Ann Med Res

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Annals of Medical Research

journal page: annalsmedres.org

Prevalence of hypertension in asymptomatic children without risk factors

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MAIN POINTS

- The study found a total hypertension prevalence of 32.5
- Multiple regression analysis revealed that Body Mass Index (BMI), family history of hypertension, maternal obesity, and paternal coronary artery disease are significant independent risk factors for hypertension in this population.
- There was a positive correlation (r: 0.468, p<0.001) between BMI and hypertension detection, indicating that higher BMI is associated with increased hypertension risk, even in children without other known risk factors.
- The findings suggest that routine blood pressure screening for all children aged 3-18 years is essential, even in the absence of risk factors, to prevent future cardiovascular issues.

Cite this article as: Arslan P, Tekin M. Prevalence of hypertension in asymptomatic children without risk factors. *Ann Med Res*. 2025;32(5):180–186. doi: 10.5455/annalsmedres.2024.12.279.

ABSTRACT

Aim: This two-year a cross-sectional study investigated the prevalence of hypertension in asymptomatic children (ages 3-18) without known risk factors, hypothesizing that increased screen time and sedentary lifestyles contribute to rising rates. The cross-sectional study, conducted from January 1, 2021, to January 1, 2022, included children attending the General Pediatrics clinic at İnönü University Faculty of Medicine.

Materials and Methods: Of the 468 participants, 10.3% had prehypertension, 15.2% had stage 1 hypertension, and 7.1% had stage 2 hypertension, resulting in a total hypertension prevalence of 32.5%. The hypertensive group had a significantly higher BMI (19.3±5.4 vs. 17.6±3.6, p<0.001). Paternal coronary artery disease was less prevalent in the hypertensive group (2.6% vs. 7.9%, p=0.038), while maternal obesity was more prevalent (14.4% vs. 6.0%, p=0.003). Spearman's correlation showed a positive association between BMI and hypertension (r: 0.468, p<0.001).

Results: Multiple regression analysis identified BMI (OR 1.154; p<0.001), family history of hypertension (OR 1.543, p=0.040), paternal coronary artery disease (OR 0.282, p=0.026), and maternal obesity (OR 2.238, p=0.022) as independent risk factors. This translates to a 1.154- fold increased risk of hypertension with higher BMI, a 1.543-fold increased risk with a family history, a protective effect (0.282-fold) with paternal coronary artery disease, and a 2.238-fold increased risk with maternal obesity.

Conclusion: This study found a higher prevalence of hypertension than previous research, likely due to the inclusion of prehypertension and stage 1 hypertension. Despite excluding obese children, hypertension correlated with increasing BMI, and family history, paternal coronary artery disease, and maternal obesity were independent predictors. Given the rising prevalence of childhood hypertension, blood pressure measurement is recommended for all 3-18-year-olds, even without known risk factors.

Keywords: Hypertension, Coronary artery disease, Obesity, Body mass index

Received: Jan 03, 2025 **Accepted:** Apr 09, 2025 **Available Online:** May 26, 2025

INTRODUCTION

According to both the American Academy of Pediatrics (AAP) and the European Society of Hypertension guidelines, normal blood pressure (BP) is defined as BP values lower than the 90th percentile based on age, gender, and height [1, 2]. Before puberty, "prehypertension" was defined as systolic blood pressure (SBP) and/or diastolic blood pressure (DBP) ≥90th percentile and <95th percentile (according to age, gender, and height tables). For adolescents, "prehypertension" was defined as BP ≥120/80 mm Hg and <95th percentile, or ≥90th and <95th percentile (whichever is lower) [1]. Hypertension (HT) is defined as clinically measured mean SBP and/or DBP ≥95th percentile (based on age, gender, and height percentiles) [1]. It is also classified as stage 1 HT (≥95th percentile) and stage 2 HT (≥95th percentile + 12 mm Hg) [1].

Although hypertension is less common in children under 18 years of age, its prevalence is gradually increasing. According to the Infant, Child, and Adolescent Monitoring Protocols (ICAP) of the Public Health Institution of Turkey, Ministry of Health, it is reported that the prevalence of high blood pressure is 1-3% throughout childhood, but the prevalence of hypertension is around 5%, in parallel with the increasing prevalence of obesity in adolescents [3]. In a study conducted in our country in 2013, the prevalence of hypertension in chil-

https://doi.org/10.5455/annalsmedres.2024.12.279

dren aged 5-18 years was found to be 6.1% [4]. It can be said that the prevalence of hypertension in childhood is increasing in our country as well as globally. Over the 15 years from 2000 to 2015, it was found that the prevalence of childhood hypertension increased, with the rates of increase being similar across all age ranges. Recent studies show the prevalence of hypertension as 4.32% in six-year-old children and 7.89% in 14-year-old children [5]. Clinical guidelines recommend the inclusion of routine blood pressure measurement in the health monitoring of children aged 3 years and above [1]. Screenings are useful for the early recognition of asymptomatic hypertension. The timely identification of abnormal blood pressure values in pediatric and adolescent populations is essential for mitigating the risk of cardiovascular disease and mortality later in life.

We hypothesize that altered eating patterns and reduced physical activity due to increased screen time may be contributing to the rising prevalence of hypertension in the pediatric population. Accordingly, our study aimed to determine the prevalence of hypertension in asymptomatic children aged 3–18 years without identifiable risk factors.

MATERIALS AND METHODS

Patients included in the study

Between January 1, 2021, and January 1, 2022, a cross-sectional study was conducted; including children aged 3 to 18 years who had no identified risk factors for high blood pressure. The number of patients who had their blood pressure measured during their first visit is as follows. Blood pressure measurements were taken for each patient during their initial application. These children were seen at the pediatric general outpatient clinic of İnönü University's Faculty of Medicine. Written informed consent was obtained from the participants and their families after a thorough explanation of the study.

Definitions

Hypertension was diagnosed as a blood pressure value above the 95th percentile based on age, gender, and height percentiles, or a value higher than 130/80 mmHg [1]. A standardized blood pressure measurement procedure was followed for all patients attending the outpatient clinic: measurements were taken on the right arm at heart level, after at least five minutes of rest. The patient's back was supported, feet were flat on the ground, and no impediments to accurate measurement were present. The first sound heard over the brachial artery while slowly releasing the cuff pressure during auscultatory blood pressure measurement (Korotkoff phase 1) was accepted as systolic blood pressure (SBP), and the moment when the sounds completely disappeared (Korotkoff phase 5) was accepted as diastolic blood pressure (DBP) [6,7,8].

Overweight and obesity were defined according to the Centers for Disease Control (CDC, 2000) criteria. According to the body mass index (BMI) percentile tables, a BMI at or above the 85th percentile was classified as overweight, and a BMI at or above the 95th percentile was classified as obese [5]. Height and weight percentiles, based on age and gender, were determined using growth curves prepared for Turkish children [6]. Participants in this study were children aged 3 to 18 years who attended the general pediatrics outpatient department and had no established risk factors for hypertension.

Data collection

The following variables were recorded for each participant: age, gender, weight, BMI, blood pressure percentile, history of hypertension in parents, hypertension in other family members, coronary disease in parents, coronary disease in other family members, renal disease in parents, renal disease in other family members, obesity in parents, and obesity in other family members.

Exclusion criteria

- History of previously diagnosed hypertension
- History of preterm birth, low birth weight, or hospitalization in a neonatal care unit
- Use of medications that may increase blood pressure, including antihypertensive drugs
- Presence of conditions such as diabetes mellitus, hyperlipidemia, obesity, congenital heart disease, recurrent urinary tract infections, kidney disease, or anomalies that may lead to increased intracranial pressure and hypertension
- Chronic diseases such as organ transplantation or malignancy
- Obesity (defined as a BMI >95th percentile)
- Patients with a history of hypertension or cardiovascular disease in a first-degree relative were excluded from the study.

Power analysis

In the power analysis conducted to evaluate the prevalence of hypertension in asymptomatic children without risk factors, we determined that the minimum required sample size was 450. This calculation was based on an alpha margin of error of 0.05, an effect size of 0.15, power of 0.95, and a critical t-value of 1.64.

Statistical analysis

Data analysis was performed using IBM SPSS Version 22.0 (Armonk, NY: IBM Corp.). Continuous data were summarized using mean and standard deviation or median and range, whereas categorical data were presented as counts (n) and proportions (%), along with the median and interquartile range (IQR), representing the 25th and 75th percentiles. Chi-square

https://doi.org/10.5455/annalsmedres.2024.12.279

analysis (Pearson Chi-square) was used to compare categorical variables between the groups, and the normality of continuous variables was assessed using the Shapiro-Wilks Test. Independent Samples t-test was employed to compare continuous variables conforming to normal distribution between the two groups. The Spearman correlation test was used to evaluate the correlation between body mass index (BMI) and hypertension detection. Multiple binary logistic regression analysis (Backward LR model) was applied to determine the independent risk factors for hypertension. A p-value of less than 0.05 was considered statistically significant for all analyses.

RESULTS

The study ultimately included 468 children (220 females [47%] and 248 males [53%]) after excluding 32 participants from the initial cohort of 500. Exclusions were made due to subsequent diagnoses of chronic diseases (n=10), incomplete data (n=20), and recurrent urinary tract infections (n=2).

As shown in Table 1, the median age of the participants was 9 years (range: 2 years to 17 years). The median body weight was 33.5 kg (range: 11.5 kg to 88.0 kg). The median BMI was 17.05 (range: 1.0 to 36.6).

Regarding family medical history, 29 (6.2%) children's mothers, 38 (8.1%) children's fathers, and 233 (49.3%) children had a diagnosis of hypertension (HT). Additionally, 24 (5.1%) children's mothers, 29 (6.2%) children's fathers, and 197 (42.7%) children had a history of coronary artery disease (CAD). Furthermore, 8 (1.7%) children's mothers, 14 (3.0%) children's fathers, and 102 (21.8%) children had a history of kidney disease. Finally, 41 (8.8%) children's mothers, 32 (6.6%) children's fathers, and 120 (25.6%) children's family members (other than first-degree relatives) were diagnosed with obesity (Table 1).

Table 1. Demographic data of the patients included in the study.

	Frequency (n %)
Age (years) (min. - max.)	9 (3 - 17)
Body Weight (min. - max.)	33.5 (11.5 -- 88.0)
Body Mass Index (min. - max.)	17.05 (1.0 -- 36.6)
Maternal HT	29 (6.2)
Paternal HT	38 (8.1)
Family HT	233 (49.3)
Maternal coronary artery disease	24 (5.1)
Paternal history of coronary artery disease	29 (6.2)
Family history of coronary artery disease	197 (42.7)
Maternal Kidney Disease	8 (1.7)
Paternal Kidney Disease	14 (3.0)
Family history of kidney disease	102 (21.8)
Maternal Obesity	41 (8.8)
Paternal Obesity	32 (6.6)
Obesity in the Family	120 (25.6)

Table 2. Classification of cases according to blood pressure measurement.

Blood pressure	Frequency (n %)
Normal blood pressure	316 (67.5)
Pre-HT	48 (10.3)
Stage 1	71 (15.2)
Stage 2	33 (7.1)

Of the 468 children included in the study, 316 (67.5%) had normal blood pressure, 48 (10.3%) had prehypertension, 71 (15.2%) had stage 1 HT, and 33 (7.1%) had stage 2 HT (Table 2). The overall prevalence of hypertension in our study group was calculated to be 32.5%.

The mean age was 9.1 ± 4.1 years in the hypertensive group and 9.9 ± 4.2 years in the non- hypertensive group (p = 0.044). However, a statistically significant difference was observed in body mass index (BMI), with the hypertensive group exhibiting a mean of 19.3 ± 5.4 compared to 17.6 ± 3.6 in the non-hypertensive group (p < 0.001). A history of hypertension (HT) in family members other than first-degree relatives was present in 86 (56.6%) patients in the hypertensive group and 147 (46.5%) children in the non-hypertensive group (p = 0.048).

The fathers of 4 (2.6%) patients in the hypertensive group had a history of coronary artery disease (CAD), while the fathers of 25 (7.9%) children in the non-hypertensive group had a history of CAD (p = 0.038). The mothers of 22 (14.4%) children in the hypertensive group had a history of obesity, whereas the mothers of 19 (6.0%) children in the non-hypertensive group had a history of obesity (p = 0.003). A statistically significant difference was observed in the presence of maternal obesity between the two groups, with a higher proportion found in the hypertensive group (Table 3).

Spearman's correlation test performed to determine the correlation between body mass index and HT detection revealed a positive correlation between BMI and HT detection (r: 0.468 p<0.001) (Table 4).

In the binary multiple regression analysis (Backward LR model), the following were identified as independent risk factors for hypertension in children: body mass index (OR 1.154; p<0.001), a history of hypertension in family members other than first-degree relatives (OR 1.543, p = 0.040), a history of coronary artery disease in the father (OR 0.282, p = 0.026), and the presence of obesity in the mother (OR 2.238, p = 0.022) (Table 5).

According to these results, the risk of hypertension increased by 1.154-fold for higher body mass index, 1.543-fold for a family history of hypertension, 0.282-fold for a father's history of coronary artery disease, and 2.238-fold for maternal obesity. Furthermore, younger age appeared to increase the risk of hypertension by 0.884-fold.

DISCUSSION

Hypertension is a significant health issue that contributes to a high number of deaths worldwide each year [9]. An increasing number of studies suggest that the causes of hypertension seen in adults often begin in childhood. Since childhood hy-

https://doi.org/10.5455/annalsmedres.2024.12.279

Table 3. Comparison of demographic characteristics between the hypertension and non- hypertension groups.

	Group with hypertension (n=152) (n, %)	Group without hypertension (n=316) (n, %)	p
Gender (female/male)[a]	72/80	148/168	0.922
Age (years)[b]	9.1±4.1	9.9±4.2	0.044*
Body Weight (kg)[b]	38.0±19.0	36.3±16.5	0.323
Body Mass Index[b]	19.3±5.4	17.6±3.6	<0.001*
Maternal HT[a]	12 (7.8)	17 (5.3)	0.309
Paternal HT[a]	10 (6.5)	28 (8.8)	0.472
Family HT[§]	86 (56.6)	147(46.5)	0.048*
Maternal coronary artery disease[a]	9 (5.9)	15 (4.7)	0.656
Paternal history of coronary artery disease[a]	4 (2.6)	25 (7.9)	0.038*
Family history of coronary artery disease[a§]	1 (0.6)	0 (0.0)	0.163
Maternal Kidney Disease[a]	2 (1.3)	6 (1.8)	0.728
Paternal Kidney Disease[a]	3 (1.9)	10 (3.1)	0.410
Family history of kidney disease[a§]	28 (18.4)	74 (23.4)	0.234
Maternal Obesity[a]	22 (14.4)	19 (6.0)	0.003*
Paternal Obesity[a]	12 (7.8)	19 (6.0)	0.552
Obesity in the Family[a§]	43 (28.2)	77 (24.3)	0.368

**p<0.05;, Pearson Chi-square test (number, %): , Independent Student T test (meanSD) , Family assessment includes family members other than mother and father.*

Table 4. Correlation between body mass index and hypertension.

	r	p
BMI- Hypertension	0.468	<0.001*

pertension is a known risk factor for renal diseases, cardiovascular conditions, and cerebrovascular diseases in adulthood, early diagnosis and management are crucial [10]. Although hypertension is less common in children than in adults, diagnosing it can be challenging. This study aimed to examine the current prevalence of hypertension in children aged 3-18 years who have no known risk factors.

A study conducted in China in 2018 found that the prevalence of prehypertension was 6% among children aged 7-15 years [10]. In a 2017 report by Larkins et al. in Australia, the prevalence of hypertension in children aged 2-17 years was reported as 15.6%, while the prevalence of prehypertension was 12.3% [11]. Similarly, a 2010 study in Turkey reported a 7% hypertension prevalence among 1,963 children aged 7-16 years [12]. The lower figure in this study may be attributed to the exclusion of prehypertension and stage 1 hypertension.

In our study, which included 468 children, the following distribution was observed: normal blood pressure in 316 children (67.5%), prehypertension in 48 children (10.3%), stage 1 hypertension in 71 children (15.2%), and stage 2 hypertension in 33 children (7.1%). Thus, the total prevalence of hypertension in our study group was calculated to be 32.5%. This figure is higher compared to previous studies, which can be attributed to the inclusion of prehypertension and stage 1 hypertension in our analysis. This highlights the importance of considering these stages for a more accurate estimation of hypertension prevalence in asymptomatic children without identified risk factors.

Different results have been reported in studies investigating the relationship between hypertension and gender in children. While many studies have shown no significant association with gender, others conducted in various geographical regions and among different ethnic groups have found that hypertension is more common in males [13]. A study by M. Kaplan, conducted at Istanbul University with 349 hypertensive patients, reported a higher prevalence of hypertension in males (58.2%), but this difference did not reach statistical significance [14]. Similarly, a 2015 study by Yücel and Toprak found no significant gender-based differences in hypertension prevalence [15]. In our study, 72 (15.38%) of the hypertensive patients were female, while 80 (17.09%) were male, and this difference was not statistically significant.

Growth and development are directly related to blood pressure. It is known that blood pressure increases linearly in children between the ages of 1 and 3 years, likely due to body development rather than age alone. The differing growth patterns between boys and girls as they mature also lead to corresponding changes in blood pressure levels. In children under six years of age, blood pressure levels tend to be similar between the sexes. However, research suggests that girls experience a more rapid increase in blood pressure during the 6-11 year age range compared to the 11-17 year age range, while boys show a more pronounced rise in blood pressure between the ages of 12 and 17 [16,17].

Bachmann et al., in a study conducted with 1,165 subjects aged 4-18 years in the Essen region of Germany, found that blood pressure increased with age, and adolescent boys had higher blood pressure compared to preadolescent boys and adolescent girls [18]. Similarly, Akış et al. [19] found a positive association between age and hypertension. However, our study revealed a different trend: the mean age of the hypertensive group (9.1 ± 4.1 years) was lower than the mean age of the normotensive group (9.9 ± 4.2 years). We hypothesize that

https://doi.org/10.5455/annalsmedres.2024.12.279

Table 5. Determination of independent risk factors increasing the risk of hypertension detection in children by multiple logistic regression analysis.

	Beta	OR	%95 CI	p
Body Mass Index	0.144	1.154	1.089 -- 1.224	<0.001*
History of hypertension in family members other than first degree	0.433	1.543	1.020 -- 2.333	0.040*
Paternal history of coronary artery disease	-1.267	0.282	0.092 -- 0.861	0.026*
Maternal obesity	0.806	2.238	1.121 -- 4.467	0.022*

**p<0.05; OR, odds ratio; 95% CI, confidence interval.*

the significantly lower mean age in the hypertensive group was due to the exclusion of obese children from the study. As is well known, obesity is more prevalent in adolescents.

In recent years, the increase in the prevalence of obesity, the consumption of high-calorie, fatty, and salty foods, decreased physical activity, and increased stress have contributed to the rising prevalence of hypertension [20]. It has been reported that the prevalence of obesity has increased by approximately 40% in the last 40 years [16]. In a study by Fuiano et al., which measured blood pressure three times in 1,563 schoolchildren aged 3-16 years, obesity was found in 23% of boys and 31.2% of girls whose blood pressure exceeded the 95th percentile [21]. These values were significantly higher than those in children with normal blood pressure, and obesity was identified as a risk factor for hypertension. Similarly, Akış et al. found a correlation between weight gain and hypertension in a study involving 2,478 school- aged children aged 12-14 years in Bursa Province [22]. In their study, excess weight was found to significantly increase the frequency of hypertension.

In our study, the body mass index (BMI) of the hypertensive group was 19.3 ± 5.4, compared to 17.6 ± 3.6 in the normotensive group. The BMI was statistically significantly higher in the hypertensive group compared to the normotensive group. Although we did not include obese patients in our study, the BMI was found to be higher in the hypertensive group, which further supports the relationship between weight gain and the prevalence of hypertension.

Additionally, a positive correlation was observed between BMI and the detection of hypertension. These findings reinforce the established link between excess weight and increased risk of hypertension.

A family history of hypertension is considered an important risk factor for the development of hypertension in both childhood and adulthood [23]. In a study by Bryl et al., which examined 86 children diagnosed with primary hypertension, 39% had a history of hypertension in their fathers and 27% in their mothers [24]. Similarly, a retrospective study by Robinson et al. found that 49% of the parents of children with primary hypertension had hypertension, while 10% had secondary hypertension [23]. In a study by Akış et al., the prevalence of hypertension was 4.9% in children without a family history of hypertension, whereas it was 10.9% in children with a family history of hypertension [19]. Additionally, Anand and Tandon found that in children aged 5-17 years, the prevalence of hypertension was 5.9% in those with a family history of hypertension and 0.14% in those without [25].

In our study, when examining family history, 7.8% of children in the hypertensive group had a history of hypertension in their mothers, compared to 5.3% in the normotensive group. Likewise, 6.5% of children in the hypertensive group had a history of hypertension in their fathers, while 7.9% of the children in the normotensive group had a family history of hypertension in their fathers. Notably, 56.6% of the non-first-degree family members of hypertensive children had a history of hypertension, compared to 46.5% in the group without hypertension. Although there was no significant difference between the two groups in terms of hypertension prevalence in parents, the family history of hypertension in extended family members (outside of the first degree) was significantly higher in the hypertensive group. This finding is consistent with the literature, which emphasizes the role of family history in the development of childhood hypertension.

Gupta et al. conducted a study in 3194 children aged 5-15 years, finding that the presence of a family history of coronary heart disease (CAD) was significantly lower in the families of children with normal blood pressure compared to those with hypertension [25]. In our study, the mothers of 9 children in the hypertensive group had a history of CAD, while the mothers of 15 children in the normotensive group had a history of CAD. Similarly, the fathers of 4 children in the hypertensive group had a history of CAD, compared to 25 fathers in the normotensive group. Consistent with previous studies, our findings suggest that a history of CAD in fathers was more prevalent in children with hypertension.

Renal diseases are among the most common causes of secondary hypertension in children. In developing countries, consanguineous marriages contribute to an increased frequency of hereditary kidney diseases, such as polycystic kidney disease [26]. In our study, the mothers of two children in the hypertensive group had a history of renal disease, compared to six mothers in the normotensive group. The fathers of three children in the hypertensive group had a history of renal disease, while ten fathers in the normotensive group had a history of renal disease. When considering the entire family, 28 patients in the hypertensive group had a family history of kidney disease, compared to 74 patients in the normotensive group. Since we excluded children with chronic diseases or recurrent urinary tract infections from our study, no significant

https://doi.org/10.5455/annalsmedres.2024.12.279

difference was observed between the two groups in terms of family history of kidney disease.

In a study conducted in Canada with 15,245 participants, it was reported that the likelihood of obesity in relatives was five times higher when familial risk was considered, compared to the general Canadian population [27]. Similarly, a study titled "Renal functions and inflammation markers in healthy obese school children," conducted in Adana, found that the obesity rate in the parents of obese children was significantly higher compared to the control group [28]. Furthermore, it has been shown that if both parents are obese, the likelihood of their children becoming overweight between the ages of 3 and 10 years exceeds 75%. In contrast, this probability drops to 25-50% if only one parent is obese [8]. In our study, when evaluating the families of children with hypertension, a history of maternal obesity was present in 22 children in the hypertensive group, compared to 19 children in the normotensive group. The presence of maternal obesity was statistically significantly higher in the hypertensive group. Additionally, 12 fathers in the hypertensive group had a history of obesity, while 19 fathers in the normotensive group had a history of obesity. Moreover, 43 children in the hypertensive group had a family history of obesity in relatives beyond the first degree, compared to 77 children in the normotensive group.

Limitations

The exclusion of obese patients, who are already known to have a risk factor for hypertension, strengthens the validity of our study in determining the true prevalence of hypertension (HT) in children without risk factors. This study is hospital-based, which limits its ability to be generalized to the broader population. The inclusion of patients from a single hospital may not fully represent the entire pediatric population. Additionally, the relatively small sample size further restricts the generalizability of our findings.

CONCLUSION

In conclusion, the prevalence of HT in our study was higher compared to previous studies. We believe this result is due to the inclusion of prehypertension and stage 1 HT in our study. Although we excluded obese children, we found a correlation between increasing body mass index (BMI) and the prevalence of HT. Additionally, a family history of HT, coronary artery disease (CAD) in the father, and maternal obesity were identified as independent predictors of HT in children. Given the rising prevalence of HT in children, we recommend that blood pressure be measured during physical examinations for all patients aged 3–18 years, even in those without apparent risk factors. To further strengthen our findings, future studies should involve larger patient cohorts, including those from primary care centers.

Ethics Committee Approval: Our study was approved by the İnönü University Faculty of Medicine, Health Sciences Non-Interventional Clinical Research Ethics Committee on October 15, 2020 (Approval No. 27942812-770). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Informed Consent: Written informed consent was obtained from the participants and their families after a thorough explanation of the study.

Peer-review: Externally peer-reviewed.

Conflict of Interest: No conflict of interest for authors.

Financial Disclosure: None.

REFERENCES

1. Flynn JT, Kaelber DC, Baker-Smith CM, et al. Clinical practice guideline for screening and management of high blood pressure in children and adolescents. *Pediatrics.* 2017 Sep;140(3):e20171904. doi: 10.1542/peds.2017-1904. Epub 2017 Aug 21.
2. Lurbe E, Cifkova R, Cruickshank JK, et al. Management of high blood pressure in children and adolescents: recommendations of the European Society of Hypertension. *J Hypertens.* 2009;27(9):1719–42. doi: 10.1097/hjh.0b013e32832f4f6b.
3. Kural B. Sağlam Çocuk İzleminde Hipertansiyon Taraması. *Çocuk Dergisi.* 2019;19(2):60–62. doi:10.5222/j.child.2019.45403.
4. Duzova A, Yalcinkaya F, Baskin E, Bakkaloğlu A, Soylemezoglu O (2013) Prevalence of hypertension and decreased glomerular filtration rate in obese children: results of a population-based field study. *Nephrol Dial Transplant.* 2013;28:166–71. doi: 10.1093/ndt/gft317.
5. Song P, Zhang Y, Yu J, et al. Global prevalence of hypertension in children: a systematic review and meta-analysis. *JAMA Pediatr.* 2019;173(12):1154–63. doi: 10.1001/jamapediatrics.2019.3310.
6. National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents. The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents. *Pediatrics.* 2004;114(2 Suppl 4th Report):555-76. PMID: 15286277.
7. Lurbe E, Agabiti-Rosei E, Cruickshank JK, et al. 2016 European Society of Hypertension guidelines for the management of high blood pressure in children and adolescents. *J Hypertens.* 2016;34(10):1887–1920. doi: 10.1097/HJH.0000000000001039.
8. Paskalev D, Kircheva A, Krivoshiev S. A centenary of auscultatory blood pressure measurement: a tribute to Nikolai Korotkoff. *Kidney Blood Press Res.* 2005;28(4):259–63. doi: 10.1159/000090084.
9. Peterson CG, Miyashita Y. The use of ambulatory blood pressure monitoring as standard of care in pediatrics. *Front Pediatr.* 2017;5:153. doi: 10.3389/fped.2017.00153.
10. Lu Y, et al. Prevalence of hypertension and prehypertension and its association with anthropometrics among children: a cross-sectional survey in Tianjin, China. *J Hum Hypertens.* 2018;32(11):789–98. doi: 10.1038/s41371-018-0088-4.
11. Larkins N, Teixeira-Pinto A, Banks E, et al. Blood pressure among Australian Aboriginal children. *J Hypertens.* 2017 Sep;35(9):1801–7. doi: 10.1097/HJH.0000000000001401.
12. Akgun C, Dogan M, Akbayram S, et al. The incidence of asymptomatic hypertension in school children. *J Nippon Med Sch.* 2010 Jun;77(3):160–165. doi: 10.1272/jnms.77.160.
13. Kit BK, Kuklina E, Carroll MD, et al. Prevalence of and trends in dyslipidemia and blood pressure among US children and adolescents, 1999-2012. *JAMA Pediatr.* 2015;169(3):272–9. doi: 10.1001/jamapediatrics.2014.3216.
14. Kaplan MM, Yıldırım ZY, Aksu BY, et al. Çocuklarda hipertansiyon etiyolojisi ile yaşam içi kan basıncı izlemi arasındaki ilişki. *J Child.* 2018;18(3):121–128. doi: 10.5222/j.child.2018.60465.

https://doi.org/10.5455/annalsmedres.2024.12.279

15. Yücel BB, Toprak D. 6-16 yaş arası obez çocuklarda antropometrik ölçümlerin ve biyokimyasal parametrelerin değerlendirilmesi. *Ankara Med J.* 2016;16(1) doi: 10.17098/amj.90827.
16. Buyan N. Çocukluk çağı hipertansiyonu. *Turk Klinikleri Pediatrik Bilimler-Özel Konular.* 2008;4(1):72–93.
17. Ün M, Yegül S, Çoşanay B, et al. Çocuk ve Hastane. *Nobel Akademik Yayıncılık.*
18. Bachmann H, Horacek U, Leowsky M, et al. Blood pressure in children and adolescents aged 4 to 18. Correlation of blood pressure values with age, sex, body height, body weight and skinfold thickness (Essen Blood Pressure Study). *Monatsschr Kinderheilkd.* 1987;135(3):128–134. PMID: 3587234.
19. Akis N, Pala K, Irgil E, et al. Prevalence and risk factors of hypertension among schoolchildren aged 12-14 years in Bursa, Turkey. S*audi Med J*. 2007;28(8):1263–8. PMID: 17676215.
20. Manzoli L, Ripari P, Rotolo S, et al. Prevalence of obesity, overweight, and hypertension in children and adolescents from Abruzzo, Italy. *Ann Ig.* 2005;17(5):419–31. PMID: 16353679.
21. Fuiano N. Overweight and HT longitudinal study in school-aged children. *Minerva Pediatr.* 2006;58(5):451–459. PMID: 17008856.
22. Akış N, Pala K, İrgil E, et al. Bursa ili Orhangazi ilçesi 6 merkez ilköğretim okulunda 6- 14 yaş grubu öğrencilerde kilo fazlalığı ve obezite. *Uludağ Univ Tip Fak Derg*. 2003;29(3):17–20.
23. Flynn JT, Alderman MH. Characteristics of children with primary hypertension seen at a referral center. *Pediatr Nephrol.* 2005;20(7):961–6. doi: 10.1007/s00467-005-1855-3.
24. Bryl W, Miczke A, Cymerys M, et al. PO16-428 Prevalence of risk factors in children and youth with primary hypertension. *Atherosclerosis Suppl.* 2007;8(1):122. doi: 10.1016/S1567-5688(07)71438-1.
25. Gupta AK. Influence of family history of morbid cardiovascular events on blood pressure levels of school children. *Indian Pediatr.* 1991;28(2):131–9.
26. Smellie JM, Prescod NP, Shaw PJ, et al. Childhood reflux and urinary infection: a follow- up of 10–41 years in 226 adults. *Pediatr Nephrol.* 1998;12:727–36. PMID: 2055627.
27. Katzmarzyk PT, Perusse L, Rao DC, et al. Familial risk of obesity and central adipose tissue distribution in the general Canadian population. *Am J Epidemiol.* 1999;149(10):933– 42. doi: 10.1093/oxfordjournals.aje.a009737.
28. Cındık N, Baskın E, Ağras PI, et al. Sağlıklı şişman okul çocuklarında böbrek fonksiyonları ve enflamasyon belirteçleri. *Çocuk Sağlığı ve Hastalıkları Derg.* 2006;49(1):24– 29.
29. Zinner SH, Rosner BERNARD, Oh WILLIAM, et al. Significance of blood pressure in infancy. Familial aggregation and predictive effect on later blood pressure. *Hypertension.* 1985;7(3 Pt 1):411–16. PMID: 3997223.
30. Jobbágy Á, Csordás P, Mersich A. Blood pressure measurement: assessment of a variable quantity. *Zdravn Vestn*. 2011;80(4).

https://doi.org/10.5455/annalsmedres.2024.12.279