Scholars Journal of Arts, Humanities and Social Sciences ISSN 2347-5374(Online)
Abbreviated Key Title: Sch. J. Arts Humanit. Soc. Sci. ISSN 2347-9493(Print)

(An International Publisher for Academic and Scientific Resources) DOI: 10.36347/sjahss.2018.v06i07.019

The Effect of a Four-Week Physical Activity Program on Liver Enzyme Levels, Uric Acid, Urea and Creatine Kinase Activity in Obese and Overweight Children

Zarife Pancar[1*], Mustafa Özdal[2], Mehmet Vural[1]
[1]Research Assistant, Department of Physical Education and Sports, School of Physical Education and Sport, Gaziantep, University: Besyo, Osmangazi Mahallesi, Üniversite Blv., 27310 Şehitkamil/Gaziantep, Turkey
[2]Associate Professor, Gaziantep University, School of Physical Education and Sport, Osmangazi Mahallesi, Üniversite Blv., 27310 Şehitkamil/Gaziantep, Turkey

***Corresponding author**
Zarife Pancar

Article History
Received: 15.07.2018
Accepted: 26.07.2018
Published: 30.07.2018

Abstract: The human organism's capacity for physical activity decreases and the organism loses its fitness in a sedentary lifestyle. Obesity is a global epidemic which also affects children**.** The purpose of this study is to investigate the effect that a four-week low intensity physical activity program will have on the liver enzyme levels, uric acid, urea and creatine kinase activity of obese and overweight boys. The study included 27 boys between the ages of 12-14 divided into two groups as the obese group of 12 boys and overweight group consisting of 15 boys. The children who participated in the study were included in a three-day-a-week program for four weeks. The AST, ALT, ALP, uric acid, urea and creatine kinase levels were quantified from plasma blood samples collected while resting in the beginning and end of the study. Statistical analysis of was performed using program SPSS 22.0 statistics software (SPSS Inc., Chicago, Illinois, USA). 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-tests and post-tests of the groups. At the end of the study, it was found that the obese group had decreased their body weight and showed a significant increase in creatine kinase and ALP levels in favor of the post-test. The overweight group exhibited a decrease in BMI and a significant increase in ALP levels in favor of the post-test. None of the difference values between the two groups exhibited a significant change (p>0.05). Consequently, it can be stated that low intensity physical activity program applied to children results in a change in body weight, BMI, ALP and creatine kinase activity.
Keywords: Physical activity, AST, ALP.

INTRODUCTION

Although obesity is simply defined as energy intake being higher than the energy spent, obesity that occurs as result of the complex interaction of genetic structure, conditions affecting energy metabolism, eating habits and sociocultural factors is a complicated condition that is closely associated with many diseases such as hypertension, cardiovascular disease, diabetes, degenerative arthritis and thrombophlebitis, etc. It is considered to be a disease that concerns all age and socioeconomic groups with extremely serious social and psychological effects [1, 2]. Obesity is a global epidemic which also affects children [3]. It is well known that obesity is associated with many diseases in the short and long term and that the onset of obesity in the majority of adult obese individuals extends back to their childhood [4].

Physical inactivity constitutes 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 this unspent energy as fat. The human organism's capacity for physical activity decreases and the organism loses its fitness in a sedentary lifestyle. Muscles become weaker and lose functionality, thus obesity develops as a result of weight gain due to insufficient expenditure of consumed energy sources [5-7]. Physical activity is an important function of living systems. It can affect biochemical parameters, as well as many systems. It is also known that biochemical levels change depending on the type, intensity and duration of exercise [8].

Enzymes that are frequently used and that can provide information for fatty liver, liver disease and its follow-up, the increase or decrease in the amount of urea and uric acid excreted from kidneys due to tissue breakdown in exercise, and some parameters as an indicator of muscle damage in sedentary individuals or after exercise, are used. This study was conducted to investigate how a four-week low intensity physical activity program changes liver enzyme levels, uric acid, urea and creatine kinase activity in obese and overweight children between the ages 12-14, and to investigate the effects of said program.

MATERIALS AND METHODS

Experimental Design

The children who participated in the study were included in a three-day-a-week program for four weeks, which consisted of 60 minutes of sports games and a walk that gradually increased in duration. The children's body weight and BMI were determined, and their AST, ALT, ALP, urea and creatine kinase levels were quantified from fasting blood samples collected while resting in the morning one day before and one day after the four-week exercise program. Eating habits were not altered.

Selection of Subjects

The study included 27 boys between the ages 12-14 divided into two groups as the obese group consisting of 12 and the overweight group consisting of 15 voluntary 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.

Procedure

Physical Activity Program

The children who participated in the study were included in a three-day-a-week program for four weeks, which consisted of 60 minutes of sports games and a walk that gradually increased in duration. The physical activity program was prepared by considering the age and condition of children, at the intensity to achieve a heart rate between 120-140 [9].

	1. Week	2. Week	3. Week	4. Week
Day 1	30-minute walk	15-minute warmup / 15-minute basketball	15-minute warmup / 30-minute football	45-minute walk
Day 2	45-minute walk	15-minute warmup / 20-minute basketball	15-minute warmup / 45-minute football	60-minute walk
Day 3	60-minute walk	15-minute warmup / 25-minute basketball	15-minute warmup / 60-minute football	75-minute walk

Blood Testing Procedure

Venous fasting blood samples from the right arm were obtained from the children that participated in the study between 9.00-10.30am at the Central Laboratory of the pediatric hospital, one day before and one day after the four-week physical activity program. The blood samples collected were centrifuged for seven minutes at 4000 rpm in a Nüve-NF800 device to separate the serum. Serum AST, ALT, ALP, uric acid, urea and creatine kinase levels were quantified using an ABBOTT ARCHITECH- C 16000 autoanalyzer.

Statistical Analysis

Statistical analysis of the data obtained in the study was performed using SPSS package program SPSS 22.0 statistics software (SPSS Inc., Chicago, Illinois, USA). 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-tests and post-tests of the groups.

RESULTS

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

Table-1: Analysis of the values measured in obese subjects (n=12) between pre and post-tests

		Mean	Std D	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		
Creatine Kinase	Pre-test	117,9	25,46	2,212	**0,049**
	Post-test	151,4	51,67		
Urea	Pre-test	23,50	5,760	-1,131	0,282
	Post-test	26,08	8,151		
Uric Acid	Pre-test	5,67	1,349	0,312	0,761
	Post-test	5,57	1,256		
AST	Pre-test	23,50	3,849	1,224	0,246
	Post-test	21,83	3,927		
ALP	Pre-test	227,0	39,84	3,090	**0,010**
	Post-test	264,3	33,27		
ALT	Pre-test	22,00	9,165	-0,892	0,391
	Post-test	23,50	8,262		

*****$p<0.05$

Table-2: Analysis of the values measured in overweight subjects (n=15) between pre and post-tests

		Mean	Std. D.	t	p
Weight	Pre-test	69,90	4,851	9,771	**0,001**
	Post-test	66,81	4,618		
BMI	Pre-test	26,36	,2443	8,810	**0,001**
	Post-test	25,22	,4345		
Creatine Kinase	Pre-test	142,9	87,47	-0,076	0,941
	Post-test	145,0	105,1		
Urea	Pre-test	19,86	3,888	-1,079	0,299
	Post-test	22,06	7,245		
Uric Acid	Pre-test	4,973	1,306	-1,113	0,284
	Post-test	5,313	,8425		
AST	Pre-test	26,33	7,247	1,343	0,201
	Post-test	23,53	4,808		
ALP	Pre-test	222,5	24,55	2,600	**0,021**
	Post-test	260,4	55,11		
ALT	Pre-test	21,00	11,68	0,650	0,526
	Post-test	19,86	9,642		

*****$p<0.05$

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

		Mean	Std. D.	t	p
Weight	Obese	-3,091	1,053	0,004	0,997
	Overweight	-3,093	1,226		
BMI	Obese	-1,500	1,023	-1,199	0,242
	Overweight	-1,140	0,501		
Creatine Kinase	Obese	-33,50	52,47	-1,060	0,299
	Overweight	2,066	105,9		
Urea	Obese	-,1075	1,163	0,766	0,451
	Overweight	-,4207	,9637		
Uric Acid	Obese	-,1000	1,109	-0,987	0,333
	Overweight	,3400	1,183		
AST	Obese	-1,666	4,716	0,430	0,671
	Overweight	-2,800	8,072		
ALP	Obese	-37,33	41,85	0,027	0,978
	Overweight	-37,86	56,40		
ALT	Obese	1,500	5,823	1,069	0,295
	Overweight	-1,133	6,749		

CONCLUSION AND DISCUSSION

The purpose of this study was to investigate the effect that a four-week low intensity physical activity program would have on the liver enzyme levels, uric acid, urea and creatine kinase activity of obese and overweight boys. According to the analyses, after physical activity, the body weight, creatine kinase and ALP levels of the obese group were found to be significant in favor of the post-test compared to the pre-test ($p<0.05$). The body weight, BMI and ALP levels of the overweight group were found to be significant in favor of the post-test ($p<0.05$). There were no statistically significant differences in the intergroup analysis of the pre and post-test values of obese and overweight subjects ($p>0.05$).

The studies conducted indicate that AST and ALT are enzymes that function within the liver's parenchymal cells and enter the bloodstream only in cellular abnormalities, that serum AST and ALT levels may increase in acute cardiac muscle and musculoskeletal disorders, and that their level in the blood may also increase in case of muscle degeneration due to excessive forcing of muscles [10]. Fatty liver has been shown to be the cause of the increase in blood serum ALT levels at least in half of the cases and it was emphasized that fatty liver was more frequently seen in those with permanently high levels of ALT. In our study, the change in AST and ALT levels was not significant. It can be said that short-term exercise does not lead to a change in these levels.

In our study, there was an increase in the uric acid and urea levels of the obese and overweight groups in favor of the post-test; however, this increase was not statistically significant ($p>0.05$). In Kahraman *et al*., studies [11] reporting that intense physical activity increases urea levels, according to the samples collected right before and after the exercise, the urea level of the group that exercised was found to be higher than the group that did not exercise and it was reported that increased metabolic rate and oxygen intake during training and games could lead to an increase in urea levels [12].

It is known that uric acid acts as an antioxidant in the early phases of the atherosclerotic process and is the strongest predictor of plasma antioxidant capacity [13, 14]. Uric acid in the body can be of endogenous (especially formed by the transformation of the nucleic acids of muscle cells) and exogenous (food) origin [15]. Uric acid has antioxidant properties and is responsible for scavenging 60% of the free radicals in the human serum [16]. Uric acid is an effective extracellular radical scavenger. It has also been reported that uric acid stimulates granulocyte adherence to the endothelium, as well as the release of peroxide and superoxide free radicals [17]. In our study, it was found that a low intensity physical activity program did not affect urea and uric acid levels.

In our study, the creatine kinase and ALP values of the obese group exhibited a significant increase in favor of the post-test, whereas the ALP values of the overweight group were significant ($p<0.05$). Exercise reduces cellular adenosine triphosphate, which in turn increases cellular permeability. Increased cellular permeability leads to a slight increase in the serum levels of the enzymes of musculoskeletal origin such as CK. There are studies indicating that even a walk lasting as short as five minutes can increase the level of these enzymes in plasma. Physical exercises that involve various types of contractions cause trauma in skeletal muscles and it has been reported that such injury might cause some signs such as muscle pain, elevated CK, myoglobin and such muscle proteins in the bloodstream [18]. Human blood CK levels vary depending on age, gender, race, muscle mass, physical activity and climatic conditions. In healthy individuals, elevated CK enzyme serum levels are associated with intense physical exercise that damages musculoskeletal cells. The highest CK values are seen after physical activities that involve eccentric muscle contractions and that last for a long period. CK serum levels may increase with muscle tissue injury due to intense and long-lasting exercise. The time for creatine kinase to be secreted and excreted from plasma may vary depending on the intensity, type, level and duration of the exercise [18].

The main origin of CK, which is normally present in low levels in the bloodstream, is the skeletal muscles and it enters the bloodstream via release from the cell when there is muscle damage. Thus, the CK level in the blood begins to increase. In a sense, as an indicator of adaptation to exercise or response to exercise, creatine kinase level increased in the obese group, whereas the increase was not significant in the overweight group. The fact that the increase in the ALP levels in both groups in favor of the post-test is associated with increased serum ALP activity and bone growth rate in children is supported by previous studies. The production of ALP enzyme, which takes place in various organs and tissues in the body, is higher in some periods. Excessive production is normally seen during childhood and developmental age, when bone growth is rapid. Conditions other than these are associated with various diseases [19].

In conclusion, it can be stated that a four-week low intensity physical activity program results in a change in the body weight, BMI, ALP and creatine kinase activity in children between the ages of 12-14.

REFERENCES

1. Hofbauer KG, Nicholson JR, Boss O. The obesity epidemic: current and future pharmacological treatments. Annu. Rev. Pharmacol. Toxicol.. 2007 Feb 10;47:565-92.
2. Altunoglu E, Ülgen E, Müderrisoglu C, Erdenen F. Obezite ve tiroid fonksiyonları. İstanbul Tıp Dergisi. 2009:24-5.
3. World Health Organization. Obesity: preventing and managing the global epidemic. World Health Organization; 2000.
4. Mo-Suwan L, Tongkumchum P, Puetpaiboon A. Determinants of overweight tracking from childhood to adolescence: a 5 y follow-up study of Hat Yai schoolchildren. International journal of obesity. 2000 Dec;24(12):1642.
5. Bray GA. Classification and evaluation of the obesities. Medical Clinics of North America. 1989 Jan 1;73(1):161-84.
6. Taras HL, Sallis JF, Patterson TL, Nader PR, Nelson JA. Television's influence on children's diet and physical activity. Journal of Developmental and Behavioral Pediatrics. 1989 Aug.
7. Buchowski MS, Sun M. Energy expenditure, television viewing and obesity. International Journal of Obesity. 1996 Mar 1;20:236-44.
8. Çakmakçı E, Pulur A. Milli takım kamp döneminin bayan taekwondocularda bazı biyokimyasal parametreler üzerine etkileri. SÜ Bes Bilim Dergisi. 2008;10(1):39-47.
9. Baltacı G, Tedavi F. Çocuk ve Spor. Ankara: Hacettepe Üniversitesi-Sağlık Bilimleri Fakültesi, Fizik Tedavi ve Rehabilitasyon Bölümü, Birinci Basım: Şubat. 2008.
10. Şentürk H, Canbakan B, Hatemi İ. Karaciğer enzim yüksekliklerine klinik yaklaşım. İstanbul Üniversitesi Cerrahpaşa Tıp Fakültesi Sürekli Tıp Eğitimi Etkinlikleri, Gastroenteroloji Klinik Yaklaşım Sempozyum Dizisi, İstanbul. 2004;38:9-13.
11. Kahraman C, Cebeci U, Ulukan Z. Multi-criteria supplier selection using fuzzy AHP. Logistics information management. 2003 Dec 1;16(6):382-94.

12. Öztürk Ç. *Sporcularda ve sedanter bireylerde akut egzersiz öncesi gliserol takviyesinin bazı biyokimyasal parametreler ile laktat ve aerobik güç üzerine etkileri* (Doctoral dissertation, Selçuk Üniversitesi Sağlık Bilimleri Enstitüsü); 2009.
13. Nyyssönen K, Porkkala-Sarataho E, Kaikkonen J, Salonen JT. Ascorbate and urate are the strongest determinants of plasma antioxidative capacity and serum lipid resistance to oxidation in Finnish men. Atherosclerosis. 1997 Apr 1;130(1-2):223-33.
14. Naghavi M, John R, Naguib S, Siadaty MS, Grasu R, Kurian KC, van Winkle WB, Soller B, Litovsky S, Madjid M, Willerson JT. pH Heterogeneity of human and rabbit atherosclerotic plaques; a new insight into detection of vulnerable plaque. Atherosclerosis. 2002 Sep 1;164(1):27-35.
15. Champe PC, Harvey RA. Nucleotid Metabolism In: Biochemistry; 1994.
16. Maxwell SR, Thomason H, Sandler D, Leguen C, Baxter MA, Thorpe GH, Jones AF, Barnett AH. Antioxidant status in patients with uncomplicated insulin-dependent and non-insulin-dependent diabetes mellitus. European journal of clinical investigation. 1997 Jun;27(6):484-90.
17. Basaga HS. Biochemical aspect of free radical. Biochem Cell Biol 1990; 68: 989-998.
18. Alibeyoğlu A. Düzenli Spor Yapmayan Genç Erkeklerde Akut Dayanıklılık Egzersizi Sonrası Hematolojik Ve Serum Enzim Değerlerindeki Değişikliklerin İncelenmesi, Yüksek Lisans Tezi, Kafkas Üniversitesi Sağlık Bilimleri Enstitüsü, Kars 2008: 10-14.
19. Kaplowitz N, Stolz S. Biochemical Tests for Liver Disease. “Hepatology: A Texbook of Liver Disease” Ed: D Zakim, TD Boyer, WB Saunders Co, Philadelphia, 1990.