Original Research

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Are Mean Platelet Volume and Neutrophil-to-Lymphocyte Ratio Related with Hepatosteatosis in Obese Children?

Serdar Kertmen[1], Ozlem Bostan Gayret[1], Meltem Erol[1], Ozgul Yigit[1], Fatih Mete[1], Abdulrahman Ozel[1]

ABSTRACT

Objective: Obesity is an important health problem, which affects children and adolescents and is highly prevalent throughout the world. Non-alcoholic fatty liver disease is fattening that occurs due to non-alcohol causes, and it is associated with obesity in most of the cases. We investigated the relation of mean platelet volume (MPV) and neutrophil-to-lymphocyte ratio (NLR) to hepatosteatosis in obese children in our study.

Material and Methods: 104 obese children aged between 4-16 years, who were determined to have a body mass index (BMI) of 95th percentile or higher according to age and gender, were examined retrospectively. The genders, ages, and examination findings of the patients were recorded. In obese children, leukocyte, hemoglobin, platelet, mean platelet volume, neutrophil and lymphocyte levels were assessed in the complete blood count performed during the first application. Neutrophil-to-lymphocyte ratio was calculated. Fasting blood glucose (FBG) and fasting insulin, serum aminotransferase values, ultrasonographic results of patients were recorded.

Results: Hepatosteatosis was determined in 64 of 104 patients (61.53%) while it was not determined in 40 patients (38.47%). The BMI, fasting insulin, HOMA-IR, ALT levels were higher in obese children with hepatosteatosis than patients without hepatosteatosis. The average MPV of the group with hepatosteatosis was 7.78±1.57, and the average MPV of the group without hepatosteatosis was 7.42±1.43, no statistical difference was observed between the groups (p=0.236). The average NLR was 1.62±1.06 in the group with hepatosteatosis and 1.38±0.59 in the group without hepatosteatosis. There was no statistical difference between the NLR averages of both groups (p=0.200).

Conclusion: No relation was determined between MPV and NLR and liver fattening in obese children.

Keywords: Child, hepatosteatosis, obesity, NLR, MPV

ÖZ

Obez çocuklarda ortalama trombosit hacmi ve nötrofil lenfosit oranı hepatosteatoz ile ilişkili mi?

Amaç: Obezite tüm dünyada yaygın olarak görülen çocukları ve adolesanları etkileyen önemli bir sağlık problemidir. Nonalkolik yağlı karaciğer hastalığı alkol harici sebeplerle oluşan yağlanma olup çoğu vakada obezite ile ilişkilidir. Çalışmamızda obez çocuklarda ortalama trombosit hacmi (OTH) ve nötrofil lenfosit oranı (NLO) ile hepatosteatoz arasındaki ilişkiyi araştırdık.

Yöntem ve Gereçler: Vücut kitle indeksi (VKİ)'i yaş ve cinsiyete göre 95. persentil ve üstü saptanan 4-16 yaş arası 104 obez çocuk retrospektif olarak incelendi. Olguların cinsiyetleri, yaşları, muayene bulguları kaydedildi. Obez çocuklarda ilk başvuruda alınan tam kan sayımında lokosit, hemoglobin, trombosit, ortalama trombosit hacmi, nötrofil ve lenfosit düzeyleri değerlendirildi. Nötrofil lenfosit oranı hesaplandı. Olguların açlık kan şekeri (AKŞ) ve açlık insulin, serum aminotransferaz değerleri, ultrasonografi bulguları kaydedildi.

Bulgular: Yüz dört olgunun 64'ünde (%61.5) hepatosteatoz varken 40'ında (%38.5) hepatosteatoz saptanmadı. Hepatosteatoz saptanan obez çocukların VKİ, açlık insulin, HOMO-IR, ALT düzeyi hepatosteatoz olmayan olgulardan daha yüksekti. Hepatosteatozu olan grubun OTH ortalaması 7.78±1.57, hepatosteatozu olmayan grubun OTH ortalaması 7.42±1.43 idi, gruplar arası farklılık gözlenmemiştir (p=0.236). NLO ortalaması hepatosteatozu olan grubda 1.62±1.06, hepatosteatozu olmayan grupta 1.38±0.59 idi. Her iki grubun NLO ortalaması arasında farklılık gözlenmemiştir (p=0.200).

Sonuç: Obez çocuklarda OTH ve NLO ile karaciğer yağlanması arasında ilişki saptanmadı.

Anahtar kelimeler: Çocuk, hepatosteatoz, obezite, NLO, OTH

[1]Health Sciences University, Bagcilar Training and Research Hospital, Department of Pediatrics, Istanbul, Turkey

Corresponding author:
Ozlem Bostan Gayret,
Health Sciences University, Bagcilar Training and Research Hospital, Department of Pediatrics, Istanbul, Turkey
E-mail address: drozlemgayret@gmail.com

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Introduction

Obesity is an important nutritional problem affecting 25-30% of children, and its prevalence is increasing all over the world (1,2). It is observed that approximately 50% of obese adolescents continue to be obese in adulthood (3). In the United States of America, its prevalence during childhood is rising considerably. The prevalence in overweight adolescents and children is varying between 21% and 24%, and in obese children and adolescents between 16% and 18% (4). In studies conducted in different provinces in Turkey, it was determined that the proportion of overweight children in school age is 4-13% and the proportion of obese children is 9-27% (5-7).

The fact that obese children have high morbidity and mortality during adulthood and children who become obese during adolescence are at the risk of cardiovascular diseases and diabetes. These findings indicate that obesity is an important health problem (8,9).

It is reported that against the belief that obesity does not lead to a significant problem in childhood. Obese children have elevated transaminases or ultrasonographic examinations show hepatic steatosis and obese children undergo silent liver changes (10).

Hepatosteatosis (liver fattening) is defined as lipids making up more than 5% of the liver weight, or fatty vacuoles present in more than 5% of hepatocytes in the histopathological examination (11). Hepatosteatosis, a reversible condition, is asymptomatic in most patients. However, in advanced patients that cannot be treated, steatohepatitis and consequently cirrhosis are inevitable (12).

Obesity causes many metabolic changes, insulin resistance, and cardiovascular diseases. Complications of obesity in children and adolescents are now better known. Therefore, the prevention and treatment of obesity have become important problem that should be solved urgently (13).

In recent years, the relationship between obesity and hepatosteatosis due to diabetes has been investigated in various studies, since mean platelet volume (MPV) and neutrophil-to-lymphocyte ratio (NLR) are inexpensive, easily accessible hemogram parameters (14-16). The relation of NLR and MPV to hepatosteatosis was assessed in obese children in the present study.

Material and Methods

104 patients between 4 and 16 years of age who were admitted to the polyclinic in Bagcılar Training and Research Hospital Pediatric Clinic of University of Health Sciences and diagnosed with obesity between April 2015 and August 2015 were examined retrospectively. Children who were determined to have a body mass index (BMI) of the 95th percentile or higher according to age and gender were accepted as obese. The BMI values (Weight [kg]/Height^2 [m^2]) of the patients were calculated using height and weight measurements.

Patients with infection, metabolic or endocrine diseases and receiving food supplements were excluded from the study. Children with primary liver disease leading to liver fattening, those receiving regular treatment for a chronic disease, and those with systemic infections or immunological disorders were excluded from the study.

The genders, ages, and examination findings of the patients were recorded. In obese children, leukocyte, hemoglobin, platelet, mean platelet volume, neutrophil and lymphocyte levels were assessed in the complete blood count performed during the first application. Neutrophil-to-lymphocyte ratio was calculated. Serum aminotransferase, fasting blood glucose (FBG) and fasting insulin values were recorded. The FBG (mg/dL) x fasting insulin (μU/mL)/405 formula showed us homeostasis model assessment-insulin resistance (HOMA-IR) (17). Ultrasonographic results of the patients were recorded.

The ethics committee approval of the study was obtained from local ethics committee (no: 2017-576). The informed consent forms were signed in accordance with the Declaration of Helsinki.

Statistical Evaluation

The NCSS 2007 (Number Cruncher Statistical System 2007 Statistical Software, Utah, USA) packaged program was used to analyse for statistical evaluation. Descriptive statistics were used to assess the data. Student's t-tests were used to compare continuous data between groups and chi-square test to compare the categorical data.

Results

Hepatosteatosis was diagnosed in 64 of 104 obese patients (61.5%) while it was not diagnosed in 40 patients (38.5%). The average age of hepatosteatosis cases was 11.45±2.98 years. The average age of those without hepatosteatosis was 11.15±3.46

Table 1: Demographic characteristics of patients with and without hepatosteatosis

		Hepatosteatosis(-) n:40		Hepatosteatosis(+) n:64		p
Age		11.15±3.46		11.45±2.98		0.367
Gender	Male	15	37.50%	27	42.19%	0.636
	Female	25	62.5%	37	57.81%	

Table 2: Clinical and laboratory characteristics of patients with and without hepatosteatosis

	Hepatosteatosis(-) n:40	Hepatosteatosis(+) n:64	p
BMI	26.98±4.36	31.06±4.76	<0.001
Fasting Glucose	89.38±6.73	90.6±9.85	0.492
Fasting Insulin	17.27±14.17	25.31±17.5	0.016
HOMA-IR	3.90±3.48	5.84±4.41	0.02
ALT	21.08±8.02	29.14±17.05	0.006
AST	23.01±5.67	23.83±8.13	0.578

BMI: Body mass index, HOMA-IR: Homeostasis model assessment-insulin resistance, ALT: Alanine aminotransferase, AST: Aspartate aminotransferase

Table 3: Hemogram parameters of patients with and without hepatosteatosis

	Hepatosteatosis(-) n:40	Hepatosteatosis(+) n:64	p
Hemoglobin	13.44±0.95	13.59±0.94	0.454
Platelet	326.68±67.86	322.86±74.25	0.793
MPV	7.42±1.43	7.78±1.57	0.236
Neutrophil	4.31±1.75	4.93±1.9	0.099
Lymphocyte	3.26±0.92	3.33±1	0.696
NLR	1.38±0.59	1.62±1.06	0.200

MPV: Mean platelet volume, NLR: Neutrophil-to-lymphocyte ratio

years. Of the patients with hepatosteatosis, 27 were male (42.19%), and 37 were female (57.81%), while of the patients without hepatosteatosis, 15 were male (37.5%), and 25 were female (62.50%). There was no difference between the age and gender distributions of both groups (Table 1).

The mean BMI, ALT levels, fasting insulin levels and HOMA-IR were higher in the group with hepatosteatosis than in the cases without hepatosteatosis (Table 2).

Hemoglobin, platelet, neutrophil, lymphocyte, MPV, NLR values among the hemogram parameters were not determined statistically significant different between the cases with and without hepatosteatosis (Table 3).

Discussion

Obesity is an increasing of the adipose tissue volume in the body. Due to the problems caused by that, obesity threaten children as much as adults, and it is a serious health problem at later ages (18,19). Non-alcoholic fatty liver disease (NAFLD) is liver fattening not to alcoholuse, and it is associated with obesity in most of the cases (20,21). In a study conducted by ultrasonography among 810 school children in Japan, the prevalence of fatty liver was determined to be 2.6% (22). Fatty liver was reported 77% of 84 children in obese Chinese children (23). The proportion of hepatosteatosis detected by ultrasonography in our study was determined to be 61.53%.

Non-alcoholic fatty liver is associated atherosclerosis, cardiovascular disease, insulin resistance, type II diabetes mellitus (24,25). Chan et al. (23) showed a correlation with BMI, high ALT, insulin resistance, triacylglycerol and hepatic steatosis. In a study conducted by Arslan et al. (26), BMI, AST, ALT and triglyceride levels of obese patients with hepatosteatosis were significantly higher than those of obese patients without hepatosteatosis. In our study, obese cases with hepatosteatosis had higher BMI, ALT and insulin resistance levels compared to obese children without hepatosteatosis, which is consistent with the literature.

Thrombocytes play an important role in hemostasis and endothelial repair, but also in the formation of atherothrombosis (27). The platelet volume is associated with platelet functions and activation (28). The MPV is an indication of platelet activation, and there is a limited number of studies in the literature about the MPV level in obese children with fatty liver (14,15). Arslan et al. (14) found out that obese children with fatty liver had higher MPV levels than the control group and obese children without fatty liver, and they suggested that MPV may be a marker for monitoring atherosclerosis in liver fattening. Unlike the literature, we did not determine any significant difference between obese cases with and without hepatosteatosis in terms of MPV levels.

The NLR is generally considered to be an indication of sub-clinical inflammation and is gaining popularity nowadays (29). In the literature there are few studies about the effect of the NLR on liver fattening (30,31). Abdel-Razik et al. (30) compared mean platelet volume and neutrophil-to-lymphocyte ratio on a total of 873 NAFLD patients (753 not diagnosed with non-alcoholic steatohepatitis (NASH) and 120 diagnosed with NASH by biopsy) diagnosed by biopsy and 150 individuals in the healthy control group. The levels of MPV and NLR in cases diagnosed with NASH were determined to be significantly

higher compared to patients who had fatty liver and were not diagnosed with NASH. In the study of Acar et al. (31), no relation was found between simple liver fattening and NLR, and it was concluded that NLR would not provide an additional contribution to the clinical data in early period of liver fattening. We also found no relation between NLR and liver fattening in obese children in the present study.

Obesity itself is a low-level chronic inflammatory process (32). The source of many cytokines that initiate and spread inflammation is the adipose tissue (33). In recent years, it has shown that the adipose tissue, originally thought to be a passive storehouse, plays an important role in the secretion of metabolic cytokines and can function actively in harmful lipid accumulation in other tissues and change insulin resistance (32). Glucose converted to fat as a result of overnutrition is stored in muscles and liver, not in adipose tissue (20). Subclinical inflammatory processes play a role in the pathogenesis of both obesity-related hepatosteatosis and atherosclerosis (14).

Obesity-related hepatosteatosis is less prevalent in children. In childhood, other metabolic complications of obesity are also less common. The above-mentioned studies were performed on the adult age group and adolescents. However, our patient group was aged between 4 and 16 years and included younger individuals. There are few studies on children in this regard. We think that the serious metabolic complications of obesity are less prevalent in the younger age. The lack of a difference between the of the obese children with and without hepatosteatosis in terms of MPV and NLR suggests that this may be due to the presence of younger children in our study group, and the lower incidence of metabolic and cardiovascular complications and inflammation in this age group.

Conclusion

There was no relation of MPV and NLR to liver fattening in obese children in our study. In the literature, we did not encounter any study examining the relation between NLR and liver fattening in obese children. The weak aspect of our study is that it is a retrospective study. Furthermore, no comparison was made between obese groups and healthy control group in terms of MPV and NLR in the study. Therefore, there is a need for controlled and prospective studies.

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Informed Consent: Written informed consent was obtained from the patient.

Ethics Committee Approval: Ethics Committee approval was obtained from the local ethics committee.

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