Neutrophil/lymphocyte ratio in obese adolescents

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ABSTRACT

OBJECTIVE: Obesity is a growing health problem in most of the developed countries. It is associated with many chronic diseases, affecting particularly endocrine and cardiovascular systems. Inflammation plays a key role in pathophysiology of obesity. In this study, we aimed to investigate the inflammation status in obese children using neutrophil/lymphocyte ratio.

METHODS: In this study 130 obese and 57 healthy children were assessed retrospectively. According to Centers for Disease Control 2000 (CDC) BMI percentiles for childhood and adulthood, 85–95 percentile was considered as overweight and >95 percentile as obese.

RESULTS: Lymphocyte/neutrophil ratios in the obese group were significantly higher compared to those in healthy controls (p=0.03 and p=0.045, respectively). Neutrophil/lymphocyte ratio and CRP level in the obese group were significantly higher compared to those in healthy controls (p=0.02 and p=0.00, respectively). Thrombocyte/lymphocyte ratios were not significantly different between two groups (p=0.156).

CONCLUSION: It is possible that childhood obesity which has been increasingly prevalent recently triggers the pathogenesis of atherosclerosis during the early years of life. Increased neutrophil/lymphocyte ratio might be associated with the severity of inflammation which plays a role in the early stages of atherosclerosis. Therefore, taking childhood obesity under control using diet and other treatment methods will prevent mortality and morbidity in the elderly.

Keywords: Childhood obesity; inflammation; neutrophil/lymphocyte ratio.

Obesity is a multifactorial disease which can cause diabetes, cardiovascular disease, and renal failure [1]. Obesity which is a global health problem causes increases in morbidity, and mortality. In recent years, health problems account 2–7% of all health expenditures [2]. Therefore investigations on pathophysiology of obesity have gained increasing importance.

In the pathogenesis of obesity many factors play important roles. Inflammation which is characterized by abnormal cytokine production, and penetration of macrophages into adipose tissue is one of these factors Besides this mechanism can also contribute to the development of insulin resistance [3].

Pediatric obesity is a determinative factor of adult obesity. One-third of obese children become obese adults [4]. Besides, childhood obesity increases the risk of cardiovascular, metabolic, pulmonary, gastrointestinal, and skeletal system diseases [5]. In obese children, it has been proposed that endothelial dysfunction caused by insulin resistance, free fatty acids, nitric oxide, and inflammatory cytokines results in cardiovascular diseases in obese children [6].

NLR is the ratio between the number of neutrophils, and lymphocytes. The neutrophil/lymphocyte ratio is a simple, cost-effective, and useful inflammation marker which has been studied in many inflammatory diseases, cardiovascular diseases, and cancer [7, 8].

In our study, assessments of NLR between obese children, and the control group were performed with the intention to investigate the usefulness of NLR as a marker in the evaluation of the severity of inflammation in obesity.

MATERIALS AND METODS

Study group

Medical files of the patients who were referred to the outpatient clinics of Children's Health and Diseases of Namik Kemal University Research, and Application Hospital were analyzed, and height, bodyweight, waist, and hip circumferences of the patients were recorded. Among these cases, patients who had undergone complete word counts because of medical requirement or routine control were included in the study, and their neutrophil, and lymphocyte parameters were evaluated. Medical files or the patients were screened, and those with viral-bacterial infection, insulin-dependent diabetes, congenital metabolic disease or hormonal disorder were excluded from the study group. A to-

tal of 130 obese (aged 6–15 years) and 57 (aged 7–15 years) healthy control subjects were included in the study. Demographic data of the patients are presented in Table 1.

Body mass indices (BMIs) of the children were estimated based on BMI percentiles established by The Centers for Disease Control 2000 (CDC) for children, and adolescents. Participants with BMIs between 85–95 percentiles were defined as overweight, and those over 95 percentile as obese [9].

Hematological measurements

Blood samples to be analyzed for neutrophils, lymphocytes, and other hemogram parametres were placed in tubes containing K2 EDTA. Following 15 minutes of agitation, the samples were analyzed in Pentra Dx Nexus (UK) device under room temperature. For biochemical measurements venous blood samples obtained after 8–10 hours of fasting period were analyzed. All biochemical tests were performed in Cobas C 501 Roche (Japan) biochemical analyzer using commercial kits.

Statistical analysis

In all analyses SPSS 17.0 (Chicago, IL.) program was used. Numerical variables were expressed as medians, maximum, and minimum. Normality of continuous variables was checked with Kruskal-Wallis test. For comparison of data with non-normal distribution Mann- Whitney U test was used.

RESULTS

Measured parametres of a total of 187 healthy, and obese children are given as median, minimum, and

TABLE 1. Age, and measured body parametres of the healthy control, and obese individuals participating in the study

	Healthy control	Obese group
Age (year)	13.14±1.88	12.84±2.04
Bodyweight (kg)	39.23±9.04	67.52±14.36
Height (cm)	144.02±13.09	153.04±12.02

maximum values in Table 2. Obese, and healthy control groups were compared, and lymphocyte, and neutrophil ratios were found to be significantly higher in the obese group (p=0.03, and 0.045, respectively). Similarly, neutrophil/lymphocyte ratio, and CRP levels were found to be significantly higher in the obese group (p=0.03, p=0.02, and p=0.00). Besides, mean platelet volume (MPV) was significantly higher in the obese group (p=0.005). Both groups did not differ significantly as for platelet/lymphocyte ratio (p=0.156)

DISCUSSION

In recent years because of diets rich in fats, and sedentary life style, prevalence of obesity has rapidly increased [2]. Obesity plays a central role in insulin resistance which include hyperinsulinemia,

hypertension, hyperlipidemia, and type-2 diabetes, and increases the risk of cardiovascular disease [10]. Although, obesity has been demonstrated to be an independent risk factor for atherosclerotic cardiovascular diseases, the mechanism of increased cardiovascular risk in obese individuals has not been clarified yet [11]. In studies performed, the pathogenesis of pathological processes of atherosclerotic cardiovascular disease, and related risk factors have been dated back to the pediatric age [12].

Obesity is a chronic inflamatory disease characterized by altered adipokine production, and increase in the levels of inflammatory cytokines. Kim et al. analyzed levels of leptin, and inflammatory cytokines including hs-CRP, tumor-necrosis factor (TNT-α), interleukin-6 (IL-6) in young obese girls, and they were found to be significantly higher

TABLE 2. Biochemical, and hematological parametres measured in healthy controls, and obese individuals

	Obese			Control			
	Median	Min.	Max.	Median	Min.	Max.	p
Red blood cell (10^3/uL)	4.91	4.23	5.99	4.76	4.26	5.66	.871
HGB (g/dL)	12.92	11.4	15.3	12.68	11.5	13.9	.807
HCT (%)	38.58	32.7	43.9	37.77	34.4	42.2	.343
MCV (fL)	78.54	66.9	87.5	77.42	73.3	85.9	.193
MCH (pg)	27.37	23.1	29.6	28.27	23.4	28.2	.878
MCHC (g/dL)	33.34	32.1	35.6	33.56	31.8	35.8	.047
RDW (%)	13.89	11.5	16.1	13.48	12.4	17.5	.079
WBC (10^3/uL)	7.09	4.39	9.86	7.08	5.07	8.62	.718
Netrophil (%)	49.05	32.4	65.5	46.87	30.7	60.8	.045*
Lymphocyte (%)	39.28	25.6	52.5	41.67	30.6	57.3	.021*
Monocyte (%)	8.70	5.4	12.8	8.70	5.3	15.4	.851
Eosinophil (%)	2.44	0.5	5.9	2.72	1.1	4.3	.336
Basophil (%)	0.32	0.1	0.9	0.34	0.1	0.9	.591
Platelets (10^3/uL)	311.75	165	493	324.92	199	455	.694
MPV (fL)	9.90	8.6	12.9	9.50	8.5	10.9	.005*
PDW (%)	11.00	9.1	14.5	10.36	9	13.1	.007
Netrophil/Lymphocyte ratio	1.33	0.53	2.23	1.21	0.52	2.09	.030*
Platelet/Lymphocyte ratio	94.73	50.27	189.21	103.68	57.3	181.4	.155
CRP (mg/dL)	3.36	0.04	4.99	1.37	0.07	4.34	.000*

*p<0.05 statistically significant; HGB: Hemoglobin; HCT: Hematocrit; MCV: Mean corpuscular volume; MCH: Mean corpuscular hemoglobin; MCHC: Mean corpuscular hemoglobin concentration; RDW: Red blood cell distribution width; WBC: White blood cell; MPV: Mean platelet volume; PDW: Platelet distribution width; CRP: C-reactive protein.

in obese women relative to non-obese women [13].

In recent studies increased levels of CRP were detected in obese individuals [14, 15]. High-sensitive C-reactive protein (hs-CRP) which can be used as a marker of metabolic syndrome is a useful marker of childhood obesity. Prevention of obesity, and inflammation which start in childhood will contribute to the prevention of metabolic syndrome in the future [16]. Similarly, CRP level in the obese group was found to be significantly higher in our study when compared with the healthy controls.

Arslan and Makay have demonstrated that MPV levels were higher in obese adolescents with non-alcoholic fatty liver when compared with healthy controls, and other obese patient groups [17]. However, Kilciler et al. reported that any significant difference was not found between the patients with non-alcoholic fatty liver disease as for MPV levels [18]. Also in our study, we detected higher MPV levels in the obese patient group when compared with the healthy controls.

NLR which is a strong indicator of inflammation has been investigated in various inflammatory, and neoplasic diseases including metabolic syndrome [19], Behcet's disease [20], coronary artery disease [21, 22], heart failure [23, 24], colorectal cancer, chest, and lung diseases, and hepatocellular carcinoma [8]. The main fundamental etiological factor of this wide spectrum is that NLR contains two separate inflammation markers.

Neutrophils have been reported to migrate into ischemic myocardial tissue before other inflammatory cells, and cause destructive changes by stimulating release of proteolytic enzymes, reactive oxygen radicals, and neutrophils [25]. As a known fact, in the pathophysiology of atherosclerotic cardiovascular diseases, increased inflammation, and endothelial dysfunction play fundamental roles [26]. Outcomes of this study suggest that NLR may be one of the markers of endothelial dysfunction, and inflammation in obese patients.

Obesity–related studies performed in adults have suggested that various comorbidities as diabetes, insulin resistance, hyperlipidemia, and coronary artery disease prevent disclosure of cause-effect relationship between obesity, and inflammation. However, in the pediatric age group rarely any disease state accompanies obesity. Therefore this study provides a clarification on this issue which also aids in the evaluation of this correlation between obesity, and inflammation.

In conclusion, in chidhood obesity, increased NLR, and MPV levels probably trigger atherogenesis. Therefore keeping obesity under control using dietary modifications, and other treatment methods carries importance in decreasing mortality, and morbidity rates in adulthood.

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