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ORIGINAL ARTICLE
ORİJİNAL ARAŞTIRMA

Risk Factors for Atherosclerosis in Children of Parents Who Had Early Cardiovascular Disease or Those Followed for Hyperlipidemia

Ebeveynleri Erken Yaşta Kalp Krizi Geçirenlerin Çocukları ile Hiperlipidemi Sebebiyle Takip Edilenlerin Çocuklarında Ateroskleroz İçin Risk Faktörleri

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ABSTRACT

Aim: Atherosclerosis describes the pathology that causes serious ischemic diseases such as stroke and myocardial infarction that these pathologies are the most common causes of morbidity and mortality. Although clinical results appear in adulthood, the process of atherosclerosis begins in childhood. In our study, we aimed to investigate cardiovascular risk factors in children with a family history of early cardiovascular disease or those followed up for hyperlipidemia.

Matherial and Method: The children / grandchildren, whose ages were between 2 and 18 of the patients who have had myocardial infarct in their early ages (<55-year-old) and stabil angina, and for whom invazive diagnosis techniques have been applied to detect a cardiovascular disease or who are followed for hyperlipidemia. One hundred and three cases and 103 controls which have not had any mentioned risk factors exist in the study. The structural measurement of the cases were recorded, blood pressure and carotid intima media thickness are measured, fasting blood glucose, cholesterol and lipoprotein values are obtained and smoking was examined.

Results: In our study, cholesterol levels were found to be significantly higher than in the control group (165.60±50.17 mg/dl and 148.90±34.30 mg/dl, respectively). In addition, HDL value was also significantly higher in the study group (50.01±13.42 mg/dl) than in the control group (37.05±13.98 mg/dl). On the other hand, triglyceride value was significantly higher in the control group than in the study group (95.00±53.43 mg/dl vs 76.60±49.20 mg/dl, respectively). No significant differences were found between the two groups in terms of anthropometric measurements, blood pressure, fasting blood glucose, low-density lipoprotein, lipoprotein (a) levels and carotid intima media measurements.

Conclusion: In our study, total cholesterol and high-density lipoprotein were found to be significantly higher in the case group, and triglyceride was found to be significantly higher in the controls. It is known that the atherosclerosis process begins in childhood and accelerates in individuals with risk factors. Therefore, pediatricians should evaluate patients who apply to the outpatient clinic in terms of risk factors and conduct further research when necessary.

Keywords: Atherosclerosis, carotid intima-media thickness, hyperlipidemia, risk factors

ÖZ

Amaç: Ateroskleroz, inme ve miyokard enfarktüsü gibi ciddi iskemik hastalıklara neden olan patolojiyi tanımlar ve bu patolojiler morbidite ve mortalitenin en sık görülen nedenleridir. Klinik sonuçlar erişkinlikte ortaya çıksa da ateorskleroz süreci çocukluk çağında başlar. Çalışmamızda, ailesinde erken yaşta kardiyovasküler hastalık öyküsü olan veya hiperlipidemi sebebiyle takip edilenlerin çocuklarda kardiyovasküler risk faktörlerini araştırmayı amaçladık.

Gereç ve Yöntem: Çalışmaya erken yaşta (<55 yaş) miyokard infarktüsü ve stabil angina geçiren, kardiyovasküler hastalık tanısı için invaziv tanı teknikleri uygulanan veya hiperlipidemi açısından takip edilen hastaların, yaşları 2 ile 18 arasında olan çocukları/torunları dahil edildi. Çalışmada, ailesinde yukarıda bahsedilen risk faktörlerine sahip 103 olgu ve öyküsünde risk faktörlerine sahip olmayan 103 kontrol yer aldı. Çocukların yapısal ölçümleri kaydedildi, kan basıncı ve karotis intima media kalınlığı ölçüldü, açlık kan şekeri, kolesterol ve lipoprotein değerleri alındı ve sigara kullanımı sorgulandı.

Bulgular: Çalışmamızda kolesterol düzeyleri kontrol grubuna göre anlamlı olarak yüksek bulundu (sırasıyla 165,60±50,17 mg/dl ve 148,90±34,30 mg/dl). Ayrıca HDL değeri de çalışma grubunda (50,01±13,42 mg/dl) kontrol grubuna göre (37,05±13,98 mg/dl) anlamlı olarak yüksek idi. Buna karşın trigliserid değeri kontrol grubunda çalışma grubuna göre anlamlı olarak yüksekti (sırasıyla 95,00±53,43 mg/dl vs 76,60±49,20 mg/dl). Her iki grup arasında antropometrik ölçümler, kan basınçları, açlık kan şekeri, düşük yoğunluklu lipoprotein, lipoprotein (a) düzeyleri ve karotis intima media ölçümleri açısından anlamlı fark bulunmadı.

Sonuç: Çalışmamızda total kolesterol ve yüksek dansiteli lipoprotein vaka grubunda, trigliserid ise kontrol grubunda anlamlı olarak yüksek bulundu. Ateroskleroz sürecinin çocukluk çağında başladığı ve risk faktörlerine sahip bireylerde bu sürecin hızlandığı bilinmektedir. Bu nedenle çocuk doktorları, polikliniğe başvuran hastaları risk faktörleri açısından değerlendirmeli ve gerektiğinde ileri araştırmalar yapılmalıdır.

Anahtar Kelimeler: Ateroskleroz, hiperlipidemi, karotis intima-media kalınlığı, risk faktörleri

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INTRODUCTION

Cardiovascular disease risk factors have become more prevalent in childhood, although atherosclerosis may not emerge until adulthood. The traditional risk factors are smoking, diabetes, hyperlipidemia, hypertension, male sex and obesity. Family history of premature cardiovascular disease is an independent risk factor in first- or second-degree relatives for developing atherosclerosis. Subjects with family history for premature cardiovascular diseases may be more susceptible to the adverse effects of risk factors than subjects without family history (1). A family history of premature cardiovascular diseases is define as hospitalisation due to myocardial infarction, angina with coronary revascularisation, stroke, or cardiovascular death in parent or full sibling, with early onset considered as disease onset before age 55 (2). Presence of family history may be part of the screening approach for risk factors in children at risk of cardiovascular disease.

In our study, we aimed to investigate the risk factors in children with a family history of premature cardiovascular disease.

MATERIAL AND METHOD

The study protocols were approved by our hospital's ethics committee. Signed informed consent forms were obtained from the parents of the adolescents. All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

This study was conducted in Selcuk University Meram Faculty of Medicine, Department of Child Health and Diseases and Department of Cardiology between 01.09.2008 and 01.09.2009. The study is a prospective case-controlled study. The children/grandchildren between the ages of 2 and 18 of the patients with those who (1) had a myocardial infarction at an early age (<55 years), (2) had angina at rest, (3) patients who were followed up due to hyperlipidemia (>240 mg/dl) and (4) had to use invasive diagnostic methods to detect cardiovascular disease were included in the study. Children with clinical or laboratory signs of any systemic disease, known heart disease and those with a disease that could increase cholesterol levels secondary to nephrotic syndrome or hypothyroidism were excluded in the study.

One hundred and three (mean age 10.2±1.8 years, range 2.0 to 18.0; mean body mass index (BMI) 20.5 (12.9-40)) children/grandchildren of individuals admitted to the cardiology unit between January 2008 and January 2009. Controls (mean age 10.0±1.2 years, range 2.0 to 17.1; mean BMI 18.3 (12.0-40.0)), were children who were admitted to the hospital due to minor illnesses such as common cold, conjunctivitis, short stature, and constipation. They had no family history of cardiac diseases.

Height and weight were measured with an empty bladder in postabsorptive conditions. BMI was calculated as weight in kilograms divided by the square of height in meters. After resting for ≥5 minutes, systolic and diastolic blood pressures were measured in the sitting position, using a mercury-gravity manometer and a cuff appropriate for body size.

Fasting blood samples (at 8 A.M.) were obtained to measure serum glucose level and other parameters in the morning by venipuncture after an overnight fast (≥12 hours). Serum concentrations of total cholesterol, high-density lipoprotein cholesterol, and triglycerides were measured using routine enzymatic methods with an Abbott Diagnostics c16000 chemistry analyzer (Abbott Diagnostics, Lake Forest, Illinois).

Carotid ultrasound studies were performed by a single cardiologist, who was blinded to the clinical and laboratory status of the patients, using high-resolution B-mode ultrasonography (Logiq 7) using a high-resolution linear-array vascular transducer (14 MHz). An optimal 2-dimensional image of the common carotid artery was obtained in which the near and far wall intima-media complex was well visualized. After a 10-minute rest and according to standard guidelines, the M-mode cursor was then placed 1 cm proximal to the beginning of the carotid artery bulb during end-diastole. Carotid intima-media thickness (CIMT) was calculated by taking the mean value of 3 measurements. There was no evidence of carotid plaque formation in both of groups.

Stepwise multivariate linear regression was then used to determine which determinants independently explained a significant ($p < 0.05$) fraction of the variance of the dependent variables. A p value <0.05 was considered to indicate statistical significance. Statistical analyses were performed using SPSS version 15.0 for Windows (SPSS, Inc., Chicago, Illinois).

RESULTS

We studied 206 children; those whose parents have a history of heart attack at an early age and who are being followed up due to hyperlipidemia, 103 children of these families constituted our study group. The remaining 103 children were those who did not have such a family history. In the study group 54.4% of cases (n:56) were male and the average age was 10.2±3.50 years). Among 103 children without risk factors 43.7% (n:45) of the control group were male and their average age was 10.0±4.04 years). There were no significant differences between the groups regarding age, body weight, height, BMI, systolic blood pressure, and diastolic blood pressure. In the study population obese children (BMI>30 kg/m2) was 2.9%. High systolic blood pressure (>95 percentile) was found to be 10.67%, high diastolic blood pressure was 8.73%.

Demographic characteristics for the study participants are shown in **Table 1**.

There were no significant differences in fasting blood glucose (FBG), low density lipoprotein (LDL) cholesterol and Lp(a) levels, while total cholesterol (TC) and high density lipoprotein (HDL) were significantly higher in the study group than in the controls, and trigliseride (TG) levels were significantly higher in controls than in the study group. The CIMT mesaurements were found similar in both groups. Three children in both groups were smokers, and all of them were adolescents.

Cardiometabolic risk factors and CIMT results of the study group and controls are listed in **Table 2**.

There were no significant differences between the genders regarding, body weight, height, BMI, systolic blood pressure, and diastolic blood pressure. Additionally, there were no significant differences in FBG, LDL and Lp(a) levels, while TG, TC, HDL levels found to be significantly higher in females. Furthermore, HDL found to be significantly higher in males. Finally, CIMT was found to be similar in boys and girls in both groups.

Demographic characteristics, cardiometabolic risk factors and CIMT results of the study group and controls compared by gender are listed in **Table 3**.

Table 1: Comparison of structural features of cases

	Number	Case	Number	Control	p
Age (year)	103	10.2 (2.0-18.0)	103	10.0 (2.0-17.1)	0.769
Male	56	%54.4	45	%43.7	
Female	47	%45.6	58	%56.3	
Height (cm)	103	137.7 (94-183)	103	134.6 (81-175)	0.316
Weight (kg)	103	38.8 (15-95.5)	103	36.1 (15.7-84.5)	0.280
BMI (kg/m2)#	103	20.5 (12.9-40)	103	18.3 (12.0-40.0)	0.162
Systolic (mm/Hg)	103	104.7 (80-140)	103	104.7 (100-134)	0.251
Diastolic (mm/Hg)	103	67.6 (40-90)	103	67.6 (50-85)	0.306
Total	103		103		

BMI: # Body mass index *Statistically significant (p<0.05)

Table 2: Comparison of laboratory values of all cases

	Number	Case	Number	Control	p
FBG (mg/dl)±	103	86,5 (14-106)	103	87,1 (60-136)	0,719
Total Chol. (mg/dl)¥	103	165,6 (15,4-346)	103	148,9 (87-260)	0,006*
TG (mg/dl)µ	103	76,6 (20-244)	103	95,0 (21-413)	0,011*
LDL (mg/dl)α	103	102,0 9 (37,4-272,6)	103	93,7 (9,5-204)	0,114
HDL (mg/dl)§	103	50,01 (23,4-93)	103	37,05 (4,8-89,2)	0,001*
Lp(a) (mg/dl)¶	103	25,78 (2,5-353)	103	24,06 (1,0-416,0)	0,767
CIMT (cm)^ Smoking	103	0,03582 (0,028-0,042) 3 (%2,9)	103	0,03594 (0,031-0,044) 3 (%2,9)	0,343
Total	103		103		

FBG±: Fasting blood glucose, total chol¥: total cholesterol, TGµ: triglyceride, LDLα: low density lipoprotein, HDL§: high density lipoprotein , LP(a)¶: lipoprotein (a), CIMT^: Carotid intima media thickness, * Statistically significant (p<0.05)

Table 3: Comparison of risk factors by gender

	Female					Male				
	Case		Control		p	Case		Control		p
	Number	Average	Number	Average		Number	Average	Number	Average	
Height (cm)	47	134.9	58	133.1	0.665	56	140.2	45	136.6	0.457
Weight (kg)	47	35.6	58	33,6	0.544	56	41.5	45	39.1	0.554
BMI (kg/m2)#	47	18.7	58	17.6	0.214	56	22.0	45	19.44	0.381
Systolic (mm/Hg)	47	104.0	58	101.9	0.353	56	105.2	45	103.3	0.530
Diastolic (mm/Hg)	47	67.6	58	64.9	0.167	56	67.7	45	67.6	0.981
FBG (mg/dl)±	47	85.1	58	85.7	0.758	56	87.8	45	88.9	0.631
Tot. Chol. (mg/dl)¥	47	163.4	58	148.7	0.040*	56	167.4	45	149.1	0.068
TG (mg/dl)µ	47	72.3	58	97.2	0.026*	56	80.3	45	92.1	0.206
LDL (mg/dl)α	47	96.0	58	92.2	0.560	56	107.1	45	95.8	0.173
HDL (mg/dl)§	47	51.8	58	38.1	0.001*	56	48.4	45	35.7	0.001*
Lp(a) (mg/dl)¶	47	22.7	58	26.5	0.664	56	28.3	45	20.9	0.342
CIMT (cm)^	47	0.0356	58	0.0358	0.773	56	0.0360	45	0.0361	0.811
Smoking	47	9.99	58	10.1	0.921	56	10.3	45	10.0	0.645
Total	47		58			56		45		

BMI#: body mass index, FBG±: fasting blood glucose, total chol¥: total cholesterol, TGµ: triglyceride, LDLα: low density lipoprotein, HDL§: high density lipoprotein, LP(a)¶: lipoprotein (a), CIMT^: carotid intima media thickness, * Statistically significant (p<0.05)

Since it is known that atherosclerosis progresses with age, we examined the results in the adolescents (13 to 18 ages). There were no significant differences in adolescents between the groups regarding age, body weight, height, BMI, systolic blood pressure, and diastolic blood pressure. Additionally, there were no significant differences in FBG, TG, TC, LDL and Lp(a) levels in whole groups, however HDL cholesterol was found significantly higher in females in the study group compared the controls (p = < 0.001). Finally, CIMT meaurements were found to be similar in boys and girls in both groups.

Demographic characteristics, cardiometabolic risk factors and CIMT results of the study group and controls compared by gender in 13-18 ages are listed in **Table 4**.

DISCUSSION

There are many studies in the literature that have found significant increases in risk factors in children with a family history of premature cardiovascular disease or hyperlipidemia (3,4). The risk of premature cardiovascular disease increases linearly with increase in number of affected family members (5). In support of this, Muchira et al. (6) reported in their study that children of parents with ideal cardiovascular health had a higher cardiovascular disease-free survival rate.

The main risk factors for the development of atherosclerosis are hypercholesterolemia and abnormal levels of lipid fractions. In the Pathobiological Determinants of Atherosclerosis in Youth (PDAY) study, fatty streaks were detected in 25% of the aorta areas of 15-year-old individuals with serum total cholesterol levels between 140–200 mg/dl and in 50% of those with levels >200 mg/dl (7). Morower, it's demonstrated that serum lipid and lipoprotein levels continue to track from childhood into young adulthood (8). In a study reported from Italy, the cholesterol levels reported in children of those with a family history of early cardiovascular disease were 166 mg/dl and 158 mg/dl in the case and control groups, respectively (9). The values in our study were found 165,60 mg/dl and 148,90 mg/dl, respectively. Additionally, 19,4% and 6,8% of the cases and controls had high cholesterol levels, respectively, and it was significantly higher in females. The inclusion of obese children in the study may have resulted in higher lipid values. In the study reported above, these rates were reported as 11.0% and 18.9% in the case and control groups, respectively (9). In another study, high cholesterol levels in children with risk factors were reported as 5,87% (10). Since a positive parental history of CVD involves an increased cardiovascular risk, parental history inquiry is useful in clinical practice (11,12). However, Davidson et al. (13) reported that, 157 children with blood cholesterol 200 mg/dl or greater, only 61 (38.9%) had a family history of early myocardial infarction or hyperlipidemia, and they claimed that, following screening only children with a positive family history will lead to the failure to detect many children with high blood cholesterol levels.

It's found that, increased LDL, Lp(a) and ox-LDL levels are common in the offspring of patients with early onset coronary heart disease (CHD) and account largely for their familial predisposition for coronary heart disease and dyslipidemia (1). In studies conducted in two different countries, the reported LDL values in children with a family history of early myocardial infarction were 97,1 mg/dl and 186 mg/dl (9,14). In our study, the mean LDL values were 102,09 mg/dl in the study group and 93,70 mg/dl in the controls. There was no significant association between the groups or gender.

Table 4: Comparison of risk factors in girls and boys aged 13–18 compared to the control group

	Female					Male				
	Case		Control		p	Case		Control		p
	Number	Average	Number	Average		Number	Average	Number	Average	
Height (cm)	12	155.0	17	155.2	0.982	15	164.4	16	161.4	0.513
Weight (kg)	12	57.4	17	50,6	0.223	15	61.3	16	55.3	0.304
BMI (kg/m2)#	12	24.1	17	20.9	0.184	15	21.8	16	21.0	0.220
Systolic (mm/Hg)	12	113.3	17	108.6	0.236	15	110.3	16	113.3	0.573
Diastolic (mm/Hg)	12	75.0	17	67.6	0.154	15	70.3	16	71.2	0.670
FBG (mg/dl)±	12	86.4	17	90.8	0.297	15	87.1	16	92.4	0.233
Tot. Chol. (mg/dl) ¥	12	166.3	17	144.6	0.041*	15	154.1	16	142.2	0.767
TG (mg/dl)µ	12	74.1	17	95.7	0.278	15	76.3	16	90.7	0.440
LDL (mg/dl)α	12	105.0	17	93.5	0.191	15	101.2	16	87.2	0.782
HDL (mg/dl)§	12	49.6	17	33.7	0.001*	15	46.8	16	38.2	0.058
Lp(a) (mg/dl)¶	12	20.9	17	20.9	0.894	15	56.3	16	26.9	0.033*
CIMT (cm)^	12	0.03750	17	0.03694	0.501	15	0.03987	16	0.03738	0.659
Smoking	12	9.99	17	10.1	0.921	15	10.3	16	10.0	0.645
Total	12		17			15		16		

BMI#: body mass index, FBG±: fasting blood glucose, total chol¥: total cholesterol, TGµ: triglyceride, LDLα: low density lipoprotein, HDL§: high density lipoprotein, LP(a)¶: lipoprotein (a), CIMT^: carotid intima media thickness, *Statistically significant (p<0.05)

It is stated that high TG alone does not have an effect on the development of atherosclerosis, but it may increase the risk when combined with disorders in other lipid fractions (15). Trigliseride has been reported in screening tests at values ranging from 29,36 mg/dl to 91,81 mg/dl (16,17). In a study conducted in Italy on children with risk factors, the value was found to be 87,70 mg/dl (9). In our study, TG value was significantly higher in control group than study group, and also significantly higher in study group in females, except for adolescent females.

HDL plays a role in reversing the atherosclerosis process (18). It's levels are particularly low in smokers and have been reported to increase with weight loss, regular physical activity, and smoking cessation (19,20). In a study conducted on children with risk factors, the HDL value was reported as 50,80 mg/dl (9). In this study, it was significantly higher in the case group (50,01 mg/dl and 37,05 mg/dl, respectively). Morover, it was significantly higher in cases in both genders, but only significantly higher in study group in female adolescents.

In the study, higher total cholesterol and HDL cholesterol levels and lower triglyceride levels were measured in the case group compared to the control group. Insufficient sample size, children's obesity status, diet and its diversity, and level of physical activity may have contributed to this result.

Elevated plasma Lp(a) levels and family history have independent and additive joint associations with cardiovascular risk (21,22). Lp(a) has pro-inflammatory and pro-atherosclerotic properties, which may partly relate to the oxidized phospholipids carried by Lp(a), morover, it's progressing the atherosclerosis process (23,24). Elevated Lp(a) is a risk factor even at very low levels of LDL. It is reported that lowering its level together with LDL rather than lowering its level alone is more important in preventing the development of atherosclerosi (25). The mean Lp(a) value was below the threshold value in the study group and the control group (25,78 mg/dl and 24,06 mg/dl, respectively). In the literature, values similar to the results of the cases in our study have been reported in children with risk factors (9,14). There was no significant association between the groups or gender, in this study.

Hypertension is one of the main risk factors for the development of atherosclerotic lesions. Atherosclerotic plaques have been found to be 12% more common in individuals with isolated systolic hypertension than in those without hypertantion (26). In our study, the mean systolic blood pressure was found to be 104,71 mmHg and diastolic blood pressure was found to be 67,66 mmHg in the case group, and these values were measured as 102,50 mmHg and 66,11 mmHg in the control group, respectively. There was no significant association between the groups or gender. In a study conducted by Muntner et al. (27) reported that, systolic and diastolic blood pressures were close to the values, as reported in our study. Kayikcioglu et al. (28) found that the relative weight, blood pressure, and plasma cholesterol were significantly higher in the children with family history of early cardiovascular disaese, than in the control group. Although hypertension is a primary cardiovascular risk factor, it was found at similar levels in both groups. Because secondary hypertension is less common in childhood and its prevalence is expected to increase with age, its prevalence in adults becomes even more important.

Numerous studies have shown that adults who have one or more first- or second-degree relatives affected with diabetes or cardiovascular disease are at high risk of having or developing these diseases. Valdez et al. (29) suggested that, family history can be part of the approach to screening for children at risk of diabetes and cardiovascular disease and should be part of prevention campaigns aimed at reducing the burden of these diseases and their risk factors in children. In our study, serum glucose levels were found to be normal in both genders and all age groups in the study and control groups. Additionally, there was no significant association between the gender. The development of childhood diabetes is observed in children with metabolic syndrome, with the exception of type 1 diabetes. Because there were no individuals with metabolic syndrome in the study, a difference in glucose levels may not have been found.

It's found that subjects with family history of coronary heart disease have increased CIMT. Carotid intima media thickness measurement is accepted as a simple, reproducible, reliable, and quite convenient method that can be used in practice for the prediction of coronary artery disease (30). It has been stated that repeated measurements of CIMT are of significant value in following the progression of atherosclerosis (31). In a study conducted in Finland with 2229 people over a 20-year period (3-18 years old in 1980, 24-39 years old in 2001), it was determined that the CIMT value measuremend in adulthood was associated with risk factors in childhood. In particular, risk factors such as LDL, systolic blood pressure, BMI and smoking were found to be significantly associated with CIMT (32). In contrary, Murali et al, (33) found no significant association between family history of diabetes mellitus and CIMT. However, studies showed that, CIMT values were higher in children with a family history of early cardiovascular disease or had hyperlipidemia compared to controls (34-36). In our study, total cholesterol, LDL, BMI, systolic and diastolic pressure values increased with age, while CIMT also increased with these parameters in both groups, but no statistical difference was found between the two groups or gender. Since the atherosclerosis process is

known to accelerate, especially after the age of twenties, in response to the long-term continuation of the risk, we believe that no significant difference was found in the CIMT value in both groups in this study.

There are some limitations in this study, The most obvious limitation of this study was its hospital based design and small sample size. Thus, the results must be interpreted with caution. Other limitation was in the evaluation of subjects for diet and exercise behavior. We performed only self-report conversations and did not use diet and exercise questionnaire. The inclusion of obese children in the study and the possibility that obesity may be a contributing variable affecting the results can be considered among the limitations of the study.

CONCLUSION

Atherosclerosis begins in childhood and clinical consequences occur in adulthood. Atherosclerosis process, progress faster in individuals with risk factors. For this reason, the American Academy of Pediatrics (APA) Nutrition Commission, recommends investigating the risk factors in children, with a history of hyperlipidemia or of those who had a heart attack at an early age or those who needed invasive procedures (37). Additionally, APA Committee on Nutrition by screening only children, who have had the risk factors, it can be 59% overlooked the patients in the society (37). American Heart Academy recommended that, at every outpatient clinic, questioning whether the children's parents have risk factors, learning about diet and physical activities, obtaining weight, height and BMI values, after the age of three, blood pressure should be measured at every check-up and check whether it is normal or not with the charts. After the age of 9-10, smoking recommends questioning (38).

ETHICAL DECLARATIONS

Ethics Committee Approval: The study protocols were approved by our hospital's ethics committee. All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

Informed Consent: All patients signed the free and informed consent form.

Referee Evaluation Process: Externally peer-reviewed.

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