



# Down Syndrome Patients in the Pediatric Emergency Department

## Çocuk Acil Serviste Down Sendromlu Hastalar

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### Abstract

**Objective:** The purpose of this study was to evaluate Down syndrome (DS) cases presenting to the pediatric emergency department and to compare them with DS cases with clinical presentations for routine check-ups.

**Method:** DS patients presenting to the pediatric emergency department of a tertiary hospital between 01.10.2018 and 31.03.2019 (group 1) and DS patients presenting for routine clinical check-ups (group 2) were included in the study. Patients' demographic data (age and gender), weight, height and head circumference measurements, and data for general health were examined.

**Results:** Forty-one patients (13 girls, 28 boys) with a mean age of 50.24±48.4 (1-163) months were enrolled in group 1, and 49 cases (17 girls, 32 boys) with a mean age of 52.94±50.1 (1-168) months in group 2. Cases in group 1 had higher rates of heart disease (p=0.004), drug use for heart disease (p=0.038), thyroid disease (0.001), and drug use for thyroid disease (p=0.001) compared to group 2, while engagement in sporting activity was significantly higher among cases in group 2 (p=0.32) than in group 1. There was no difference between the groups in terms of anthropometric measurements.

**Conclusion:** DS cases presenting to the pediatric emergency department differ from DS cases presenting for routine check-ups in terms of general health status and accompanying diseases. Pediatric practitioners can be more knowledgeable about cases with DS who are admitted to the emergency department.

**Keywords:** Down syndrome, fever, health, pediatric emergency medicine

### Öz

**Amaç:** Bu çalışmada çocuk acil servise başvuran Down sendromlu (DS) olguların değerlendirilmesi ve rutin kontrol amacı ile poliklinik başvurusu yapan DS olgularla karşılaştırılması amaçlandı.

**Yöntem:** 01.10.2018-31.03.2019 tarihleri arasında, üçüncü basamak bir üniversite hastanesi çocuk acil servisine herhangi bir nedenle başvuran DS hastalar (grup 1) ile, çocuk polikliniğine rutin kontrol amacıyla başvuran DS hastalar (grup 2) çalışmaya alındı. Hastalara ait demografik veriler (yaş, cinsiyet), ağırlık, boy ve baş çevresi ölçümleri, genel sağlık durumlarına ait veriler incelendi. Grup 1'deki olguların çocuk acil servise başvuru şikayeti, fizik muayene bulguları, laboratuvar tetkikleri, görüntüleme yöntemleri ve hastanın sonlanımı değerlendirildi.

**Bulgular:** Grup 1'de ortalama yaşları 50,24±48,4 (1-163) ay olan 41 olgu (13 kız, 28 erkek), grup 2'de ortalama yaşları 52,94±50,1 (1-168) ay olan 49 olgu (17 kız, 32 erkek) çalışmaya alındı. Grup 1'deki olguların grup 2'ye göre kalp hastalığı (p=0,004), kalp hastalığı için ilaç kullanma (p=0,038), tiroid hastalığı (p=0,001) ve tiroid hastalığı için ilaç kullanma (p=0,001) oranı daha yüksek iken grup 2'deki olguların grup 1'e göre spor yapma (p=0,032) durumu istatistiksel olarak anlamlı yüksek idi. Gruplar arasında antropometrik ölçümler açısından fark yoktu.

**Sonuç:** Dezavantajlı hasta gruplarının genel sağlık durumlarının bilinmesi onlara daha iyi sağlık hizmeti sunumuna imkan verecektir. Çocuk acil servise başvuran DS olgular genel sağlık durumu ve eşlik eden hastalıklar açısından rutin kontrol amaçlı polikliniğe başvuran DS olgulardan farklı özellik sergilemektedir.

**Anahtar kelimeler:** Down sendromu, ateş, sağlık, çocuk acil tıp



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## Introduction

Down syndrome (DS) is the most common genetic disease. The reported incidence is 1/600-1/800 live births (1-3). Studies examining the general health of DS patients have reported mental retardation, loss of hearing, obstructive sleep apnea syndrome, ophthalmological diseases (such as cataract and vision problems), congenital heart diseases (such as atrioventricular septal defect, and ventricular septal defect), gastrointestinal system diseases [such as celiac disease (CD) and Hirschprung disease], thyroid diseases, hematological diseases, and infections such as otitis media (1,2,4-8).

Life expectancy in DS patients ranges between 43 and 55 years (9). The main factors reported in this reduced life expectancy are respiratory system diseases (pneumonia, respiratory failure, and acute respiratory distress syndrome), congenital heart diseases, and dementia (9-11). Length of hospital stay is longer in DS patients than in the general pediatric population, and intensive care requirements are greater (12). Although DS cases in the childhood age group present to the pediatric emergency department with symptoms related to the diseases listed above, no previous studies have evaluated DS cases in the pediatric emergency department and outpatient clinic.

The purpose of this prospective study was to examine the clinical findings and general health status of DS patients presenting to the pediatric emergency department of a tertiary university hospital and to compare these with those of DS cases presenting for routine clinical check-ups.

## Materials and Methods

The study was planned prospectively in the pediatric emergency department and outpatient clinic of a tertiary university hospital in Turkey. DS patients presenting to the pediatric emergency department (group 1) for any reason or to the outpatient clinic (group 2) for routine examination between 01.10.2018 and 31.03.2019 were enrolled. Non-DS patients were excluded. In addition, in the event of repeat presentations by DS patients during the study period, the first presentation was evaluated.

Demographic data (age and sex), month of presentation, presentation symptoms to the pediatric emergency department, weight, height and head circumference measurements were recorded for patients in group 1 and 2. Laboratory tests (complete blood count, blood gas analysis, biochemical parameters, and C-reactive protein), imaging methods (direct X-ray, computed tomography,

ultrasonography, and magnetic resonance imaging), and outcomes (discharge, or admission to the ward or intensive care) were recorded for group 1. Reference ranges for Turkish children with DS were used in the interpretation of anthropometric measurements (13).

Information concerning whether or not patients received special education, involvement in any sporting activities, hearing problems and hearing aid use, heart disease or drug use in association with heart disease, history of heart surgery and/or angiography, presence of gastrointestinal disease, vision problems or use of visual aids, thyroid disease and use of drugs associated with thyroid disease, presence of snoring/sleep apnea, hematological disease, and whether patients had been investigated for CD and the results if applicable was recorded in order to determine the general health of the DS patients included in the study.

## Statistical Analysis

The data obtained were analyzed on SPSS software (IBM, version 24.0, Chicago, IL, USA). Categorical data were expressed as number and percentage, and constant variables as mean plus standard deviation. The test of normality was evaluated with the Shapiro-Wilk test. The chi-square test was used to compare non-parametric categorical variables, independent sample t-test in the comparison of normally distributed variables.

The study was performed in compliance with the Declaration of Helsinki for human research and was approved by the Institutional Ethics Committee (no: 2018/6-5). Written informed consent was obtained from the patients' parents for their anonymized information to be published in this article.

## Results

Forty-one DS patients, with a mean age of 50.24±48.4 (1-163) months, 13 girls (31.7%) and 28 boys (68.3%), presented to the pediatric emergency department during the six-month study period (group 1). Forty-nine DS cases, 17 (34.7%) girls and 32 (65.3%) boys with a mean age of 52.94±50.1 (1-168) months presented to the pediatric outpatient clinic for routine examinations during the same period (group 2). No statistically significant difference was determined between group 1 and group 2 in terms of age [(p=0.957), independent sample t-test] or gender (p=0.471). The most frequent month of presentation in group 1 was October (36.6%), followed in decreasing order by November (24.4%), December (14.6%), January (9.8%), February (9.8%), and March (4.9%). In group 2, presentations were most frequent in October (28.6 %) followed by November

(18.4%) and December (18.4%), January (16.3%), February (10.2%), and March (8.2%). No significant difference was determined between the groups in terms of months of presentation (p=0.835).

The most common presentation symptoms among the cases in group 1 were fever and respiratory difficulty. The most common physical examination finding at time of presentation in group 1 involved the lower respiratory system (Table 1).

The mean weight in group 1 was 17.7±22.3 (2.1-130) kg, and the mean height was 88.3±27.3 (47-148) cm. The mean weight and height values in group 2 were 18.2±15.6 (2.75-64) kg and 88.9±29.15 (46-159) cm. No statistically significant difference was observed between the groups in terms of weight [(p=0.886), independent sample t-test] or height [(p=0.67), independent sample t-test]. The mean

head circumference in the 22 cases aged less than 36 months in group 1 was 40.9±3.4 (33-46) cm, and while that of the 25 cases aged under 36 months in group 2 was 41±4 (33-47) cm [(p=0.238), independent sample t-test]. Cases' weight, height, and cranial circumference percentiles for age are shown in Table 2. No significant differences were observed between the groups in terms of weight percentiles [(p=0.629), chi-square test] height percentiles [(p=0.21), chi-square test] and head circumference percentiles [(0.336), chi-square test].

Analysis of laboratory tests and imaging techniques performed in the emergency department revealed that complete blood count and biochemical tests were studied in 30 (73.2%) of the 41 cases, blood gas analysis was performed in 15 (36.6%), X-ray in 29 (70.7), and computed tomography in one (2.4%). Twenty-three (56.1%) of the 41 cases were discharged without admission to hospital, while 13 (31.7%) were admitted to the pediatric ward, and five (12.2%) to the pediatric intensive care unit. The total rate of admission to hospital from the pediatric emergency department during the study department was 4.3%.

Comparison of group 1 and group 2 in terms of general health status revealed statistically significant differences in terms of heart disease (p=0.004)\* and drug use for heart disease (p=0.038)\*, engagement in sporting activity (p=0.032)\*, thyroid disease (p=0.001)\*, and drug use for thyroid disease (p=0.001)\* [\*chi-square test]. CD was investigated in eight (18.9%) of the cases in group 1 and six (12.2%) of those in group 2, and only one case from each group was diagnosed with the disease. Drugs used, comorbidities and general health status of the subjects included in the study are shown in Table 3.

**Table 1. DS cases' emergency department presentation symptoms and physical examination findings**

Symptoms	n (%)
Fever	11 (22)
Respiratory difficulty	11 (22)
Cough	10 (20)
Vomiting	6 (12)
Diarrhea	6 (12)
Abdominal pain	2 (4)
Constipation	1 (2)
Foreign body aspiration	1 (2)
Rash	1 (2)
Seizure	1 (2)
Physical examination findings	n (%)
Wheezing	17 (20)
Prolonged expirium	12 (13.8)
Rhoncus	6 (6.9)
Rales	4 (4.5)
Nasal discharge	7 (8)
Lower respiratory tract (n=31)	
Tonsillar hyperemia	5 (5.7)
Tonsillar crypt	2 (2.2)
Tonsillar hypertrophy	8 (9.1)
Increased bowel sounds	2 (2.2)
Defense	1 (1.1)
Upper respiratory tract (n=10)	
Abdominal tenderness	2 (2.2)
Decreased skin turgor and prolonged capillary refilling	2 (2.2)
Gastrointestinal system (n=4)	
Urticarial eruption	1 (1.1)
General findings (n=21)	
Cardiac murmur	18 (21)
Wheezing	17 (20)

DS: Down syndrome

**Table 2. DS cases' weight, height, and head circumference percentiles**

	Weight		Height		Head circumference	
	Group 1 n (%)	Group 2 n (%)	Group 1 n (%)	Group 2 n (%)	Group 1 n (%)	Group 2 n (%)
<3p	12 (29.2)	6 (12.2)	10 (24.4)	8 (16.3)	10 (24.4)	7 (28)
3-10p	4 (9.7)	4 (8.2)	4 (9.8)	6 (12.2)	4 (9.8)	2 (8)
10-25p	6 (14.6)	7 (14.3)	8 (19.5)	9 (18.4)	4 (9.8)	3 (12)
25-50p	7 (17)	12 (24.5)	9 (22)	11 (22.4)	1 (2.4)	5 (20)
50-75p	6 (14.6)	9 (18.4)	3 (7.3)	12 (24.5)	1 (2.4)	5 (20)
75-90p	3 (7.3)	7 (14.3)	3 (7.3)	3 (6.1)	1 (2.4)	2 (8)
90-97p	1 (2.4)	2 (4.1)	2 (4.9)	-	-	1 (4)
>97p	2 (4.8)	2 (4.1)	2 (4.9)	-	1 (2.4)	-
p*	0.629		0.21		0.336	

\*chi square test, DS: Down syndrome

**Table 3. Drugs used, comorbidities and general health status of the subjects included in the study**

		<b>Group 1 n (%)</b>	<b>Group 2 n (%)</b>	<b>p*</b>
<b>Special education</b>	Yes	22 (53.7)	24 (49)	0.678
	No	19 (46.3)	25 (51)	
<b>Taking part in sporting activity</b>	Yes	2 (4.8)	11 (22.4)	<b>0.032</b>
	No	39 (95.2)	38 (77.6)	
<b>Hearing problems</b>	Yes	8 (19.5)	10 (20.4)	0.565
	No	33 (80.5)	39 (79.6)	
<b>Use of hearing aid</b>	Yes	4 (9.8)	4 (8.2)	0.539
	No	37 (90.2)	45 (91.8)	
<b>Heart disease</b>	Yes	22 (53.6)	12 (24.5)	<b>0.004</b>
	No	19 (46.4)	37 (75.5)	
<b>Drug use for heart disease</b>	Yes	11 (26.7)	5 (10.2)	<b>0.038</b>
	No	30 (73.2)	44 (88.8)	
<b>History of heart surgery and/or angiography for heart disease</b>	Yes	10 (24.4)	4 (8.2)	0.065
	No	31 (75.6)	45 (91.8)	
<b>Gastrointestinal system disease</b>	Yes	10 (24.4)	7 (14.3)	0.279
	No	31 (75.6)	42 (85.7)	
<b>Vision problems</b>	Yes	2 (4.9)	3 (6.1)	0.585
	No	39 (95.1)	46 (93.9)	
<b>Using spectacles</b>	Yes	1 (2.4)	1 (2)	0.706
	No	40 (97.6)	48 (98)	
<b>Thyroid disease</b>	Hypothyroidism	15 (36.6)	4 (8.2)	<b>0.001</b>
	No	26 (63.4)	45 (91.8)	
<b>Drug use for thyroid disease</b>	Yes	12 (29.3)	2 (4.1)	<b>0.001</b>
	No	29 (70.7)	47 (95.9)	
<b>Snoring/sleep apnea</b>	Yes	8 (19.5)	9 (18.4)	0.550
	No	33 (80.5)	49 (81.6)	
<b>Musculoskeletal system disease</b>	Yes	2 (4.9)	3 (6.1)	0.585
	No	39 (95.1)	46 (93.9)	
<b>Hematological disease</b>	Yes	8 (19.5)	7 (14.3)	0.351
	No	33 (80.5)	42 (85.7)	
<b>Investigated for celiac disease</b>	Yes	8 (19.5)	6 (12.2)	0.256
	No	33 (80.5)	43 (87.8)	

\*chi-square test

## Discussion

Although there have been several studies involving DS, to the best of our knowledge, no previous research has examined DS cases in the emergency department and compared these with DS cases presenting for routine check-ups. The most common presentation symptoms in our DS cases were fever and respiratory difficulty. Physical examination findings supported the presentation symptoms, with lower respiratory system findings being most frequent. Diseases of the lower respiratory system in DS cases are more commonly seen as a result of structural pulmonary development

anomalies accompanying congenital heart diseases and particularly prolonged ventilator requirements following cardiac surgery (3,14,15). Immune system components are also known to involve more abnormal parameters in DS cases compared to the healthy population (2). Additionally, swallowing dysfunction and gastroesophageal reflux have also been proved to exacerbate lower respiratory system infection findings (2,16). Several studies have identified lower respiratory system infections as the most common cause of admission to hospital in DS cases (16,17). Pneumonia/aspiration has also been reported as the most

common cause of admission in adult DS cases (18). Our study is consistent with the existing literature. Analysis of admission rates from the pediatric emergency department shows an approximately 10-fold greater hospitalization requirement in DS cases compared to non-DS cases. Our study data show that physicians must exhibit greater care in terms of lower respiratory system infections and hospitalization when DS cases present to the pediatric emergency department.

DS cases present more frequently to hospital due to accompanying comorbid conditions. Congenital heart diseases are an important disease group in determining the general health status of patients with DS. The incidence of congenital heart disease in group 1 (53.6%) was consistent with the previous literature. However, the incidence of heart disease was significantly higher in group 1 compared to group 2 [(p=0.004), chi-square test]. We think that there is now a need for further studies investigating the potential effects (such as the likelihood of admission to hospital) of this higher incidence of heart disease in DS cases presenting to the pediatric emergency department. The incidence of thyroid gland diseases in DS cases ranges between 4% and 8% (19). Our data indicate the presence of thyroid gland disease in 36.6% of cases in group 1 and 8.2% of cases in group 2 [(p=0.001), chi-square test]. The significantly higher incidences of thyroid disease and heart disease in group 1 compared to group 2 suggest that the presence of additional chronic disease for DS cases presenting to the emergency department increases the numbers of such presentations.

Bermudez et al. (20) investigated 1,027 DS patients and determined gastrointestinal system symptoms and diseases in 50.7% of them, the most common of which was chronic intestinal constipation. In addition, one meta-analysis reported a comorbidity rate of 5.8% for biopsy-confirmed CD and DS (21). CD was investigated in eight (19.5%) cases in group 1 and six (12.2%) in group 2 but was only diagnosed in one case from each group. Although co-existence of CD and DS has been described in the literature, the presence of CD was investigated at lower rates in both groups than in the previous literature. This indicates that awareness of CD needs to be increased among physicians planning follow-up and treatment of cases of DS.

The prevalence of obstructive sleep apnea syndrome (OSAS) in several studies ranged between 24% and 95% (22). The prevalence of OSAS and/or snoring was lower in the present study. Hematological abnormalities (such as transient neonatal myelopoiesis, and acute myeloid leukemia) have previously been reported in DS cases (23). The reported

prevalence of iron deficiency anemia in DS is 2.6% (24). No statistically significant difference was observed between the two groups in terms of hematological diseases.

Although the incidences of some chronic diseases were similar between group 1 and 2, comorbid diseases that were not similar in DS cases presenting to the emergency department and in other DS cases (such as heart disease and thyroid disease) need to be determined. If a disease accompanying cases of DS presenting to the emergency department is identified, we think that health workers' accumulated knowledge will expand, and that the quality of the health service provided for patients will improve.

Various problems concerning growth are encountered in anthropometric measurements of DS cases. Obesity is one noteworthy problem in addition to retardation in weight, height, and cranial circumference (25,26). Gastrointestinal system problems such as absorption, chewing and swallowing disorders result in inadequate calorie intake, leading to subsequent short stature. Approximately 25% of the DS cases presenting to the pediatric emergency department in our study exhibited retardation in weight, height and head circumference compared to their peers, but there was no statistically significant difference between the groups. Weight and height retardation may be expected to result in DS patients falling ill more frequently and presenting to emergency departments. The number of obese DS cases was quite low, at approximately 5% in both groups.

Participation in case-specific sporting activities is recommended to increase DS patients' social adaptation and skills (27). A sedentary life is known to lead to health problems in all age groups. Mentally deficient individuals have been reported to be at greater risk of low physical activity (28). The fact that only two (4.8%) of the DS cases in group 1 took part in sporting activities, a figure significantly lower compared to group 2 [(p=0.032), chi-square test], was interpreted as showing that their general health status was not conducive to sporting activity.

## Conclusion

This is the first study to compare general health status and accompanying diseases in cases of DS presenting to the pediatric emergency department with those of DS cases presenting for routine clinical examination. A good knowledge of the general health status of disadvantaged patient groups will make it possible to provide better health services for them.

## Ethics

**Ethics Committee Approval:** The study was performed in compliance with the Declaration of Helsinki for human research and was approved by the Adiyaman University Institutional Ethics Committee (no: 2018/6-5).

**Informed Consent:** Written informed consent was obtained from the patients' parents for their anonymized information to be published in this article.

**Peer-review:** Internally and externally peer-reviewed.

## Authorship Contributions

Concept: İ.H.B., H.A., M.G., Design: İ.H.B., H.A., M.G., Data Collection or Processing: M.G., H.T., Analysis or Interpretation: İ.H.B., H.A., F.E.K., Critical Revision of Manuscript: H.A., M.G., Final Approval and Accountability: İ.H.B., H.A., M.G., H.T., F.E.K., Technical or Material Support: İ.H.B., H.A., M.G., Supervision: H.T., F.E.K.

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