Comparison of Anaerobic Performance and Agility Characteristics Between American Football and Indoor Soccer Players

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Abstract

Anaerobic energy metabolism and agility are significant determinants of performance within the game actions of team sports such as Indoor Soccer (IS) and American Football (AF) where physical activities labeled as explosive power take place intensively (Beam & Adam, 2011). In the study, the agility skills of male participants of Indoor soccer players (IS_P; n10) and American Football players (AF_P; n10) have been measured by T-test, Illinois agility test and 505 agility tests and the anaerobic energy metabolism, anaerobic capacity (AC) and anaerobic power (AP) has been measured by Wingate anaerobic power test (WAnT) Monark E894 bicycle ergometer. According to the findings of agility and WAnT measurements, IS_P has a significant superiority at AP evaluations although AC averages of two groups are similar ($p<0,05$). IS_P have better scores than AF_P at agility tests T-test 23.7% ($p<0,05$), Illinois agility test 9.6% ($p<0,05$), 505 test 8.9% ($p>0,05$). AF_P has 9.2% more BMI averages than IS_P. Considering the negative effect of BMI on agility skill, this situation is thought to affect the agility skill of AF_P negatively. WAnT measurements have enabled us to evaluate the lower extremity power output of the participants of AF_P and IS_P. It has been recommended to determine the upper extremity power output in order to understand the differences and the anaerobic energy metabolism between two groups better.

Keywords: anaerobic power, agility, American football, indoor soccer

1. Introduction

While anaerobic power is expressed as "the ability of the individual to use the phosphagen system in short term high intensity muscle activities", anaerobic capacity is defined as the total amount of energy obtained from the combination of anaerobic glycolysis and phosphagen system (Medbo, et al., 1988; Rogers, 1990; Tabata, et al., 1996; Calvo, et al., 2002). Performing the activities difficult to practice qualitatively is directly proportionate to anaerobic power (AP) and anaerobic capacity (AC) should be high in order to repeat these activities successively and coordinately without fatigue (Katch & Weltman, 1979; Maud & Shultz, 1986). In case of the fact that body fat percentage is excessive and body mass without fat is insufficient, high fat rate may cause decrease in the capacity of agility at the same time (Heyward & Stolarczyk 1996).

Agility is a significant component for many branches of sports (Getchell, 1979; Çakır, 2019). It is also a control and coordination skill which enables the body and the joints to be at the right position at space during rapid change of directions all along an activity streak (Sheppard & Young, 2006). It can be defined as being able to change the direction of the body parallel or the other way round swiftly, flowingly and in a controlled manner in case of a high momentum. Meanwhile, "Agility is defined as the ability of stopping suddenly, changing direction and accelerate again. These components are important in several branches of sports such as American football, basketball, football, indoor soccer." (Reiman & Manske, 2009). Sheppar has touched upon the importance of the sub classifications of the concept of agility by responding to the question "Which factors affect the agility performance?" as; "When the sub classifications of the concept of agility are not understood by sport scientists and trainers, it means that they cannot satisfy the needs of the players about agility" and they have identified the sub components that constitute the agility at the table of universal agility evaluation (Sheppard & Young, 2006).

Indoor soccer is a type of game played in the field of 20 x 40 m with 1 goalkeeper and 4 players and which each team

has no limits of player substitutions. The time stops when the ball is out of the game which is similar to the basketball. For this reason, it is seen that the duration of the game which is 40 minutes extends 75-85% (Pepe et al, 2010). IS includes high intensity activities (Barbero-Alvarez, et al, 2008; Castagna, et al, 2009) and there are several integrities of actions that require instant change of speed and direction within the competitive game (R ẻ, et al., 2010;).Since the size of the playing field and the ground is suitable for the acceleration of the game ball, it affects the flow of the game. The average running rate in Indoor Soccer consists of 13.7% high intensity sprints and 8.9% sub-maximal sprints. This shows that the players HR_{res} have a work load of 90% (Barbero-Alvarez, et al, 2008). An improved anaerobic power and a rapid recovery capacity for indoor soccer players will help them be successful in meeting the workload requested by the branch.

American Football team consists of 45 players whose positions and duties are different. There are different duties such as blocking, ball stealing, ball carrying, passing within the positions of defense and offence. The selection of the players to the positions is proportionate to their physical features to large extent. AF is based on adapting the instant variables in basic game principles in a short time. Agility trainings constitute an important portion of training programs in terms of adapting instant changes as far as possible (Young, et al., 2001; Hoffman, 2008; Nimphius, et al., 2013; Condello, et al., 2013).

Anaerobic power and agility features are significant determinants of performance for both branches of sports (Beam & Adam, 2011). In this respect, it was aimed to better understand the anaerobic power and agility aspects of these two groups.

2. Method

2.1 Subjects

Indoor soccer players (IS_P; n10) and American Football players (AF_P; n10) who are intercollegiate athletics have participated in the study. PARQ and ACSM risk factor analysis has been applied to the participants before the study and only the participants having no health risks have been included in the study.

2.2 Experimental Procedure

Tall stature, body weights and agility tests (photocell) have been measured. A 10-minute warm-up protocol has been implemented to the participants before the measurements. They have been given a full break at every measurement. The measurement of both groups has been carried out on the same ground with regards to the standardization of the measurements. Test procedures have been introduced before implementation for familiarization.

2.3 Agility Tests Protocol

In agility performance measurements of the participants, T-test including forward, lateral and backward running (Pauole, 2000,), 505 agility test including deceleration and acceleration at 180 degrees rotation (Draper, 1985), and Illınois agility test which tests the ability to turn in different directions and angles (Getchell, 1979) have been used.The participants have been requested to implement the test twice and their best score has been recorded. They have been given full break between these two trials.

2.4 Wingate Anaerobic Perfomance Test (WAnT) Protocol

In the study, Monark E894 bicycle ergometer has been used. WAnT is based on maximal pedaling on bicycle ergometer against previously determined stable load (7.5%/0.1-Kg) within six equal time periods once in every five seconds (Reiser, et al., 2002; Calbet, et al., 2003; Stone, et al., 2004) automatically in 30 seconds (Zupan, et al., 2009). In WAnT measurements, lover body-peak power (AP) obtained within any of the five second-period carried out during the test, anaerobic capacity (AC) showing the average workload performed during the test and the fatigue index (FI) that represents for the percentage of the decrease of performance have been received for consideration. The test procedure consists of 10-second countdown phase at the participants' own speed, pedaling phase at maximum speed for 30 seconds and active recovery phase.

2.5 Data Analysis

Descriptive statistical analysis has been applied in the study and arithmetic average, standard deviation, maximum and minimum values of each variable in terms of measurement results have been estimated separately and normality distribution (Shapiro-wilk) assessments have been made. Independent two sample T-tests have been used for determining the difference between groups and the significance level has been taken as p<0,05.

3. Results

Table 1. Age, height, weight and BMI statistics of participants

	IS_p (n:10)	AF_p (n:10)
Age (years)	20 ± 2	22 ± 2
Height (cm)	176.7 ± 5.5	177 ± 5.1
Weight (kg)	68.9 ± 6.7	75.3 ± 7.6
BMI	22.02 ± 1.24	24.06 ± 2.62

Although IS_P and AF_P have similarities in view of age, height and body weight averages, BMI averages of AF_P is 9.4% higher than IS_P. (p = .039; p<0,05).

Table 2. Wingate anaerobic test (WAnT) assessment

		Mean	SD	Min	Max	P
AP (W/kg)	IS_p	9.88	1.464	8.05	12.33	.008
	AF_p	7.82	1.644	5.8	10.60	
AC (W/kg)	IS_p	6.17	0.762	4.79	7.17	.134
	AF_p	5.33	1.509	3.45	8.86	
FI (%)	IS_p	71.54	7.106	57.03	81.99	.078
	AF_p	78.08	8.388	63.14	91.71	

No significant difference has been found between the participant groups in view of fatigue index occurred during the test (FI; 71.5% - 78.08%) and anaerobic capacity (AC; 6.17 ± 0.762 W/kg - 5.33 ± 1.509 W/kg). However, at the highest power output measurements showed up at any period of time, IS_P has significant difference in anaerobic power output (AP; 9.88 ± 1.464 W/kg - 7.82 ± 1.644 W/kg).

Table 3. Agility tests assessment

		Mean	SD	Min	Max	P
T.Test (sec)	IS_p	9.31	0.362	8.79	9.89	.000
	AF_p	11.52	1.172	9.98	8.79	
İllusion Agility Test (sec)	IS_p	15.41	0.498	14.69	16.43	.001
	AF_p	16.90	0.974	15.94	18.82	
505 Agility Test (sec)	IS_p	2.34	0.077	2.24	2.52	.063
	AF_p	2.55	0.257	2.24	2.96	

IS_P has a significant difference statistically in T-tests and Illinois agility tests including rotations of different directions and angles(p<0,05).On the contrary, there is no significant difference between IS_P and AF_P in 505 agility test which requires a deceleration from a high speed and maximum acceleration later again.

4. Discussion

Table 4.A comparison of literature on AF_p and IS_p participants scores

	*NCAA Division III (sec)	*Elite High School Football (sec)	*Competitor College Athletes (sec)	IS_p (sec)	AF_p (sec)
Mean (sec)	9.11	10.30	10.0	9.31	11.51

*J.Hoffman, 2006, Norm for fitness, performance, and health (Champaign, IL, Human Kinetics)

When agility test evaluation of AF_P in literature has been compared over T-test agility test with NCAA Division III (9.11 sec), Elite High School Football (10.30 sec) and competitor college athletes (10 sec.), it has been observed that it is lower as a feature of agility and it can be stated that IS_P has approached the times of NCAA Division III.

There is a positive relationship between fat-free mass and physical performance. The increase in body fat rate can result

in a negative effect in terms of physical performance. High rate of body fat and the increase in body mass may affect sportive performance negatively regarding both accelerating the body weight rapidly and increasing the energy cost (Heyward & Stolarczyk, 1996; Boileau & Horswill, 2002).

In the proportion between BMI body mass with fat and fat-free mass, the increase in fat will result in the decrease in power per kg. For this reason, high BMI values of AF_P results in the decrease in relative average power distribution per kg. It has been considered that higher BMI values of AF_P than IS_P affect the agility performance negatively.

It is impossible to say that this feature of intercollegiate athletes who are tested for American football where high rate of agility skill in game actions has impact on positive performance is more developed in respect to IS_P. Although there is a similarity between the two groups about the instant peak power output, AF_P is significantly lower than IS_P in terms of overcoming the total workload. According to this evaluation, it means that the increase in the number of changes in direction will result in decrease in the agility performance of AF_P. In addition, when we compare with the players of NCAA Division III College American Football which is similar in view of the categories of branch and age, it has been observed that it is low likewise. However, it is clear that the number of participants is needed to be increased and a table of comparison which compares the population with equivalent populations is necessary.

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