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Do Active Sports and Games Affect Hemoglobin and Hematocrit Levels in Overweight Children?

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Abstract: The purpose of this study is to investigate the effect of an eight-week active sports and games program on hemoglobin and hematocrit levels in obese and overweight boys. The study included 40 boys, between the ages of 13-15, divided into two groups: one an obese group consisting of 20 boys, and the other, an overweight group also consisting of 20 boys. The children who participated in the study were included in a three-day-a-week program for 8 weeks. This consisted of 60 minutes of selected active sports and games and a walk that gradually increased in duration. Hemoglobin and hematocrit levels were determined from blood samples collected while resting at the beginning and at the end of the study. SPSS 22.0 statistics software (SPSS Inc., Chicago, Illinois, USA) was used in the statistical analysis of data obtained in the study. The Independent Samples T test was used to compare the two groups, and the Paired Samples T test was used to analyze the difference between the pre and post-tests of the groups. After the application, analyzing the pre- and post-tests of the measured values taken from obese subjects, the body weight of the obese group significantly changed in favor of the post-test ($p<0.05$), whereas hemoglobin and hematocrit levels increased. However, this increase was not found to be statistically significant ($p>0.05$). The body weight, BMI, hemoglobin and hematocrit levels of the overweight group were significantly increased in favor of the post-test ($p<0.05$). A statistically significant difference was found in favor of the overweight group in the hematocrit levels in the intergroup analysis of pre- and post-test differences between the measured values of both groups ($p<0.05$). Consequently, it can be stated that the 8-week program, consisting of sports games applied to obese and overweight children between the ages 13-15, alters hemogram and hematocrit levels.
Keywords: Active sports, games, hemogram, hematocrit.

INTRODUCTION

Physical inactivity is the main cause for the development of obesity. In modern communities, the ability to perform work by expending less energy, and spending more time watching TV, especially during childhood, causes the body to store unspent energy as fat. In such cases, the human organism's capacity for physical activity decreases, and the organism becomes less fit due to a sedentary lifestyle. Muscles become weaker and lose functionality, and obesity develops as a result of weight gain due to insufficient expenditure of consumed energy sources [1-3]. Physical activity is an important function of living systems. It can affect biochemical parameters, as well as many other systems. It is also known that biochemical levels change depending on the type, intensity and duration of exercise [4].

MATERIALS AND METHODS

Participants

The study included 40 boys, between the ages of 13-15, divided into two groups: one an obese group consisting of 20 boys, and the other, an overweight group also consisting of 20 boys. In order to determine obesity and to form the groups, Body Mass Index (BMI), which is calculated by dividing the individual's body weight (kg) by the square of his height (m) (BMI=kg/m2), was used. The subjects participating in the study were informed about the physical activity program and the laboratory tests that would be performed. Informed consent forms and written confirmation for participation in the study were obtained from the parents of the children that were included in the study.

Study Design

The children who participated in the study were included in a three-day-a-week program for 8 weeks. This consisted of 60 minutes of selected active sports and games and a walk that gradually increased in duration. The children's body weight and BMI were determined, and their hematocrit and hemoglobin levels were obtained from fasting blood samples collected

while resting in the morning, one day before and one day after the 8-week exercise program.

Physical Activity Program

The children who participated in the study were included in a three-day-a-week program for 8 weeks. This consisted of 60 minutes of selected sports games and a walk that gradually increased in duration. The physical activity program was prepared by considering the age and condition of children to achieve a heart rate during vigorous activity of between 120-140 [5].

	1.day	2.day	3.day
1.week	30 min. walk	45 min. walk	60 min. walk
2.week	30 min. walk	45 min. walk	60 min. walk
3.week	15 min. warming/ 15 dk basketball	15 min. warming/ 20 dk basketball	15 min. warming/ 25 dk basketball
4.week	15 min. warming/ 15 dk basketball	15 min. warming/ 20 dk basketball	15 min. warming/ 25 dk basketball
5.week	15 min. warming/ 30 dk football	15 min. warming/ 5 dk football	15 min. warming/ 60 dk football
6.week	15 min. warming/ 30 dk football	15 min. warming/ 5 dk football	15 min. warming/ 60 dk football
7.week	45 min. walk	60 min. walk	75 min. walk
8.week	45 min. walk	60 min. walk	75 min. walk

STATISTICAL ANALYSIS

SPSS package software SPSS 22.0 (SPSS Inc., Chicago, Illinois, USA) was used in the statistical analysis of data obtained in the study. The Independent Samples T test was used to compare the two groups, and the Paired Samples T test was used to analyze the difference between the pre and post-tests of the groups.

RESULTS

The statistical analysis of the pre-test and post-test values of the obese and overweight groups is provided in the tables.

Table-1: Analysis of the values measured in obese subjects (n=20) between pre- and post-tests.

		Mean	Std. Dev.	t	p
Weight	Pre-test	79,47	9,636	8,216	0,001
	Post-test	76,55	8,993		
BMI	Pre-test	28,75	2,147	1,325	0,212
	Post-test	27,85	3,154		
HGB	Pre-test	13,28	,8980	0,987	0,345
	Post-test	13,86	1,700		
HCT	Pre-test	39,86	7,391	-0,883	0,396
	Post-test	41,74	2,929		

According to Table 1, body weight and BMI values of obese subjects were reduced in favor of the post-test, and this decrease was found to be a significant in favor of the body weight post-test ($p<0.05$). Hemoglobin and hematocrit levels were increased, however this change was not found to be statistically significant ($p>0.05$).

Table-2: Analysis of the values measured in overweight subjects (n=20) between pre- and post-tests

		Mean	Std. Dev.	t	p
Weight	Pre-test	69,9067	4,85158	9,771	0,001
	Post-test	66,8133	4,61811		
BMI	Pre-test	26,3600	,24437	8,810	0,001
	Post-test	25,2200	,43458		
HGB	Pre-test	13,3967	1,06562	4,678	0,001
	Post-test	14,4380	,85502		
HCT	Pre-test	40,2500	1,96671	4,344	0,001
	Post-test	42,5293	2,72083		

According to Table 2, the body weight, BMI, hemoglobin and hematocrit values of overweight subjects exhibited a statistically significant change ($p<0.05$).

Table-3: Intergroup analysis of pre-post test differences of measured values in obese and overweight subjects

		Mean	Std. Dev.	t	p
Weight	Pre-test	-3,091	1,053	0,004	0,997
	Post-test	-3,093	1,226		
BMI	Pre-test	-1,500	1,023	-1,199	0,242
	Post-test	-1,140	0,501		
HGB	Pre-test	-1,041	,8621	0,822	0,419
	Post-test	-,5708	2,003		
HCT	Pre-test	-2,279	2,032	2,096	0,046
	Post-test	1,880	7,379		

Considering the intergroup analysis of the pre-post test differences of measured values in obese and overweight subjects, a significant difference in favor of the overweight group was only detected within hematocrit levels ($p<0.05$).

DISCUSSION

The purpose of this study is to investigate the effect of an eight-week active sports and games program on hemoglobin and hematocrit levels in obese and overweight boys. According to the analysis conducted, after applying the sports game program to obese and overweight subjects, the change in the body weight of the obese group was found to be statistically significant ($p<0.05$), whereas the body weight, BMI, hemoglobin and hematocrit values of the overweight group exhibited a significant change in favor of the post-test ($p<0.05$).

Age, gender, genetic predisposition, eating habits, knowledge of nutrition and habits, psychological factors, and a sedentary lifestyle at home form, the basis of the development of obesity in children. During the physical growth process in adolescents, there is an increase in muscle tissue in both genders, especially males, as well as an increase in body fat [6].

It is known that obesity is a risk factor for cardiovascular diseases. Insulin resistance, diabetes, dyslipidemia and atherosclerotic diseases are more common in obese individuals, as compared to those who are not obese [7, 8]. It was emphasized in many studies that there is a close relationship between cardiovascular risk factors such as hypertension, hyperlipoproteinemia, diabetes, smoking and hemorheological factors [9-11].

These studies indicate that exercise has a positive effect on and improves the physical, physiological, psychological and motoric features of individuals [12]. Exercise creates stress in the human organism, and this stress creates various physiological and metabolic effects in human body. One of these effects are the changes that take place in the blood [13]. The most important effect of regular exercise is seen on blood cells. In analyzing the blood cells, it was seen that regular exercise had different effects on blood cell levels. It is stated that these differences depend on the intensity, duration and frequency of exercise as well as the physical, physiological and fitness condition of the subjects that participate in the study [14].

Investigating the studies concerning hemogram and hematocrit, there was a significant difference in a study that compares sedentary individuals and the individuals who exercise in these values in favor of those who exercise [15]. In another study, there was a significant increase in the hemoglobin values of subjects after an 8-week aerobic exercise program [16]. This finding was supported by similar results from other studies [17, 18]. According to a study by İbiş *et al*. there were no significant differences in any of the hematological values after aerobic exercise, whereas there was a significant increase right after anaerobic exercise and a significant decrease 24 hours after the exercise, in Hb and Hct values [19]. It was indicated that hemogram and hematocrit levels were higher in individuals who exercise, in comparison to sedentary individuals. It is thought that this increase depends on the level of exercise or physical activity. In literature, it is stated that the increase in these values is explained by exercise-induced hemoconcentration, or more importantly by the provision of blood with a high hematocrit level from the spleen to circulation [20-22]. Furthermore, particularly the increase in leukocytes is more marked as the leukocytes in the margination pool join blood circulation due to the acceleration thereof [23]. Consequently, it is plausible to state that a regular eight-week exercise program can alter hemoglobin and hematocrit levels in overweight individuals.

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