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European Journal of Experimental Biology, 2012, 2 (5):1509-1513

ISSN: 2248 –9215
CODEN (USA): EJEBAU

Relationship between body composition with Blood Lipids profile

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ABSTRACT

The purpose of this study was to determine the relationship between body composition with blood lipids profile among active and sedentary girls within the age range of 10-14 years old in Bandar Abbas city. In this study, after determining level of bodily activity based on Beak physical activity questionnaire, 106 people were selected from among 780 junior high school volunteers, 55 of them were classified in sedentary group and 51 were in the active group according to the same questionnaire. First, height, weight, waist circumference and hip circumference were measured in order to calculate body mass index and pattern of fat distribution. Then, in order to investigate blood factors of the study, fasting blood samples were taken from the participants. To analyze the data, Pearson correlation coefficient was used to investigate the relationship between the variables and t-test was also used to perform within-group comparisons (P<0.05). The results showed that there was a significant relationship between body mass index and fat distribution pattern; however, no significant difference was observed between low and high density lipoprotein, triglyceride and total cholesterol in the two groups. Based on the results obtained from this study, a significant relationship was found between body mass index, pattern of fat distribution and blood lipids which were among risk factors of cardiac diseases; however, no difference was found between active and sedentary participants based on the level of physical activity.

Keywords: Body composition, Serum blood lipids, Active people, sedentary people

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INTRODUCTION

Healthy lifestyle during the whole lifetime, especially in childhood and adolescence, should be considered the goal of life in order to be a preventive factor for chronic diseases at older ages. Obesity is among the most important nutritional diseases in many countries so that, in the recent two decades, it has become widely prevalent. In obesity, fat reservoirs in the body rapidly increase, which is evaluated by body mass index [1]. Recent reports from World Health Organization demonstrate that there are 1 million people with BMI more than 25 and 350 million people with BMI more than 30 in the world. Annually, over 25 million people die worldwide due to obesity [2]. Obesity has many-fold reasons and, considering genetic factors as the sole cause of obesity prevalence does not seem to be logical. Reduction in physical activity and using high-calorie foods increase excessive energy input of the body[3]. Therefore, without decreasing calorie gain or increasing physical activity, one should not expect to lose weight [4]. Since many believe that the main cause of obesity is increase in the amount of fat in the diet, they try to reach weight loss by decreasing fat percentage; but, in spite of decreasing fat in the diet, obesity prevalence is still increasing [5]. Clinical studies have shown that reduction in fat intake leads to considerable weight loss in a short term [6,7]. However, low-fat diet and change of the body's physiological path (reducing fat oxidation [8], reducing energy at rest [9] and increasing feeling of hunger [10]) would increase the feeling of hunger. On the other hand, by decreasing fat intake from the total energy intake, consumption of carbohydrates, especially refined grains and simple sugar would increase [11]. Therefore, it seems that physical activity has a very important role in weight loss.

Pattern of fat distribution is different among different people. In some people, fat is mainly stored in the stomach area while in others it is stored in the pelvic area. Pattern of fat distribution is effective in the progress of some diseases like non-insulin diabetes and cardiovascular diseases. Estimation of fat inside the body is not a simple task; but, subcutaneous fat variations can be estimated from the ratio of subcutaneous fat (via measuring skin wrinkles) to the total fat mass in the body [12]. Fat distribution in central areas of the body is independent from obesity degree and is measured through waist to hip ratio. It is the predictor of risks that endangers person’s health and expose the person in the risk of many diseases such as diabetes, cardiovascular diseases, hypertension and hyperlipidemia [1,13,14]. Risk factors are conditions in which by their presence in long term periods and possibility of diseases that gradually weaken the patient like diabetes or cardiovascular diseases in children and adolescents are rare but before and during puberty are common [12] . Common risk factors between children and adolescents include high level of triglyceride, low-density lipoprotein, blood lipids and cholesterol, low level of high-density lipoprotein, obesity, mental pressure, inheritance and level of physical activity [15].

The importance of using weight and height indices to find health and nutritional conditions in children and adolescents is increasingly growing [16,17]. Growth has been considered to be one of health indices from the beginning of infancy up to the end of maturity and has such importance that all authorities and planners of the health issues must be informed about its concept and normal ranges so that they can detect abnormal cases, recognize its causes and take proper measures to resolve it [18]. Previous studies have shown that there is a high rate of malnutrition in Iran which necessitates considering this critical issue due to the increase of young population [19,20]. Whereas anthropometric factors can be easily and cheaply measured, using these factors has become common in the diagnosis of chronic diseases. Body mass index and fat distribution pattern are among these factors.

Due to the simplicity of measuring body mass index, it is mostly used as fat content index in epidemiology. One reason for the prevalence of measuring body mass index is its relationship with fat percentage and topical fat [12].

Fat distribution in stomach and pelvic areas is a sign of central fat which can be used to prognosis diseases like cardiovascular diseases, hypertension and type-2 diabetes in future. Previous studies have demonstrated that, although fat can increase bodily capacity to store energy, high fat content in the body can increase risk of cardiovascular diseases which are related to the increase of blood fat levels (cholesterol, triglyceride and lipoproteins) [21]. Other studies have indicated that sports and physical activities not only can effectively decrease subcutaneous fat but can also affect blood lipoproteins [22].

Waist to hip ratio is an index which is used to determine the pattern of fat distribution in upper and lower bodies. This ratio is highly related to central (abdominal) fat and seems to be an acceptable index for intra-abdominal fat. There is a significant relation between fat percentage and wais to hip ratio and male and female adolescents who have waist to hip ratio equal to 0.94 and 0.82, respectively, are exposed to a great risk [23].

Fat content in blood also plays an important role in health and emergence of diseases. Triglyceride, lipoproteins and cholesterol are among the fats in the blood. Lipoproteins are classified into low-density and high-density categories. Increase in low-density lipoprotein along with cholesterol and triglyceride and decrease in low-density triglyceride are considered among the risk factors which can cause artery occlusion; in case this condition occurs in coronary arteries, arteriosclerosis and stroke would happen. High-density lipoproteins are involved in transferring cholesterol from arterial walls to liver [19].

Some studies have confirmed the existence of a positive relationship between triglyceride and arm fat circumference and negative correlation between high-density lipoproteins and arm fat circumference [24]; others have confirmed that there is a negative relationship between overweight and high-density lipoproteins among male and female adolescents [25].

Some studies have reported a positive relationship between body mass index and aerobic health and, consequently, low level of low-density lipoproteins, triglyceride and total cholesterol and high level of high-density lipoproteins [26,27,28].

The relationship between body mass index and waist circumference, hip circumference and fat percentage and its relationship with cardiovascular diseases are confirmed in many studies [28].

In some studies, significant increase in blood fat in the percentiles of higher than 80 of the body mass index and increase in systolic blood pressure from the percentile of 90 and more [15] and also the direct relationship of blood pressure with body mass index and waist circumference have been observed [29]. Moreover, it has been shown that risk factors among obese adolescents are 1.5 to 2 times that among normal adolescents [30].

Understanding the level of relationship between body mass index and anthropometric measurements with blood fats at different age of childhood and adolescence might be an effective factor in determining obesity and predicting the diseases related to blood lipids. Accordingly, effective solutions can be presented with regard to educational plans along with physical activity without spending too much and allocating limited time to the prognosis of the related diseases. Therefore, the aim of this study was to determine the relationship between body mass index and pattern of fat distribution with blood lipids profile among active and sedentary girls who were within the age range of 10-14 years old in Bandar Abbas city.

MATERIALS AND METHODS

The present study was of descriptive causal-comparative type which was performed as a survey research. Participants:

Statistical population of the research included 13600 female students at junior high school level in Bandar Abbas city in 2009, 780 of whom voluntarily participated in this study and signed the consent form. 106 participants were selected using simple random sampling. Using Beak physical activity questionnaire, they were classified into two active (51 people) and sedentary (56 people) groups.

Physiologic Measurement:
To measure body weight, GES-07 Digital Glass Scale with accuracy of ±0.1 kg (made in USA) was used. The participants were barefoot and had the least clothes on while being weighed. Their height was also measured by a wall-mounted height gauge (44440 model manufactured by Kave co., with accuracy of ±0.1 cm) at barefoot standing besides the wall position and while the shoulders were at normal state position. Waist circumference was measured in the narrowest section of the waist when the participant was at the end of her natural expiration. To measure hip circumference, its most protruding part was detected. Hip and waist measurements were done using a non-elastic tape meter without exerting any pressure on the participants' body. Body mass index was obtained by dividing the participant's weight (kg) by square of her height (cm). To calculate body fat percentage, Caliper (Harpender model) (technique of pinching three thoracic, abdominal and thigh areas on the right section of the body for three times and giving 20 seconds interval for body turn-back and the average was recorded) and Jackson and Pollock formula and Siri equation were used [17,29].

Also, in this study, Beak physical activity questionnaire was used to determine the participants' physical activity level. Then, height, weight, waist and hip circumference were measured to calculate the body mass index and fat distribution pattern. Blood samples from the participants were taken in the fasting condition to perform measurements of blood fats like triglyceride, total cholesterol, LDL and HDL.

Blood Sampling:
In order to investigate biochemical variables, in the first stage, the participants were asked not to have any sports activity until 2 days before the test and maintain their normal diet. Then, 12 hours fasting blood samples were taken to the amount of 5 ml from their left antecubital vein in sitting and resting position at 8 am from both participants in the active and sedentary groups.

Biochemical Measurements:
To measure blood plasma lipids, enzymatic colorimetric method (570 nm) was used by E2HL-100 kits with the sensitivity degree of 0.1 mmol/dl.

Statistical Method:
To analyze the data, Pearson correlation coefficient was used to determine the relationship within the groups and independent t-test was also applied to obtain significance level of the variables between the two groups.

RESULTS

The results obtained from the analysis of data showed that active group had lower weight, body mass index and waist to hip ratio compared with the sedentary participants. They also had a higher level of triglyceride and cholesterol, less LDL and higher HDL (Table 1).

Table 1: Descriptive statistical results for active and sedentary participants

		Height (cm)	Weight (kg)	BMI	Waist to Hip ratio	HDL	LDL	Triglyceride	Total cholesterol
Active Group	Mean	154.91	45.84	19.03	0.8158	43.52	100.09	68.29	156.02
	Standard Deviation	7.57	8.02	2.64	4.95×10^{-2}	4.23	19.98	30.32	22.41
Sedentary Group	Mean	154.42	50.85	21.11	0.8577	43.41	100.87	69.80	156.14
	Standard Deviation	8.85	13.87	5.39	6.66×10^{-2}	11.86	22.61	35.98	20.27

Within-group correlation coefficients showed a positive correlation between BMI and HDL, LDL, triglyceride and total cholesterol and also between fat distribution pattern and these blood factors in both active and sedentary groups ($P<0.05$) (Table 2). In other words, in each group, a direct and almost complete relationship was observed between blood variables, BMI and fat distribution pattern.

Table 2: Correlation between BMI and fat distribution pattern with blood variables in active and sedentary groups

		HDL	LDL	Triglyceride	Total cholesterol
BMI in active group	Pearson Coefficient	0.999	0.998	0.998	0.999
	Significance Probability	0.000	0.000	0.000	0.000
Fat distribution pattern in active group	Pearson Coefficient	0.999	0.998	0.996	0.999
	Significance Probability	0.000	0.000	0.000	0.000
BMI in sedentary group	Pearson Coefficient	0.994	0.993	0.989	0.998
	Significance Probability	0.000	0.000	0.000	0.000
Fat distribution pattern in sedentary group	Pearson Coefficient	0.986	0.993	0.989	0.998
	Significance Probability	0.000	0.000	0.000	0.000

The results of independent t-test demonstrated a significant difference between BMI in the two active and sedentary groups ($P>0.05$); according to Table 1, active group had less BMI than sedentary group. Also, a significant difference was observed between fat distribution pattern in active and sedentary groups. According to Table 1, waist to hip ratio was lower in the active group and no significant difference was found between blood variables in the two groups ($P<0.05$)

Table 3: Results of t-test for the studied variables in the two active and sedentary groups

	t	df	*p*
BMI	-2.486	104	0.014
Fat distribution pattern	-2.780	104	0.006
HDL	0.963	104	0.050
LDL	0.276	104	0.783
Triglyceride	0.741	104	0.817
Total cholesterol	0.093	104	0.924

DISCUSSION

The purpose of this study was to investigate the relationship between body mass index and fat distribution pattern with serum blood lipids among active and sedentary girls at junior high school level. The results of different studies investigating risk factors of chronic diseases have shown that lack of physical activity and nutrition plays an important role in the emergence of these diseases. The data demonstrated a high and direct correlation between body mass index and fat distribution pattern with main blood lipids, namely triglyceride and cholesterol, in the active and sedentary groups, which was in good agreement with the results of Brown (1998) and Plachta-danielzik et al. (2008). Main blood fats need a transporter like LDL and HDL and level of these lipoproteins depends on the fat content in the food and physical activity. Considering that, during puberty and adolescence, height and weight considerably increase, increase in physical activity at this age can cause better metabolism as well as better agreement between weight and height, which is a fundamental factor in physical fitness at older ages [12]. Also, physical activity during this age causes suitable proportion between calorie intake and consumption [32] and therefore prevent from obesity [43]. Moreover, increase in LDL and total cholesterol along with decrease in HDL is among the identified risk factors in cardiovascular diseases [23].

The results of the study on the role of physical activity in the level of these blood factors are contradictory. Many studies have concluded that increase of physical activity increases the level of HDL, which is in agreement with other studies [24,34]. Moreover, results of the studies on three other blood fats are not in agreement with each other. Some of them state that these fats are completely dependent on physical activity [20] and others including this article found no difference among them in active and sedentary groups [35]. A significant difference was observed between BMI and fat distribution pattern, which was in line with the result of Ford (2008)[30]. Fat distribution pattern is affected by genetic and hormonal factors. In women, fat is mainly stored in buttock and thigh. Physical activity and using healthy diet reduce the amount of fat stored in these areas [22].

A direct and significant correlation was observed between fat distribution pattern and blood factors in active and sedentary groups, which was in good agreement with the results of Plachta-danielzik (2008)[29].

CONCLUSION

A general view to the studied issues can help to conclude that physical activity level is a main effective factor in anthropometric measurement. Furthermore, body mass index and fat distribution pattern are related to blood fats and both have high and close correlation with body fat. Therefore, BMI and fat distribution pattern can be used as good criteria to prognosis risk factors in cardiovascular diseases.

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