Evaluation of high blood pressure, body mass index and blood lipids in obese, athletes and sedentary children in terms of cardiovascular risk factors

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Abstract: The prevalence of obesity in children has been increasing so much quickly. The study was carried out for evaluating in terms of Cardiovascular Risk Factors (CRF), Body Mass Index (BMI), High Blood Pressure (BP), and some blood parameters. A total of 56 male children between the ages of 11 and 14, 20 of them athlete (mean age 12.80 ± 0.77 years), 19 obese (mean age 12.04 ± 1.18 years), and 17 in the sedentary control group (mean age 11.87 ± 1.18 years) participated in the study to assess the obesity-related risk factors. Of the participants, body weight, height, Body Mass Index (BMI), Basal Metabolic Rate (BMR), Energy Requirement, body fat mass, lean body mass, Systolic Blood Pressure (mmHg), Diastolic Blood (mmHg), Blood Sugar (mg/dL), insulin (mU/mL), C-Peptide (ng/mL), HbA1c (%), Cholesterol (mg/dL), Triglyceride, LDL (mg/dL), HDL (mg/dL), CRP (mg/L), hemoglobin (g/dL), Hematocrit (%), and WBC (ml) were measured and recorded accordingly. The calculations and evaluations on the research, therefore, were accomplished using the program package, SPSS 18 (SPSS Inc., Chicago, Illinois). Negatively significant difference ($p < 0.05$) were found in the systolic and diastolic blood pressure of obese children when compared both to the control group and the athlete group. The BMI values of the obesity group, therefore, were found meaningfully different from both the athlete and the control groups ($p < 0.017$). Meaningful differences were determined, against the obese children, on blood lipids ($p < 0.05$), and ($p < 0.017$). That obtaining higher CRF levels in child obese than the sedentary and athlete groups shows the necessity of making sports in order to reduce down the CRF level. Some precautions, meanwhile, are needed to be taken in order to prevent the sedentary children from becoming obese adults in their future life. [EKER H. **Evaluation of high blood pressure, body mass index and blood lipids in obese, athletes and sedentary children in terms of cardiovascular risk factors**. *Life Sci J* 2013;10(5s):344-349] (ISSN:1097-8135). http://www.lifesciencesite.com. 62

Key Words: Cardiovascular risk factors, Obese, Sedentary, Athlete, Child

1. Introduction

It has become a serious problem having obesity in increasingly common during childhood periods. An obese child means an obese adolescent and obese adult thereby (1). The World Health Organization (WHO) in 1997 stated, by its announcement, the obesity as being a global health problem (2). The overweight individuals have largely harmful levels of lipid, high blood pressure, and insulin resistance (metabolic syndrome) (3, 4). High levels obtained from those measurement results pose a risk factor for cardio-circulatory and metabolic diseases thereby (5). Lack of physical activity leads, at the same time, to the cardiovascular diseases, insulin resistance, and development of atherosclerosis and inflammation (6). Being physically active ones reduces cardiovascular risks in children and adolescents, and it is, therefore, useful for insulin resistance, obesity prevention and control of body weight (7, 8, and 9). Reducing sedentary lifestyle in children and adolescents by means of physical activity can make contribution to reduce the number of children those classified as obese ones (10). Therefore, it is important to assess comparatively the health profiles of those who are obese in their childhood and adolescence, of the sedentary ones, and of the individuals involved in sports. The aim of this study, therefore, is to evaluate, in terms of cardiovascular risk factors, the high blood pressure, body mass index, and blood lipids of obesity, sedentary and athlete children.

2. Materials and Methods

Designing the Study: A total of 56 male children between the ages of 11 and 14, 20 of them athlete ones (mean age 12.80 ± 0.77 years), 19 obese (mean age 12.04 ± 1.18 years), and 17 in the sedentary control group (mean age 11.87 ± 1.18 years) participated in the study. Children engaged in regular physical activity at least 3 days per week were selected for the athlete group. The weights of the participants in the obesity group were measured, and the ones those above 95% on the percentile curve were selected. The control group was chosen from the children those not making regular physical activities, and those between normal levels in terms of their weights. The participants were subjected to health checks, and the ones with any known systemic or metabolic disease, users of drug which would affect body weight, and those with genetic disorders were excluded from the study. Written consent of the

parents of individuals included in the study was obtained, and the study was initiated after obtaining the approval of the Clinical Research Ethics Committee, the Mersin University (2012/36). The subjects participated voluntarily in each stage of the study were told they might give up the study at any time they wished. The Declaration of Helsinki has been complied with during all stages of this study.

Collecting and Studying the Samples: Of the participants, body weight, height, Body Mass Index (BMI), Basal Metabolic Rate (BMR), energy requirement, body fat mass, lean body mass, Systolic Blood Pressure (mmHg), Diastolic Blood (mmHg), Blood Sugar (mg/dL), insulin (mU/mL), C-Peptide (ng/mL), HbA1c (%), Cholesterol (mg/dL), Triglyceride, LDL (mg/dL), HDL (mg/dL), CRP (mg/L), Hemoglobin (g/dL), Hematocrit (%), and WBC (ml) were measured and recorded. All anthropometric measurements of children those barelegged and unshod, but only wearing undergarments were taken by the same person. The measurements of body fat and lean body mass of the subjects were determined using the method, Bioelectrical Impedance (BIA) (Tanita BC-418). The resting blood pressure (BP) was measured using a protocol acceptable by the Automatic Oscillometric Cuff Device (Dinamap, Criticon Inc., Tampa, Florida) (11). The ones of whom the systolic or diastolic blood pressures above 95% percentile were considered as being hypertensive ones. Then, after overnight fasting, the venous blood samples were collected. The measurements were taken under hospital conditions, taking the subjects in groups into hospital. Consultancy service and aid of the pediatric cardiology specialist was obtained during the course of the evaluations accomplished.

The calculations and assessment procedures relating to the research were conducted utilizing the program package SPSS 18 (SPSS Inc., Chicago, Illinois). The descriptive statistics, and the mean and standard deviations of the relevant groups were collected. In this study, evaluations and interpretation of the data were carried out utilizing the one-way analysis of variance (One Way ANOVA) or any appropriate testing method in the non-parametric tests of Kruskal-Wallis. That whether the data has shown a normal distribution for selecting applicable tests or not was determined by the Shapiro Wilk testing. The LSD test or Mann-Whitney U test among the Post-Hoc comparison tests was used for finding the source of differences between the groups. The Bonferroni correction was applied to determine whether the results were statistically meaningful, and therefore, meaningfulness levels of $p < 0.05$ and $p < 0.017$ were considered important.

3. Reults

Table 1. Characteristics of the Subjects

	Obesity (n=28)	Athlete (n=20)	Control (n=20)
Age (years)	12,01 ± 1,17	12,80 ± 0,77	11,99 ± 1,10
Height (cm)	156,04 ± 7,90	159,85 ± 8,31	153,10 ± 10,03
Body weight (kg)	70,02 ± 13,42	47,71 ± 8,41	43,04 ± 9,55

Table 2. The Table Giving Body Mass Index, Basal Metabolic Rates and Energy Requirements of the Subjects

Variables	Obesity (n=28)	Athlete (n=20)	Control (n=20)	P Value	Source of Difference
Body Mass Index (kg/m2)	28,42 ± 3,46	18,53 ± 1,65	18,17 ± 2,88	0,000	O-S, O-K
Basal Metabolic Rate	1696,80 ± 215,42	1501,66 ± 159,34	1399,40 ± 166,13	0,000	O-S, O-K
Energy Requirement (Cal)	2361,5 ± 188,4	3092,5 ± 355,76	2414,9 ± 186,16	0,000	O-S, S-K

The comparisons of the obesity, athlete and sedentary groups on the basis of data were evaluated using applicable tests and methods of one-way analysis of variance (ANOVA), LSD of the Post-Hoc, and Kruskal-Wallis one-way ANOVA and the Wilcoxon signed-rank as required according to the significance level of $p<0.05$ and $p<0.017$. O=Obesity group, A=Athlete group, C=Control, sedentary group.

Table 3. The Table Giving the Body Composition of the Subjects

Variables	Obesity (n=28)	Athlete (n=20)	Control (n=20)	P Value	Source of Difference
Fat Mass (kg)	26,45 ± 8,4	5,24±2,02	7,62 ± 4,52	0,000	O-S, O-K
Lean Body Mass (Kg)	43,58 ± 7,63	42,47 ± 7,83	35,42 ± 6,45	0,001	O-K, S-K

The comparisons of the obesity, athlete and sedentary groups on the basis of data were evaluated using applicable tests and methods of one-way analysis of variance (ANOVA), LSD of the Post-Hoc, and Kruskal-Wallis one-way ANOVA and the Wilcoxon signed-rank as required according to the significance level of $p < 0.05$ and $p < 0.017$. O= Obesity group, A= Athlete group, C= Control, sedentary group.

Table 4. The Table Showing the Blood Pressure and Some Blood Values of the Subjects

Variables	Obesity (n=28)	Athlete (n=20)	Sedentary (n=20)	P Value	Source of Difference
Systolic Blood Pressure (mmHg)	116,07 ± 11,96	105,50 ± 8,41	105,00 ± 6,06	0,000	O-S, O-K
Diastolic Blood (mmHg)	69,64 ± 9,98	63,00 ± 5,23	65,25 ± 8,34	0,009	O-S
Blood Sugar (mg/dL)	93,88 ± 10,42	93,54 ± 12,78	91,91 ± 7,05	0,898	
Insulin (μU/mL)	1,29 ± 14,21	4,56 ± 3,21	5,09 ± 6,04	0,000	O-S, O-K
C-Peptide (ng/mL)	2,34 ± 1,65	0,66 ± 0,38	0,76 ± 0,44	0,000	O-S, O-K
HbA1c (%)	5,61 ± 0,20	5,60 ± 0,16	5,44 ± 0,33	0,317	
Cholesterol (mg/dL)	170,94 ± 33,80	149,00 ± 20,74	163,73 ± 27,79	0,043	O-S
Triglyceride	130,45 ± 64,82	81,63 ± 25,61	86,71 ± 25,89	0,001	O-S, O-K
LDL (mg/dL)	96,51 ± 30,57	79,76 ± 18,44	84,91 ± 30,52	0,121	
HDL (mg/dL)	46,33 ± 10,16	52,90 ± 8,71	57,26 ± 13,71	0,004	O-K
CRP (mg/L)	3,73 ± 2,30	0,89 ± 1,62	1,00 ± 1,66	0,000	O-S, O-K
Hemoglobin (g/dL)	13,62 ± 0,79	13,85 ± 1,09	13,66 ± 0,89	0,691	
Hematocrit (%)	40,13 ± 1,85	40,12 ± 2,77	40,32 ± 2,13	0,952	
WBC (μl)	8,71 ± 1,90	7,01 ± 2,41	7,39 ± 1,90	0,001	O-S, O-K

The comparisons of the obesity, athlete and sedentary groups on the basis of data were evaluated using applicable tests and methods of one-way analysis of variance (ANOVA), LSD of the Post-Hoc, and Kruskal-Wallis one-way ANOVA and the Wilcoxon signed-rank as required according to the significance level of $p < 0.05$ and $p < 0.017$. O= Obesity group, A= Athlete group, C= Control, sedentary group.

4. Discussion

The study performed has shown that while evaluating the cardiovascular risk factors in children and adolescents, high blood pressure, Body Mass Index and blood lipids develop some valuable tips for early diagnosis of obesity. The childhood obesity (12, 13) which has a negative correlation with the coronary heart disease gives us also some ideas in estimating the risk factors in adults (14-16). It has been reported by several investigations accomplished that approximately 50% of the overweight children have become obese adults in their future ages (13). The BMI throughout life, particularly during childhood periods, shows a continuous upward trend (17). The adult obesity is assessed to be as BMI > 30. In children, on the other hand, the BMI> 21 corresponds to the sector of 95 percentile in contrast to the above. In this study, therefore, we have made a classification based on the 95 percentile (17). In the United Nations, about half of young people between ages of 12 and 21 fail to remain vigorous by means of some regularly applied activities, and 1 in 4 of them take no physical education courses throughout their lives. Currently, 1 in 10 children in the United States and Britain are obese ones, and, on the other hand, the prevalence rates of overweight children have been rising rapidly in Asia and in developing countries (18). In this study, when the results of BMI in obesity, athlete, and control groups of children were evaluated accordingly, it was found that the obesity group was different meaningfully from both the athlete group and the control group. No difference, however, was observed in BMI values between the athlete group and the control group. Therefore, it is clear that aforestated findings agree with several other studies (3, 19). These results, in line with previous studies, can be said to lead to a decrease in cardiovascular risk factors due to BMI (20-24).

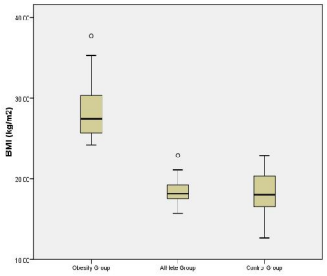

Figure 1. BMI Scatter Graph for Obesity, Athlete and Control Groups

It was reported in some studies that the indicators of inflammation (CRP, interleukin, fibrinogen) increased in overweight children, and these values were associated, at significant levels, with body fat, blood pressure, insulin resistance, and BMI (25-27). It was claimed, on the other hand, that the inflammation increased depending on the amount of CRP and fibrinogen, and such a condition might

affect the arteries, giving rise to the deterioration of endothelial function. These results, meanwhile, give support that the inflammation plays a great role for early diagnosis of atherosclerosis (28, 29). This study shows that having very high results of CRP in obesity shall jeopardize the vascular health of these children in the future. No significant difference, therefore, was observed between the control group and the athlete group.

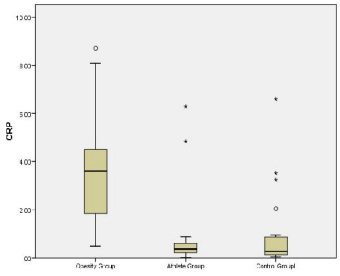

Figure 2. CRP Scatter Graph for Obesity, Athlete and Control Groups

High levels of LDL cholesterol and BMI in adolescents are very important data for estimating the Carotid Intimamedia Thickness which is strongly associated with coronary atherosclerosis and cardiovascular risk factors (30). It is a well known fact what it means having high levels of triglycerides in terms of cardiovascular risk factors (RF). It was observed in studies carried out on RF in young ones, on the other hand, that the rates of high level LDL/HDL, a component of metabolic syndrome, and very low density lipoprotein (VLDL) were increased whenever the triglyceride level was increased (31). That having significantly higher rates of triglyceride level and LDL in obesity group than the children of lean control group, and having much more decreased levels in children athlete suggest us that the cardiovascular RF can be reduced entirely by making exercises.

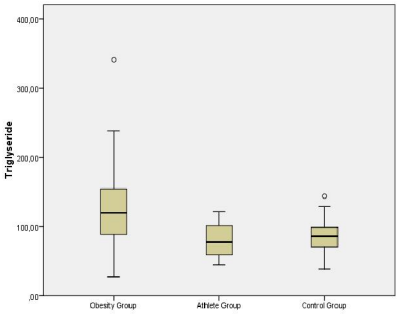

Figure 3. Triglyceride Scatter Graph for Obesity, Athlete and Control Groups

Regular physical activity and weight loss in young people is a so much important factor in the development of insulin sensitivity (32). It was observed in a study conducted aerobically on 64 children (9-11 years) with hypertension over a period of eight months that the blood pressures of systolic and diastolic were decreased (33). It was also observed that aerobic exercise performed after resistance training (such as weight lifting) prevented the blood pressure of hypertensive adolescents from returning to the levels measured prior to exercise-making (34). Therefore, it is considered that weight losing by means of medium-intensity aerobic exercises reduces hyperinsulinemia, hepatomegaly and elevated liver enzyme appeared in steatohepatit (35, 36). It was determined, as it could be understood clearly from the results of this study, that the systolic and diastolic blood pressures in obese children have got negatively meaningful differences compared to athlete and control groups. That development of insulin sensitivity in obese children, and having in different ways high blood pressures of systolic and diastolic indicate that the tendency towards metabolic diseases has arrived, beginning from the first years of life, at some dangerous levels.

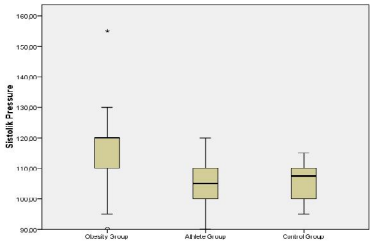

Figure 4. Systolic Blood Pressure Scatter Graph for Obesity, Athlete and Control Groups

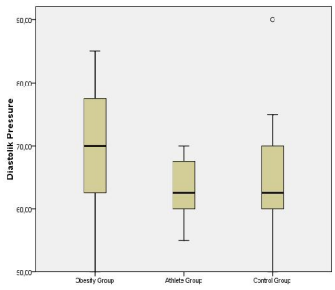

Figure 5. Diastolic Blood Pressure Scatter Graph for Obesity, Athlete and Control Groups

It was observed that the obese children compared to the children engaged in sedentary life and sports have been exposing themselves to very high risks of metabolic kind. As can be understood from the aforespecified results, the necessity to take appropriate measures for protecting children, in ages

of their childhood, against metabolic syndrome and related diseases is clear. Only the childhood ages were researched in the study performed, but no long-term follow-up was applied on the subjects. The studies to be performed in the future shall cover long-term following up and evaluating children as required, taking into consideration the lifestyles of obese and sedentary ones. Some researches to be carried out on larger populations are needed thereby.

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