, which is one of the most common complications in ED patients (31). In a study of 251 ED patients, the incidence of amenorrhoea was found to be 61% in AN patients and 11% in BN patients, and the same study found that the frequency and duration of amenorrhoea were associated with BMI. The same study reported that amenorrhoea developed in 82% of those with a BMI below 18 who exercised (32).

Cardiac complications are the most common cause of sudden death in patients with AN. Numerous cardiac abnormalities have been described in the literature, including pericardial and valvular pathologies, changes in left ventricular muscle and function, conduction abnormalities, bradycardia, hypotension, and peripheral vascular contractility abnormalities. At least one cardiac complication was observed in 29.3% of our patients. The most common cardiac complication was bradycardia and mitral regurgitation was observed with the second frequency. Sinus bradycardia is the most common cardiovascular complication in patients with AN. Bradycardia improves with nutrition and weight gain. We found that BW was inversely associated with the occurrence of bradycardia in our patients. Pericardial effusion and MVP were less common. QTc prolongation was not observed in any of our patients. Although some studies have shown QTc prolongation, most studies have reported no QTc prolongation (33).

At least one GIS complication was observed in 54.2% of patients. The most common objective GIS finding was constipation. Endoscopic oesophagitis was also found in three patients, rectal bleeding in two patients and hemorrhoids in one patient. One study reported that constipation was found in 35% of patients diagnosed with AN and in 15% of patients diagnosed with BN (34). Constipation may be expected in patients with AN in association with food and fluid restriction. However, impaired gastrointestinal motility in patients with AN and altered gut microbiota in relation to their food preferences increase the susceptibility to constipation (35).

At least one endocrine complication was observed in 68.1% of patients, the most common being hypothyroidism and menstrual disorders. In our study, sT3 levels were found to be low in 62.5% of patients. In our study, low sT3 levels were found to be significantly higher in patients with low BMI and IBW%. One study reported that the amount and rate of weight loss affected low sT3 concentrations. In addition, it was reported that low sT3 was an important determinant of weight loss in the premenopausal period, whereas low sT3 could not predict weight loss in the postmenopausal period. In the same study, serum TSH concentrations were found to be within normal limits in ED patients and were not affected by changes in BW. It was found that blood sT3 levels also increased with increasing BW and reached normal levels (36).

As seen in our study, amenorrhoea has a negative effect on bone mineral density. This increases the risk of osteopenia and osteoporosis in the long term. The severity of long-term complications also increases with the duration of the disease and its early onset. A study comparing spinal bone densities in adolescent females found that prolonged amenorrhoea was associated with decreased BMD Z-scores (37). The data from our study support this finding. A significant, negative and moderate correlation was found between BMD Z score values and age at diagnosis.

In conclusion, according to our data, medical complications affecting all body systems are common in patients with AN and BN. Although Eating Disorders are psychiatric disorders, somatic symptoms or medical complications are likely to be the reason for patients to consult a health center. Early identification of patients with weight loss or compensatory behaviors secondary to ED may prevent morbidity and mortality. Recognising possible symptoms and signs of AN and BN, which often begin in adolescence, in pediatric outpatient clinics will protect against acute and chronic complications and prevent delayed multidisciplinary treatment.

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