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The relationship between anaerobic performance and special ability skill coordination test

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This study examines the relationship between anaerobic performance and skill-coordination test performed at aptitude tests of universities. In this study, the Wingate anaerobic test (WanT) was used to measure anaerobic power (ANP), anaerobic capacity (AC) and fatigue index (FI) of candidates (n = 47, age = 19.70 ± 1.94 years, height = 169.36 ± 8.45 cm, body weight = 63.11 ± 10.63 kg) who took the aptitude test of Ordu University, School of Physical Education and Sports. Afterwards, times of skill-coordination test consisting of nine stations were measured and recorded using photocell system, and Pearson's correlation and regression analysis were performed using SPSS to analyze the data. There is a moderate and negative relationship between ANP (r = -0.648, p = 0.000) and AC (r = -0.647, p = 0.000) values, and skill-coordination times (p <005). On the other hand, there is no statistically significant relationship between FI (r = 0,098, p = 0,514) values and skill-coordination times (p> 0.05). ANP and ANC values predict (p < 0.05) while FI values do not predict (p > 0.05) skill-coordination times. Findings show that there is a statistically significant and negative relationship between anaerobic power and anaerobic capacity, and skill coordination test times, indicating that skill coordination test times decrease with an increase in ANP and ANC values.

Keywords: Anaerobic performance, Skill and Coordination, Aptitude test

INTRODUCTION

Physical performance can be considered consisting of five major components; cardiovascular durability, muscular strength, muscular endurance, flexibility, and body (Wilmore and Costill, 2004). The level of qualification capacity of an athlete to perform a physical activity, such as exercise or training, and the degree of effectiveness of various physical training practices is regarded as the "maximum performance" of that athlete (Joyner, 2008). The main goal of maximum performance measurement is to assess the amount of energy of skeletal musclesreleased by aerobic and anaerobic metabolism during physical activity. The work capacity generated by skeletal muscles using anaerobic energy transfer systems during maximal and supramaximal physical activity is defined as "anaerobic capacity" while thevalue of the work per unit of time is defined as "anaerobic power" (kgm /s, kgm/min, watt) (Yıldız, 2012). An anaerobic activity is defined as energy consumption that uses anaerobic metabolism (without the use of oxygen) up to 90 seconds in exhaustive exercise (Wilmore and Costill 2004).

Various laboratory and field tests are performed for anaerobic performance measurement (Özkan et al., 2011).Field tests such as jump tests, Margaria-Kalamen stair test, sprint test (40-50-60 yards), speed running tests and shuttle run test, or laboratory tests such as Cunningham Faulkner Treadmill Test, Katch test (ergometric cycling) and Wingate test (ergometric bicycle test) can be used to measure anaerobic performance. The Wingate Anaerobic Power Test (WAnT) is one of the tests used to determine the anaerobic character of anaerobic power and to elicit information on lactacid and alactacid components (Inbar et al., 1996). WanT was developed by the Wingate Institute in the early 1970s. Since 1974, it has often been used all over the world to measure muscle strength, endurance and fatigue, to learn about muscle metabolism in brief maximal and supramaximal intensive exercises, and to evaluate sportive performance (Calbet et al., 2003, Sands et al., 2004; Reiser et al., 2002). WanT is used to measure anaerobic power, anaerobic capacity, and power decrease referred to as fatigue index. During WanT, two basic sources of energy are used, which are adenosine triphosphate-phosphocreatine (ATP-PC) that lasts 3 to 15 seconds at the beginning of exercise and anaerobic glycolytic system that lasts until the end of exercise. Therefore, WanT measures the ability of muscles to use both the ATP-PC and the glycolytic system (Wilmore and Costill 2004).

Coordination is a very complex motorskill and closely related to speed, strength, flexibility and durability. The level of coordination of a person is an indication of his/her ability to quickly perform movements of varying degrees of difficulty, with great attention and efficiency and for specific training purposes. Athletes with high coordination have the ability toperform their skills efficiently as well as to solve problems in unexpected situations very quickly (Bompa, 2013).

This study was conducted to investigate the relationship between theanaerobic performance of athletes participating in aptitude tests and their performance in skill-coordination tests.

MATERIAL METHOD

Study Group

The study sample consists of 47 healthy athletes (n = 47; 19.70 ± 1.94 years) who were to take the aptitude test of Ordu University, School of Physical Education and Sports in the academic year of 2016-2017. They voluntarily participated in the study.

Research Method

Participants who applied for the aptitude test were evaluated for body length, body weight and Wingate (WanT) anaerobic performance a week before the test. All tests and measurements were performed in the afternoon in a laboratory with a constant temperature. In a week, the coordination test was conducted in a tiled-floor gym. The coordination test times were measured and recorded using a system of photocells (Powertimer 300-series, Newtest, Tyrnävä, Finland). Pearson's correlation and regression analysis were used to analyze the data.

Body Length and Body Weight Measurements

Body lengths were measured from crown to heel with bare foot using a Harpenden portable stadiometer (Holtain Ltd, Crosswell, Crymych, Pembs, UK) andbody weightswere measured with participants dressed in a light t-shirt and shorts using an X-Scan Plus II bioelectrical impedance device (JAWON Medical Co., Ltd., Korea).

Wingate Anaerobic Test

The Wingate anaerobic performance test was carried out using a computer-linked mechanical bicycle ergometer (MonarkErgomediks 984 E, Pike Byke, Finland). After participants warmed up, they were taken to the laboratory in groups and provided with detailed information before the test. Afterwards, they were allowed to warm up for 3 to 5 min at 80-100 rpm on the bicycle ergometer with no load.The load corresponding to 7.5% of the body weight of each participant was determined and placed on the bicycle saddle (Mayhew et al., 2001). The saddle height was adjusted according to participants and its feet were fixed to the pedal with the help of clips. Participants were allowed to reach maximal pedaling speed within 3-4 s before the load was applied and then the load on the saddle was automatically lowered by the ergometer and the resistance due to the weight was projected onto the pedal. Participants were asked to maintain pedaling speed for 30 s after the test started and verbally motivated during the test, which was carried out only once. Anaerobic power (ANP) (mean power in the first 5 s), anaerobic capacity (ANC) (mean power measured over 30 s) and fatigue index (difference between maximum power and minimum power) were determined and statistically analyzed using SPSS (İnbar 1986).

Coordination Test

The Coordination test used in the aptitude test of Ordu University, School of Physical Education and Sports consists of nine different stations; vertical jump, forward somersault, equilibrium crossing, obstacle crossing, wall juggling, slalom-crossing, crossover dribble, horse crossing and 10 meter sprint. Participantsexercised an hour a day for a week on a standard-sized track where measurements were to be taken. A week later, their aptitude test scores were recorded.

FINDINGS

There is a moderate and negative relationship between anaerobic power values and coordination times ($p < 0.05$), indicating that as maximum power values of the study group increase, coordination times decrease. There is a moderate and negative relationship between anaerobic capacity values and coordination times ($p < 0.05$), suggesting that coordination times decrease in parallel with an increase in mean power values of the study group. The relationship between fatigue index values and coordination times is not statistically significant ($p > 0.05$) (tables 1 and 2).

Table 3 shows that anaerobic capacity values accounted for 42% of the total variance of coordination times, indicating that the mean power variable is a statistically significant predictor of coordination times ($p < 0.05$).

Table 4 shows that anaerobic power values explained 42% of the total variance of coordination times, indicating that there is a statistically significant relationship between coordination times and maximum power values. In other words, maximum power values are a significant predictor of coordination times ($p < 0.05$).

Table 5 shows fatigue index accounted for only 1% of the total variance of coordination times, indicating that there is no statistically significant relationship between

Table 1: Descriptive Statistics

Variables	N	Minimum	Maximum	Mean	Standard Deviation
Age (year)	47	17.00	26.00	19.70	1.94
Height (cm.)		150.00	187.00	169.36	8.45
Weight (kg.)		44.00	88.00	63.11	10.63
Anaerobic Power (watt)		280.16	1112.1	699.69	222.21
Anaerobic Capacity (watt)		229.56	732.53	495.43	145.56
FatigueIndex		38.1	81.39	58.29	8.54
RelativePower (watt)		5.02	15.90	10.94	2.49
Coordination Time (s)		31.76	49.93	38.35	5.28

Table 2: Correlation Analysis of Relationship between Power Values and Coordination Times

	Coordination Time	
	r	p
Anaerobic Power	-0.648	0.000*
Anaerobic Capacity	-0.647	0.000*
Fatigue Index	-0.098	0.514

*p < 0.05

Table 3: Regression Analysis of Prediction of Coordination Times Depending on Mean Power Values

Variable	B	Standard Error	ß	T	p
Constant	49.990	2.129		23.479	0.000
Anaerobic Capacity	-0.023	0.004	-0.647	-5.692	0.000

R= 0.647, R^2=0.419
$F_{(1.45)}$=32.402, p=0.000

Table 4: Regression Analysis of Prediction of Coordination Times Depending on Maximum Power Values

Variable	B	Standard Error	ß	T	p
Constant	49.134	1.981		24.808	0.000
Anaerobic Power	-0.015	0.003	-0.648	-5.706	0.000

R= 0.648, R^2=0.420
$F_{(1.45)}$=32.557, p=0.000

Table 5: Regression Analysis of Prediction of Coordination Times Depending on Fatigue Index

Variable	B	Standard Error	ß	T	p
Constant	41.871	5.403		7.749	0.000
Fatigue Index	-0.060	0.092	-0.098	-0.658	0.514

R= 0.098, R^2=0.010
$F_{(1.45)}$=0.433, p=0.514

coordination times and fatigue index (p >0.05). In other words, fatigue index is not a significant predictor of coordination times.

DISCUSSION AND CONCLUSION

The aim of this study was to examine the relationship between anaerobic performance of athletes and their performance on the skill-coordination test used by many universities as a means of defining entry requirements to their schools of physical education and sports. The literature review conducted to compare the findings of this study reveals that the number of studies on this topic is limited. The literature contains studies that investigate the relationship between many test protocols used to determine anaerobic performance (Saç and Taşmektepligil, 2010; Eyüboğlu et al. 2009, Aziz and Chuan 2004, Hoffman et al. 2000, Bosco et al. 1983). Some of these studies report that there is a relationship between some variables of anaerobic power measurement methods while others do not. These studies generally address the relationship between anaerobic performance tests such as vertical jump tests, sprint tests, Margaria-Kalamen test and Wingate test.Cebi et al (2013) investigate the discriminating effect of 100-meter sprint, vertical jump and coordination test performances of athletes who were to take an exam for admission into sports colleges. They find no statistically significant relationship between anaerobic power, vertical jump and coordination levels, however, they report a statistically significant relationship between 100-meter sprint and coordination times. Albayrak et al. (2014) conducted a 5-year (2009-2013) longitudinal study of athletes from Antalya region who took a physical education and sports school's admission exam. They evaluated the athletes' 1200 m., 800 m. and 100 m. scores depending on their coordination times. They report that there is not a statistically significant relationship between the athletes' 1200 and 800 m. scores and their coordination test performances while they report a statistically significant relationship between the athletes' 100 m scores and coordination test performances.Athletes who have high 100 m running performance also have better coordination times. These results point to the relationship between 100 m running, which has anaerobic characteristics, and the coordination test. The results of this study are consistent with those in the literature. The skill-coordination test applied in this study consists of a total of nine different stations; vertical jump, forward somersault, equilibrium crossing, obstacle crossing, wall juggling, slalom-crossing, crossover dribble, horse crossing and 10 meter sprint. The main purpose of using this test is to determine the degree of certain motor and mental skills of candidates who are to take the aptitude test.

In conclusion, the results of the regression analysis reveals that maximum and mean power values each account for 42% of the total variance of coordination times. Together with the results of the studies previously cited, our findings suggest that agility, speed, reaction, vertical jump and balance comprising the coordination test used in this study are related to anaerobic performance and that anaerobic performance is a significant predictor of coordination test time.

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