

# The relation between somatotype with aerobic capacity and balance in the boys 11 - 13 years

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**Abstract.** The aim of this study is to investigate the relationship between Somatotype with aerobic capacity and balance in males of 11-13 years. The random-volunteer sampling method was employed in this study to select 90 male students of 11 to 13 years of age. Height, weight, BMI, BF%, the thickness of subcutaneous fat in four areas of the body, the area of the body in two points, the width of the arm and thigh bones, and the aerobic capacity and balance were calculated and somatotypes were determined using Heath-Carter somatotype method. The data were then analyzed through SPSS 18 software, using Spearman correlation method. The results indicated a significant relationship between the aerobic capacity and the values of ectomorphy ( $r = -0.59$ ), endomorphy ( $r = 0.69$ ), and mesomorphy ( $r = 0.57$ ). In other words, the greater the values of endomorphy and mesomorphy got, the greater the record of the 540-meter test got, which means the lesser the aerobic capacity got. However, the opposite was true regarding the value of ectomorphy. Inclination towards endomorph-mesomorph somatotypes is a factor that affects the cardiorespiratory system and balance. Thus, on the one hand, decreasing the amount of fat in individuals with obesity can improve their move and dynamism, and on the other, increasing the weight in thin individuals without increasing their body fat, or more accurately, increasing their muscle tissue can lead to their fitness, which in case results in an increased self-confidence and increased desire and inclination towards exercising and working out, leading to increased efficiency of their physiologic and metabolic systems.

**Keywords.** Aerobic capacity, balance, somatotype.

## Introduction

Childhood and adolescence are very important periods of one's life which have undeniable impacts on one's adult life, and in particular, on the state of health of one's adult life (Sadeghi, 2008; Hosseini Kakhk et al., 2010) Thus, a physiological examination of this period is a complicated undertaking (Rowland, 2005). Lifestyle, the quantity and the quality of nutrition, physical activity, and the amount of sleep and rest are among the important factors that can affect children's growth and their somatotype. Somatotype is a very important facet of a person's health profile and physical fitness. Anthropometry is known as a non-invasive and inexpensive technique that can yield a

considerable amount of information about a large number of subjects in a very short time (Sadeghi, 2008). Obesity is a serious health problem which reduces one's life expectancy as it increases the risk of other serious health problems such as coronary artery disease, hypertension, diabetes, obstructive pulmonary disease, arthritis, and specific kinds of cancer in individuals with obesity. Very low body fat is also a risk to good health because one's body requires a certain amount of fat to carry on its normal physiological duties (Vivan 2012). It has been estimated that there is a risk of 70% for obese children who do not lose weight to a normal level before the age of 14, to remain obese during their adult lives (Shojaei & Daneshfar 2014).

Pate et al. showed that youth with high BMI has very low levels of physical activity, high levels of inactive behaviors, and low cardiovascular fitness (Pate et al., 2006). Moreover, in a study entitled "the relationship between overweight and obesity and physical fitness of children of 9 to 12 years of age in South Africa" and using the anthropometric technique to determine the percent body fat and body mass index, as well as fitness factors such as, cardiovascular endurance, somatotype, muscular endurance, muscular strength and flexibility, Truter et al. concluded that overweight and obesity have negative effects on the physical fitness and health of overweight and obese individuals (Truter et al., 2010).

Balance is also one of the important and effective factors that can affect one's health and well-being. This factor is considered to be essential in daily activities, standing, walking, walking up and down the stairs, running, shifting direction, and passing obstacles. Thus, a deficiency in the muscular balance or in the function of hearing or vision of an individual can endanger their life. A lack of balance in the lower limbs can lead to inactivity which can, in turn, cause cardiorespiratory diseases, muscular dystrophy, obesity and its subsequent adverse effects, and various other ailments and disabilities. Research has indicated that accumulation of fat tissue can decrease balance which is a reason for falling down among teenagers and adults (Ledin & Odqvist, 1993; McGraw et al., 2000). In a related study, Tookuni et al. showed that overweight and low levels of physical activity lead to an increased postural instability (Tookuni et al., 2005). Moreover, Kejonen et al. claimed that there is

no significant relationship between dynamic balance and height, weight, the length of the shins, and the length of the sole of the feet in individuals between 31 to 80 years old (Kejonen et al., 2003). However, Davlin (2004) concluded that there was a significant negative correlation between dynamic balance and height and weight.

Walking and running are directly related to the two factors of cardiorespiratory fitness and balance, and these two factors are the basic requirements for physical activity, somatotype change, and an increased efficiency of physical function. Childhood and adolescence are very critical and important periods of human life and the physical and physiological conditions of these periods can extend to adulthood and even senescence; moreover, fundamental changes in these periods can affect the quality and the span of one's life. Therefore, due to the growing changes in the people's lifestyle there, conducting research in this field and on this specific age group seems necessary. Further, previous studies in this regard have focused less on the physical and physiological conditions of children and the existing research regarding the relationship between the anthropometric characteristics, aerobic capacity and balance have not yielded consistent results. Therefore, in the present study, the researchers have sought to investigate the relationship between the aerobic capacity and balance with various somatotypes of boys of 11 to 13 years old.

## Methods

The present study was a cross-sectional study conducted as a field study. The tests were conducted after obtaining the necessary legal permissions, examining the health certificate of the students, and obtaining written consent from the parents. All measurements were conducted in the afternoon. The population under study consisted of all 11 to 13-year-old male students of the primary schools. 90 students were selected based on the sample size formula and through the random-voluntary sampling procedure from among 9150 available population in the primary schools of Qom in Iran. In order to obtain the anthropometric data the complete level 1 form of ISAK was used. Moreover, based on the guidelines provided by the International Society for Advancement of Kinanthropometry (ISAK), in order to measure the relevant anthropometric variables, various variables of the right side of the body including height, weight, the thickness of subcutaneous fat in four points, the area of the limbs in two points, and the width of the bones of the elbow and the knee were measured. The height of the subjects was determined using an SECA stadiometer and their weight was determined using an SECA digital scale. The diameter of the limbs (i.e. the diameter of the upper forearm while the arm was bent and the muscles had contracted and the diameter of the shin) was measured using a Lufkin tape measure. The thickness of the subcutaneous fat was measured in four

points (i.e. the triceps brachii, the subscapularis, the iliac crest, and the shin muscles) utilizing a Slim Guide caliper and the widths of the elbow and the thigh were measured using a Mitutoyo caliper for the bones. In order to measure the anthropometric facets and determining the somatotype of the subjects based on the Heath-Carter method as well as other indices of somatotype, anthropometric software was utilized. Furthermore, aerobic capacity of the subjects was measured in minutes, seconds and milliseconds, through a 540-meter running test. Finally, the Stork Balance stand test was utilized to measure the balance of the subjects. Following the collection of the data, the data description was done using descriptive statistics (i.e. mean and standard deviation) and the Kolmogorov-Smirnov test was employed to examine the normality of the data. Due to the non-normal distribution of the data at the level of the inferential statistics, the spearman test was used. The entire statistical analyzes were conducted using the SPSS software version 18 and the level of significance were set at  $P \leq 0.05$ .

## Results

The values of the physical characteristics and the values related to the somatotype and the aerobic capacity record of the subjects are summarized in Table 1. Correlation between aerobic power and numbers of body type is inserted in Table 2. Correlation between balance and numbers of body type is presented in Table 3.

Table 1. Descriptive statistics record numbers of types of physical and aerobic fitness (n=90).

Variable	Mean $\pm$ SD
Height (cm)	149.18 $\pm$ 6.95
Weight (kg)	47.84 $\pm$ 13.02
BMI (kg/m <sup>2</sup> )	21.31 $\pm$ 4.89
BF %	21.57 $\pm$ 8.65
Number of Ectomorphy	2.28 $\pm$ 1.97
Number of Endomorphy	5.04 $\pm$ 2.02
Number of Mesomorphy	5.24 $\pm$ 1.72
Aerobic Power (s)	3.35 $\pm$ 0.57
Balance (s)	7.46 $\pm$ 8.69

Table 2. Correlation between aerobic power and numbers of body type.

Variable		Ecto	Endo	Meso
Aerobic Power	r	-0.59*	0.69*	0.57*
	p	0.001	0.001	0.001

\* Significant correlation ( $p \leq 0.05$ ).

Table 3. Correlation between balance and numbers of body type.

Variable		Ecto	Endo	Meso
Balance	r	0.37*	-0.38*	-0.22*
	p	0.001	0.03	0.001

\* Significant correlation ( $p \leq 0.05$ ).

## Discussion

In this study, the number ectomorph and aerobic fitness (test 540 m) There was a significant negative relationship (-0.59). The number endomorph, mesomorph, and aerobic fitness were a significant positive relationship, ie with increasing numbers subjects increased the record. Results of this study with Gaeini et al. and Gharakhanlou et al., Nickbakht et al. and Pat et al. is similar (Gaeini et al., 2000; Gharakhanlou et al., 2007; Nickbakht et al., 2011).

$VO_{2max}$  has a close relationship with the Lean Body Mass (LBM), and this is while fat tissue decreases  $VO_{2max}$  per  $kg/BW$  (Rowland, 2005). Having a larger body and a greater weight requires a greater amount of energy for movement (Pate et al., 2006). Decreasing the amount of fat in obese individuals can help with their agility and better movement. Further, for thin individuals, gaining weight without increasing body fat, or more accurately increasing their muscle tissues, can create a better appearance form them, resulting in a higher self-confidence and a greater interest in exercising and doing sports and an increased efficiency of their physiologic and metabolic systems (Avery et al., 2009).

With regard to the relationship between balance and somatotype, the present study indicated that balance has a significant negative relationship with the values of endomorphy and mesomorphy, meaning that the more the values inclined towards endomorphy and mesomorphy, the lesser the balance of the subjects got. However, the balance was shown to have a significant positive relationship with the ectomorphy value; in other words, the more the values inclined towards ectomorphy, the greater the balance of the subjects goes. Alonso et al. found that the anthropometric indices such as height and weight can affect the postural stability. Among the anthropomorphic indices, and apart from gender, height has been shown to be more important than others (Alonso et al., 2012). Singh et al showed in their study that a change in body mass index can cause static imbalance during long activities and that a 20% increase in body mass can decrease the physical ability to adapt oneself with external disturbances and can increase postural instability (Singh et al., 2009). The biomechanical evidence derived based on the stability index of the Biodex system also indicates that postural stability aggravates as body mass increases. Obese individuals are less active and their physical inactivity damages their balance, leading to an increased risk of falling down (Bruce et al., 2002; Freidmann et al., 2001). Moreover, it has been proven that there is a relationship between obesity and the fear of falling down, which in turn decreases the desire to have physical activity and causes damages one's physical function. A research study has indicated that an increase in weight leads to a decrease in the speed with which one can change his foot pressure center reducing his range of stability. These findings show that the stability control in heavier individuals is less sensitive to instabilities of the body which results in a

greater risk of falling in heavier individuals (Hue et al., 2007).

Both one's health and life span are threatened when one suffers from overweight or underweight. Being overweight seriously increases the risk of suffering from cardiovascular diseases, obstructive pulmonary, glucose intolerance, diabetes mellitus, and osteoarthritis (Vivan, 2012). On the other hand, underweight individuals with very little body fat are prone to malnutrition (Vivan, 2012). These individuals are at high risk of developing a liquid electrolyte imbalance, osteopenia, osteoporosis, bone fracture, muscular dystrophy, cardiac arrhythmia, cardiac arrest and sudden death, and renal and reproductive disorders (Vivan, 2012).

Since the quality of life during childhood can affect that of the adult life, the assessment of the somatotype can be very beneficial in that it can entail a change in bad habits and wrong lifestyle and suitable exercise programs. To this end, it is recommended that educational programs be included in schools increasing the awareness of the children regarding the adverse consequences of having a sedentary lifestyle, particularly during childhood. Moreover, seeking the help of expert groups to assess the somatotype of the students in schools can be beneficial and enlightening. Improving the nutrition quality and the physical activity of the children can decrease the risk of suffering from many ailments and disabilities during their adulthood and Senescence.

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