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RELATION BETWEEN FAT DISTRIBUTION AND PULMONARY FUNCTION IN TRIATHLETES

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ABSTRACT

Purpose. The aim of this study is to determine relationship between body composition and pulmonary function in triathletes. 15 male subjects were participated in this study at the racing period of the 9th Triathlon World University Championship in 2008.

Methods. Participants averaged 21.60 ± 2.50 years of age, 176.10 ± 9.57 of height and 67.07 ± 9.18 weight. Pearson Product correlation coeffient technique was used to determine the relationship between body composition (Tanita BC 418 Body Composition Analyzer) and pulmonary function (Cosmed Pony FX Spirometer, Italy) in triathletes.

Results. The results revealed that there was a significant positive correlation between FVC (Force Vital Capacity) , FEV (Force Expiratory Volume), PEF (Peak Expiratory Flow), VC (Vital Capacity), MVV (Maximal Voluntary Ventilation) and height, weight, FFM (Fat Free Mass) , TBW (Total Body Water), Trunk FFM (Trunk Free Fat Mass), FMM (Predicted Muscle Mass) Moreover, the results also showed that there was a significant positive correlation between FEV/FVC (%) and age, VC, FAT %. ($p<0.05$; $p<0.01$). On the other hand, the results demonstrated that there was a negative correlation, but not significant, between Fat % (Body fat Percentage), FM (Fat Mass) and FVC, FEV, PEF, VC, MVV. The results also showed that there was a negative correlation, but not significant, between FEV/FVC (%) and age, height, weight, FFM, TBW, Trunk FFM, Trunk FMM. ($p<0.05$, $p<0.01$).

Conclusions. It could be concluded that if the the FM rate of the triathletes increase, the parameters of pulmonary function can decrease. If the FMM rate of the triathletes increases, their pulmonary function parameters also enhance.

Key words: Triathlon, Pulmonary Function, Body Composition

PURPOSE

Triathlon is an endurance sport that involves the exercises in the order of swimming, cycling and running (G.Sleivert,1996;N.Hıll,1991). The aerobic capacity which is the most important criterion for endurance performance is defined as first the transfer of oxygen into blood by the pulmonary system, its distribution into active muscles together with blood and the ability of these muscles to use oxygen during physical work. From a physiological (W.E. Amonette,2002) point of view, it can be stated that the most important factors that affect the triathlon performance are MaxVO2, ventilantory threshold, lactate threshold and economy of movement (B.Knechtle,2008;G.Sleivert, 1996). Elite triathletes are generally tall, of average to light weight and have low levels of body fat, a physique which provides the advantages of large leverage and an optimal power to surface area or weight ratio(V.Bunc,1996). Body Composition constitute of muscles, bones, fat mass and body fluids. The ratios of these parameters and their relationship with other physiological elements are the most important criteria that affect performance (H.Steven, 2005). From time to time triathlon exercise can reach a point that can push the limits of the human body. It (B.Knechtle,2007) is known that the genetic factor constitute a large portion of achievement in sports. It is suggested that the respiration functions depend on genetic (age, gender, height) and non-genetic (level of training) factors in terms of performance and that the genetic factors have an effect of 47%, and in the case of non-genetic factors, an effect of 53% (C.Bouchard, 1997)

In many studies performed, it was observed that the percentage and distribution of body fat have a significant effect on the pulmonary functions(S.Helena, 2001; LC.Collins, 1995; R. Lazarus, 1998). While increasing body fat percentage decreases the activity of the respiratory muscles, it causes a general decrease in the dynamic compatibility of lungs, and in lung capacity (J.M. Jimenez, 2003). In numerous investigations, it was suggested that the increasing fat percentage especially in the upper body are more effective in this decrease (HL. Barlett, 1983; HL. Barlett, 1984 LC.Collins, 1995).

The physiological events that take place during maximum oxygen consumption are the introduction of oxygen into the pulmonary system, its transfer to blood from here and its use in muscles.

The aim of this study is to investigate the effects of percentage and distribution of body fat of elite triathlon athletes in Turkey on the respiration parameters.

METHOD

The investigation has been carried out on 15 male athletes volunteers who attended the 9th University World Triathlon Championships. The average age was determined as 21.60 ± 2.50, height as 176.10 ± 9.57 cm, and body weight as 67.07 ± 9.18 kg. Body compositions were analyzed by Tanita BC 418 Body Composition Analyzer and pulmonary functions by Cosmed Pony FX Spirometer before attending the race and breakfast.

The statistical analysis was carried out by SPSS 10.0 package software. After the completion of defining statistics by taking average and standard deviations, bivariate correlation test (Sperman) was applied so as to determine the effect of body composition on respiratory parameters. According to the level P<0,05 and p<0,01, the results were evaluated as inverse correlation for the values that came out negative and as direct (positive) correlation for those that came out positive.

RESULTS

As seen in Table 2, A positive correlation was found between FVC, FEV, PEF, VC and MVV values and height, weight, FMM, TBW, Trunk FFM, Trunk Muscle Mass, and between FEV/FVC (%) and FAT % and also between age and VC p<0,05, p<0,01). Moreover, while a negative correlation exists between Fat % and Fat Mass, and FVC, FEV, PEF, VC, MVV and also between FEV/FVC(%) and age, height, weight, FFM TBW, Trunk FMM, Trunk MM, it was determined that this correlation is not significant in terms of statistics.

DİSCUSSİON AND CONCLUSİON

In this study where the correlation between the body composition and pulmonary capacities of the triathletes have been investigated, it has been determined that as the body fat percentage increases, pulmonary functions decrease and accordingly, as height, weight FFM, TBW, Trunk FFM, Trunk MM increases, pulmonary functions increase in direct proportion.

It is known that height and age have an effect on pulmonary capacities as a result of genetic factors. It was suggested that as age and height increases, pulmonary functions also increase in direct proportion (S. Koziel,2007). Similarly, in this study it was found that a positive correlation exists between age and VC, height and all pulmonary functions taken.

Since no correlation was observed between respiration parameters and BMI in this study, a positive correlation was identified between Trunk muscle mass, TBW, Trunk FFM and FFM. In terms of anthropometry, respiration functions are significantly related to the power of abdominal muscles and upper body fat percentage (JM. Jimenez, 2003; Dc. Chinn,1996) In the literature, it was shown that pulmonary functions are under the influence of muscularity and fat distribution rather than body weight (JM. Jimenez.,2003; DC. Chinn,1996; R.Lazarus,1998). In the study, a negative correlation between pulmonary functions and Trunk Fat %, Trunk FM, Fat % and FM can be said to exist, although it is a statistically non-significant one. Many studies confirm the results of this study. Jimenez, in 2003, studied the effect of body weight on pulmonary functions in men within the age range of 20 to 29, actively engaged in sports. Although a direct correlation between pulmonary functions and, BMI and body weight could not be found, a negative correlation was stated to exist with respect to upper body fat percentage. He suggested that this was caused by the influence of upper body fat percentage on the mechanics of the respiratory muscles (JM. Jimenez,2003). Similar results were found by Lazares *et al* in a study carried out on 930 people from both genders within the age range of 18 to 78, where it was also revealed that as upper body fat percentage and waist circumference increase, the respiration parameters decrease (R.Lazarus,1998).

In this study, a positive correlation was observed between body weight and FVC, FEV, PEF, VC, MVV parameters and in the case of the comparison of body weight with FEV/FVC% a negative correlation was observed, however it was determined to be a statistically non-significant one. In the literature, it was reported that if the increase in body weight is caused by the increase in the amount of fat in the upper body, this especially decreases the effectiveness of FEV, FVC and FEV/FVC % capacities (IM. Carey,1999; ML. Wang,1996).

In triathlon, one of the sports branches in which oxygen consumption capacity is the most effective, when the physical and anthropometric features of the athletes are considered, it was observed that they are tall, have high muscle mass and low fat percentage (T. Reilly,2005). As stated in the literature, especially low upper body fat percentage and high muscle percentage directly increase respiration capacity. In this regard, we can say that triathletes should not be judged by their general body fat percentage and their performance is positively affected by their low upper body fat percentage and high muscle percentage.

Table 1: Average and Standard Deviations (X±SD)

Parameters	X±SD
Age (year)	21,60±2,50
Height (cm)	176,10±9,57
Weight (kg)	67,07±9,18
BMI (kg/m^2)	21,62±1,97
FAT %	10,83±6,03
FM (kg)	7,14±3,61
FFM (kg)	59,93±9,94
TBW (kg)	43,88±7,27
Trunk fat %	9,89±5,53

Trunk FM (kg)	3,55±1,85
Parameters	X±SD
Trunk FFM (kg)	32,42±5,09
Trunk MM (kg)	31,14±4,96
FVC (lt)	5,38±0,82
FEV (lt)	4,61±0,62
FEV/FVC %	85,60±5,52
PEF	9,30±1,76
VC(lt)	5,04±0,94
MVV (lt)	185,01±34,55

FVC (Force Vital Capacity), **FEV** (Force Expiratory Volume), **MVV** (Maximal Voluntary Ventilation), **VC** (Vital Capacity), **PEF** (%25-75 Force Expiratory Flow), **BMI** (Body Mass Indexs), **FAT %**, **FM** (Fat Mass), **FFM** (Free Fat Mass), **TBW** (Total Body Water), **Trunk Fat %**, **Trunk FM** (Trunk Fat Mass), **Trunk FFM** (Trunk Free Fat Mass), **Trunk MM** (Trunk Muscle Mass)

Table 2. The Correlation Between Body Composition and Pulmonary Functions of the Triathletes

Parameters	FVC (lt)	FEV(lt)	FEV/FVC(%)	PEF	VC(lt)	MVV(lt)
Age (years)	,607	,457	-,572	,320	,754*	,231
Height (cm)	,818**	,740*	-,462	,692*	,731*	,682*
Weight (kg)	,750*	,825**	-,083	,872**	,670*	,791**
BMI (kg/m^2)	,191	,400	,437	,527	,141	,428
FAT %	-,466	-,282	,645*	-,315	-,539	-,290
FM(kg)	-,304	-,111	,615	-,144	-,393	-,122
FFM (kg)	,804**	,802**	-,300	,858**	,762*	,775**
TBW (kg)	,804**	,802**	-,301	,858**	,762*	,775**
Trunk fat %	-,241	-,112	,460	-,169	-,351	-,074
Trunk FM (kg)	-,056	,054	,353	-,017	-,176	,090
Trunk FFM (kg)	,797**	,798**	-,295	,850**	,770**	,739*
Trunk MM (kg)	,800**	,799**	-,299	,850**	,773**	,741*

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed)

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