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Maximal aerobic capacity versus vital capacity which Cassel relationships determine the cardiorespiratory fitness among soccer players

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Abstract. Our study evaluated relationships between two surrogates measured vital capacity and aerobic capacity to predict the Cardiorespiratory Fitness among Soccer Players. Based on the background, which confirms that the vital capacity is a limiting factor of aerobic capacity. For this proposed, a total of 163 male soccer players under 17 years from Algerian football championship participated in the present study. There VO_2max were estimated based on the formula Cooper Test (VO_2max = 22.351 d (km) – 11.288 (ml/min/kg)). As well as their Vital capacity was calculating based on formula [vital capacity (ml) = (27.63 - 0.112 × age) × height (cm)]. Based on the statistical applied. Our results confirm: 1) There was a significant relation between soccer players' maximal aerobic Capacity and vital capacity. 2) Soccer players' maximal aerobic Capacity and vital capacity; are the features affecting each other.

Keywords. Cardiorespiratory fitness, maximal aerobic capacity, vital capacity.

Introduction

In sports, performance profile of player/ team is related to both biological and environmental factors (Clemente et al., 2013). Whereas Despite the Most physiological data on elite soccer players originate from Western Europe and North America (Chin et al., 1992). Where the Methods kinematic analysis during match play has been developed (Barros et al., 2007) including The distance covered by players in a match to calculate the index of physiological demands presented by the total distance covered in a game (Reilly & Gilbourne, 2003). Although domination energy in the soccer play is seen as more anaerobic content, to support the distance covered during a match. As much as fatigue which depends on the aerobic capacity (Göral, 2014).

Since the distance is, the most parameter used to determine an estimate maximal aerobic capacity (Haff & Triplett, 2015; Mohammed et al., 2016). The main objective of this study was to analyse the correlation between the vital capacity, as a maximum amount of air expel from the lungs after a maximum inhalation. It is equivalent to the quantity of inspiratory reserve volume, tidal volume, and expiratory reserve volume (Akbarnia et al., 2015). It measures clinically request a wet or regular spirometer (Kumar, 2016). As well as its combination with other physiological measurements can help to diagnosis the underlying lung disease (Seikel et al., 2015). The case of maximal aerobic capacity (Prentice, 2015) which is the maximum rate of oxygen consumption as well as an index oxygen activity reporting the oxygen transportation (Yabe et al., 2012). On the basis, that the vital capacity is which permit the coach to measure, compared and control the improvement on VO_2max (Sujith, 2016) case sports studies, as well as the way to determine the severity of respiratory muscle involvement in neuromuscular disease case the medical studies (Dutton, 2012). Our protocol in the present study base on vital capacity using the age and sex (Orlando, 2013) as factors to esteem its values. Furthermore, the VO_2max calculator was based on the esteem of time and distance (Hoeger & Hoeger, 2009). From these considerations, 163 male soccer players under 17 years from the Algerian football championship participated in the present study. There VO_2max were estimated based on the formula Test Cooper (VO_2max = 22.351 d (km) - 11.288 (ml/min/kg)) (Welk & Meredith, 2010). Where Vital capacity was calculating based on formula (vital capacity (ml) =

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(27.63 – 0.112 × age) × height (cm)) according to Seikel et al. (2015).

Materials & Methods

Sample

The data used in this study were obtained through the database Team 5 Physical Education Institute Laboratory OPAPS for the academic year 2014-2015 (Optimization of physical activity and sport programs (LABOPAPS), 2015). In terms of player-related data, 163 male soccer players under 17 years, from the Algerian championship national territory was examined in parameters (anthropometric and physiological planned to study). By Team 5 at the end of the physical preparation for the year 2014-2015, first weeks before the start of the championship. After the agreement with their coach. Whereas to expert the study protocol and methods we choose the laboratory OPAPS "Institute of Physical Education of our University" who approve it by the professors of football and psychologist.

Testing protocol

Vital capacity

Vital capacity was calculating based on formula (vital capacity (ml) = (27.63 − 0.112 × age) × height (cm)) according to (Seikel et al., 2015). Where the normal vital capacity varies between 3.5 and 6 letters (Ghai, 2012). Interpret by (Barker, 2003) as the benefit of training, which increases the vital capacity as a response physical capacity, to provide an increased and more efficient supply of oxygen to working muscles.

The maximal aerobic capacity

We have chosen the maximal aerobic capacity based on the formula Test Cooper (VO_2max = 22.351 d (km) - 11.288 (ml/min/kg)) (Ferré & Leroux, 2009) where (Gormley & Hussey, 2009) that the Cooper 12-minute test, the 1.5-mile test, the Rockport One-Mile Fitness Walking Test and the multi-stage shuttle have A corresponding VO_2max obtained by the formula where (Pinchas, 2006) set them accurate which is correlated between 90–95 percent. Wherever (Saari & Hintsa, 2016) indict that the Cooper test provide a better picture of endurance of maximal aerobic capacity. However, DeLisa et al., (2005) confirm that maximal aerobic capacity is rarely the limiting factor in performing daily work tasks where the Progressive respiratory muscular weakness leads to restrictive lung disease.

Weight and height

Height (m) and weight (kg) were each measured in the standing position (Goto et al., 2015) where (Hebestreit & Bar-Or, 2008) confirm that the VO_2peak is associated with biological status after controlling for height and weight.

Statistical analyses

Data analysis was performed using SPSS 22.0 for Windows. Data obtained from the tests show a normal distribution. Data was presented as mean ± standard deviation. Shapiro-Wilk test was used for normality analyses. Regression analyses were conducted to analyse the combined of the variables chosen to study where the relationship between the variables was analysed by Pearson correlations (r).

Table 1
Baseline characteristics of the participants' physiological and anthropometric characteristics (n = 163).

Physiological characteristics		
Variables	Vital Capacity	VO_2max
Mean ± SD	4434.56 ± 190.22	44.83 ± 1.64
Minimum - Maximum	3995.78 – 4917.89	39.96 – 49.39
Shapiro-Wilk test for normal distribution	0.9923 – p = 0.53	0.99 – p = 0.44
Anthropometric characteristics		
Variables	Weight	Height
Mean ± SD	64.28 ± 7.60	174.51 ± 6.36
Minimum - Maximum	48.60 – 78	156 – 186
Shapiro-Wilk test for normal distribution	0.98 - p=0.09	0.98 - p=0.28

Table 2
The correlations between the variables tested in the current study

Correlations		VO_2max	Vital Capacity
VO_2max	r	1	0.57**
	p		.00
Vital Capacity	r	0.57**	1
	p	.00	

Table 3
The results of regression analyses relating vital capacity and VO_2max.

Model Stepwise	R	R^2	Adjusted R^2	Coefficients[a]	t	p	F	p
1	.57[a]	.32	.31	Constant	8.72	.00	76.04	0.00
				VO_2max	8.72	.00		

Variables Entered: VO_2max, Dependent Variable: Vital capacity / Predictors: Constant, VO_2max

Results

The characteristics of the study sample are presented in Table1. However, most traits differed by the variables consist in BMI which rejects normality based on the Shapiro-Wilk test. The Mean ± SD of all the variables shows Good level of fitness and physiological characteristics of the participants.

All the correlations in the table 2 were significant at $p \leq 0.05$, in the opposite of weight and BMI.

Through the table 3 model method, stepwise showed a strong and significant positive association between vital capacity and VO_2max.

Discussion

Based on the statistical applied. Our results confirm:

There is a strong positive relationship between maximal aerobic capacity and the Vital capacity. Confirmed by (Collins & Roberts, 2009) a positive relationship between ventilator capacity and aerobic capacity, mentioned in several studies. The case of (Grant & Adams, 2009) which confirms that the meaning is within the pulmonary functioning and its report with the aerobic fitness. In the light of these results, our supposing line with (Grupe et al., 2012) which confirm that the vital capacity is a limiting factor of aerobic capacity. Although changes in maximal work capacity (aerobic fitness, or maximal oxygen consumption) will be immediately noticeable in response to stressors which increase vital capacity (Pathy et al., 2006). Whereas the majority of similar studies indicated that exercises cause an increase in pulmonary functions (Rong et al., 2008). Where the practice of regular sport in generally has a positive effect on Cardiorespiratory Fitness (Sable et al., 2012) due to the improve of circulatory and respiratory efficiency and lung capacity (Giesbrecht, 2010).

View the aim of this study was to examine relationships between two surrogates measured, maximal aerobic capacity versus vital capacity as parameters to determine the cardiorespiratory fitness among soccer players. It can be said that aerobic capacity and vital capacity are the features that have impacts on each other (Göral, 2014; Mohammed et al., 2016). Supported by similar studies in the benefits of aerobic threshold training which increase the athlete's aerobic capacity, especially discipline in which the oxygen supply functions as a limiting factor for performance (Bompa & Buzzichelli, 2015) the case of a soccer game. Although our finds emphases to enhance or to maintain the request aerobic fitness levels related to the energy requirement of the discipline, the player must have enhanced pulmonary function and an improved capacity for oxygen (Renström, 2008). In addition, it has been clear that exercise training inducement influences pulmonary function, as well as VO_2max (Marangoz et al., 2016). Where our results support the hypothesis that pulmonary limitation can limit the aerobic capacity and athletic performance. From the fact that dynamic pulmonary variables have close interactions with maximal oxygen uptake and they are different in levels of VO2max and these parameters may predict the level of aerobic performance of individuals (Fatemi et al., 2012).

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