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Aerobic Capacity and Anaerobic Power Levels of the University Students

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Abstract

The aim of study was to analyze aerobic capacity and anaerobic power levels of the university students. Total forty university students who is department physical education and department business (age means; 21.15±1.46 years for male and age means; 20.55±1.79 years for female in department physical education), volunteered to participate in this study. Anaerobic power was measured with Running Anaerobic Sprint Test (RAST). Oxygen consumption was estimated 20-m shuttle run test. We found that was aerobic and minimum anaerobic capacity of physical education students higher than aerobic and minimum anaerobic capacity of business students ($P<0.05$). On the other hand, we didn't found differences between physical education female and male students and business female and male students in maximal anaerobic capacity and average anaerobic capacity ($P>0.05$). We found that was aerobic and minimum anaerobic capacity of female and male students in department physical education higher than aerobic and minimum anaerobic capacity of female and male students in department of business ($P<0.05$). In addition, fatigue index of female students in department physical education lower than fatigue index of female students in department of business was found ($P<0.05$). In conclusion, recreational sportive activities affect development of aerobic capacity, depending on this, aerobic capacities of the students having education at the physical education and sport teaching department are more advanced than the students of the business management department due to applied courses included in the curriculum, in addition to recreational activities, genetic factors are determinants of anaerobic capacities.

Keyword: anaerobic, aerobic, business, sports

1. Introduction

Physical activities which change individuals' physical, social, mental and spiritual aspects in certain rules are described as sport, and these are sometimes performed individually or in teams as well (İnal, 2006). Sport is the most important social activity instrument to maintain our daily life in a balanced and healthy way (Kürkçü & Gökhan, 2011). Being successful in sport and showing high performance in relevant sport branches are common objectives of individuals doing sport. Individuals need to perform their trainings in a certain program and discipline in order to show successful performance and maintain this performance in their relevant sport. At this point, relevant scientific studies make important contributions to them about these issues (Wanderford & Stewart, 2005). Measurements regarding physical and physiological performance in individuals doing sport are significant practices which estimate athletes' advantages and disadvantages for their relevant sport branches. According to measurement results, individuals doing sport will have information about their physical and physiological capacity and arrange their training plans towards these data (Bangsbo, 2006). Capability degree for performing any exercise in persons doing sport is regarded as persons' maximum performance (Joyner & Coyle, 2008). While evaluating individuals' maximum performance, aerobic and anaerobic energy in skeleton muscles during exercises are regarded as energy amount occurring with metabolism. When ATP included in muscles as warehouse is transformed into ADP, released energy is used in muscle contractions for movements (Scott, 2005). Work capacity created when our muscles use aerobic energy system in exercises at maximal and supramaximal levels is referred to anaerobic capacity. Anaerobic power is defined as a value of this work per unit time (kgm/sec, kgm/min, watt). Anaerobic work is an exercise type resulting from tiredness, a load over anaerobic threshold value called occurrence of explosive power. It is impossible to perform an anaerobic activity for a long time. Because muscles operate more than steady rate oxygen metabolism. This level of blood and lactate level in muscle increase, Ph level decreases with increases in co2 excretion and tiredness in muscles occur (Jonathan & Euan, 1997). Explosive power, muscle strength regarding lower and upper extremities, quickness, agility and endurance which are important for individuals to show performance in their sport at a maximum level, are movements requiring a high level of anaerobic capacity in individuals (Stone, 2007). In individuals with a high level of anaerobic capacity, recovery after exercise becomes quicker and muscle tiredness does not occur at once. Relevant energy which is consumed during maximal exercises is provided from fats, and therefore, if athletes have high anaerobic capacity, their capacity for sweating off is higher (Eniseler, 2010). More important athletes' anaerobic capacity levels are in sportive activities, more important their aerobic capacity levels are in shown performance level. Because, aerobic capacity is an effective physiological criteria for athletes' performance capacity. When individuals' aerobic capacity develops, their heart rates and body composition values develop as well (Israel, 1993). As an indicator of functional capacities of circulation, respiration and metabolic systems, maximal aerobic power depends on functions of cardiovascular and pulmonary systems, blood diffusion capacity and mitochondria enzyme activities. When capacities of these systems are physiologically high, maximal aerobic capacity will rise (Scott, 2005). Life styles of students having education in universities are affected from their learning programs. Students have to arrange recreational activities in accordance with characteristics of their learning programs. As a result of this, students differ from physical and social aspects. Our study aimed to analyze aerobic capacity and anaerobic power levels of the students studying at Physical Education and Sport Teaching Department and Business Management in Batman University.

2. Methodology

Total forty university students which is department physical education and department business, (age means; 21.15±1.46 years, height means; 176.20±4.72 cm, body weight means; 71.40±4.20 kg for male and age means; 20.55±1.79 years, height means; 166.20±5.14 cm, body weight means; 56.30±5.52 kg for female in department physical education), (age means; 21.50±1.43 years, height means; 175.40±5.05 cm, body weight means; 70.60±4.05 kg for male and age means; 20.75±1.75 years, height means; 165.75±4.41 cm, body weight means; 55.70±4.04 kg for female in department business), volunteered to participate in this study after having all risks explained to them before the investigation. Prior to data collection, all participants signed a university approved consent form. After receiving a detailed explanation of the study's benefits and risks, all subject signed an informed consent document that was approved by the Helsinki declaration. None of the subjects reported any medical or orthopedic problems that would compromise his participation and performance in the study. Also, menstrual status for female students were based her self-reported menstrual history and haven't menstrual phase during study. Height was measured with an instrument sensitive to 1 mm. Their body weight was measured with participants dressed in only shorts (and no shoes) with a weight-bridge sensitive up to 20 g. Anaerobic power was measured with Running Anaerobic Sprint Test (RAST). Oxygen consumption was estimated 20-m shuttle run test.

2.1 Body Mass Index

Body mass index was calculated as weight/Height squared (kg/m^2).

2.2 Running Anaerobic Sprint Test (RAST)

The RAST was applied with the students performing six 35-m maximal sprints with a 10-second interval between each sprint. The time for each run was measured by two photocells (Smart speed, standard photocells) and the start for each sprint (10-second interval) occurred with a light from the photocell equipment. The power in each sprint was then calculated by the formulas as the following;

Power=(Body mass x $Distance^2$)/$Time^3$

Maximum power=the highest value

Minimum power=the lowest value

Average power=sum of all six value/6

Fatigue index=(maximum power-minimum power)/total time for the 6 sprints

2.3 20-M Shuttle Run Test to Estimate Peak Oxygen Consumption

This study that used the 20-m shuttle run test to estimate peak oxygen consumption (VO_2max) for visual impairment children in experimental and control groups on a wooden gymnasium floor. In brief, participants were required to run between two lines 20 m apart, while keeping pace with audio signals emitted from a pre-recorded CD. The initial speed was set at 8.5 $km \cdot h^{-1}$ (2.4 $m \cdot s^{-1}$), which was increased by 0.5 $km \cdot h^{-1}$ (0.1

$m \cdot s^{-1}$) each minute (one minute equals one stage). The CD used was calibrated for duration of one minute. Participants were instructed to run in a straight line, to pivot and turn on completing a shuttle, and to pace themselves in accordance with the audio signals. The test ended when the participant stopped due to fatigue, or when they failed to reach the end lines concurrent with the audio signals on two consecutive occasions. The participants were constantly encouraged to run for as long as possible throughout the course of the test. The last completed half-stage of the 20-m shuttle run test was recorded (e.g., if 5 stages plus a half-stage were completed: 5.5) and used in the estimation of VO_{2max} (Léger et al., 1988).

3. Findings

Table 1. Values (Mean ± SD) of physical parameters

Variables	Departments	Gender	Mean	Std. Deviation
Age	Physical Education	Male (N=20)	21.15	1.46
		Female (N=20)	20.55	1.79
	Business	Male (N=20)	21.50	1.43
		Female (N=20)	20.75	1.75
Height	Physical Education	Male (N=20)	176.20	4.72
		Female (N=20)	166.20	5.14
	Business	Male (N=20)	175.40	5.05
		Female (N=20)	165.75	4.41
Body weight	Physical Education	Male (N=20)	71.40	4.20
		Female (N=20)	56.30	5.52
	Business	Male (N=20)	70.60	4.05
		Female (N=20)	55.70	4.04
Body mass index	Physical Education	Male (N=20)	22.98	0.44
		Female (N=20)	20.35	1.35
	Business	Male (N=20)	22.98	0.50
		Female (N=20)	20.58	1.55

Table 2. Comparative of aerobic capacity and RAST parameters in department and gender

Variables	Departments	Mean	Std. Error	F	P
Aerobic capacity	Physical Education	44.135	0.685	155.535	0.000*
	Business	32.048	0.685		
	Male	42.36	0.685	77.501	0.000*
	Female	33.83	0.685		
Maximal Anaerobic capacity	Physical Education	555.90	14.78	0.050	0.824
	Business	551.23	14.78		
	Male	709.93	14.78	223.755	0.000*
	Female	397.20	14.78		
Minimum Anaerobic capacity	Physical Education	298.80	8.63	24.767	0.000*
	Business	238.05	8.63		
	Male	377.13	8.63	317.177	0.000*
	Female	159.73	8.63		
Mean Anaerobic capacity	Physical Education	411.10	8.11	0.084	0.772
	Business	407.675	8.11		
	Male	549.78	8.11	600.826	0.000*
	Female	268.90	8.11		
Fatigue index	Physical Education	7.52	0.95	3.301	0.073
	Business	9.96	0.95		
	Male	10.22	0.95	4.857	0.031*
	Female	7.26	0.95		

As shown Table 2, we found that was aerobic and minimum anaerobic capacity of physical education students higher than aerobic and minimum anaerobic capacity of business students ($P<0.05$). On the other hand, we didn't found differences between physical education students and business students in maximal anaerobic capacity, average anaerobic capacity and, fatigue index ($P>0.05$). In comparative of aerobic maximal anaerobic capacity, minimum anaerobic capacity, average anaerobic capacity and, fatigue index in gender, we found values of male higher than values of female ($P<0.05$).

Table 3. Comparative of aerobic capacity and RAST parameters in department and gender

Variables	Gender	Departments	Mean	Std. Deviation	F	P
Aerobic capacity	Male	Physical Education	50.32	6.33	134.984	0.000*
		Business	34.40	0.98		
	Female	Physical Education	37.95	5.46	36.227	0.000*
		Business	29.70	2.06		
Maximal Anaerobic capacity	Male	Physical Education	726.00	123.50	1.182	0.280
		Business	693.85	44.32		
	Female	Physical Education	385.80	53.47	0.595	0.443
		Business	408.60	122.03		
Minimum Anaerobic capacity	Male	Physical Education	403.10	52.04	9.056	0.004*
		Business	351.15	76.52		
	Female	Physical Education	194.50	36.70	16.231	0.000*
		Business	124.95	44.82		
Mean Anaerobic capacity	Male	Physical Education	543.65	62.65	0.571	0.452
		Business	555.90	43.48		
	Female	Physical Education	278.35	39.79	1.360	0.247
		Business	259.45	55.71		
Fatigue index	Male	Physical Education	10.01	3.71	0.049	0.826
		Business	10.43	2.03		
	Female	Physical Education	5.03	1.11	5.514	0.021*
		Business	9.49	11.19		

As shown Table 3, we found that was aerobic and minimum anaerobic capacity of female and male students in department physical education higher than aerobic and minimum anaerobic capacity of female and male students in department of business ($P<0.05$). In addition, fatigue index of female students in department physical education lower than fatigue index of female students in department of business was found ($P<0.05$). On the other hand, we didn't found differences between physical education female and male students and business female and male students in maximal anaerobic capacity and average anaerobic capacity (P>0.05). However, we not found differences between fatigue index of male students in department physical education and fatigue index of male students in department of business (P>0.05).

4. Discussion and Conclusion

This study aimed to analyze aerobic capacity and anaerobic power levels of the students studying at the Department of Physical Education and Sport Teaching and the Department of Business Management in Batman University. In our study the physical measurement values (age, height, weight and BMI) of the students studying at the departments of physical education and sport and business management were parallel with each other on average. Success in sport, that is, performance components depend on physical and physiological feasibility as well as capability, mental, psychological and social characteristics (Güvel et al., 1996). In showing physical performance age, height, weight and BMI values are very significant factors. Resulting from our movement system which changes with these features, variances are seen in performance (Malina et al., 2004). Within our study, the physical measurement values between the groups complied with each other while making comparisons about the measurement values regarding aerobic and anaerobic power, this is important for the validity and reliability of our findings.

When we examine about the physical measurement values related with some studies in literature, in a study dealing with the effects of judo training program on physical performance characteristics, age: 19.25±5.70 years, height: 172.55±7.58 cm., body weight: 70.55±11.12 kg., sport age: 5.85±1.60 were estimated (Karakoç, 2016). Aslan and Koç (2015) found average BMI values as 22.47±2.46 kg/m^2 in their research about football players, as the highest BMI values were seen in forward and sweeper players, the lowest values were seen in wing players. Güldal (2013) studied football players; BMI values were estimated to be 23.81±2.62 kg/m^2 in football defense players, 23.32±1.91 kg/m^2 in midfield players and 22.35±1.85 kg/m^2 in forward players.

When compared about the measurement values of maximal aerobic power in our study; the aerobic capacity values of the female and male students studying at physical education and sport teaching were statistically higher than the aerobic capacity values of the female and male students studying at business management (p<0.05). The reason for higher values associated with aerobic capacity of the students having education at physical education and sport teaching is that the students are very active in sport due to applied courses included in the curriculum of this department. However, there were no statistically significant differences in maximal and average anaerobic power values of the female and male students studying at physical education and sport teaching and business management even if these values were higher in the students at the physical education and sport department (P>0.05). There was not a statistically significant difference between maximal and average anaerobic power values of the students having education in the departments of physical education and sport teaching and business management; this results from that genetic structure is a determinant factor for anaerobic power levels as well as recreational sportive activities.

Koşar and Hazır (1996)'s research showed that anaerobic power values from the sedentary male students were lower than anaerobic power values of the students studying at sport departments. Another research about the physical education and sport students doing sport at a non-elite level but an active level determined that the male students' anaerobic maximum power was 910 watt, average power was 661watt, the females' maximum power was 649 watt, average power was 455 watt (Esbjörnsson et al., 1993). Looking at studies about the groups of one's included and not included in sportive activities, Aslan and Koç (2015) observed that the goalkeepers had the highest values as the wing players had the lowest values in terms of anaerobic power among the football players; the highest values were seen in the wing players as the lowest values were seen in the forward players about the aerobic capacity values. Another study focused on football players analyzed aerobic and anaerobic capacities of the children participated and non-participated in football summer school, found aerobic power averages of the students took part in summer school as 39.59±7.25 ml.kg/dk, values of one's not participated in summer school as 32.62±9.07 ml.kg/dk. Anaerobic power averages of one's participated in summer school were 53.86±11.70 kg.m/sn, averages of one's not participated in summer school were 47.69±10.37 kg.m/sn (İbiş et al., 2004). Daglioglu (2013) determined statistically significant differences in the aerobic capacity scores of the groups after the cardiopulmonary exercise test performed in swimmers and sedentary ones, and these ones gradually increased (P<0.05). Hiruntrakul et al. (2010) stated that mild exercises which were performed in 37 males once in a week for 12 weeks, led to increases in aerobic capacity levels. Another study related with 31 male students showed that aerobic exercises at the level of 50-70% which were applied three times in a week for 8 weeks, gave rise to increases in aerobic capacity levels (Revan et al., 2011). Arıkan (2013) found that there were increases in aerobic capacity levels of the male and female groups which endurance trainings were performed in under their research about the university students, there was not any change in aerobic capacity levels of the males and the females included in the control group.

On contrary to the research findings mentioned above, within a study on aerobic and anaerobic capacities in accordance with the degrees of football players, any statistically significant relation was not found between the aerobic and anaerobic capacities of football players at all degrees ($P>0.05$) (Güldal, 2013). The reason for having no significant relation about football players is that the differences between physical and motoric characteristics of football players having different degrees have been diminished step by step today. The reason for disappearing differences is also that football coaches want football players to help their teammates at other degrees more as well as fulfilling their responsibilities at their own degrees in today's football. When we see running distances covered by athletes at different degrees in competitions, running distances are close to each other.

In examination of aerobic and anaerobic capacity values of the males and the females in our study, the males' aerobic capacity and anaerobic power values were statistically higher than the females' aerobic capacity and anaerobic power values ($P<0.05$). In Koşar and İşler's (2004) research about university students, the males' anaerobic power values were higher than the females' anaerobic power values. The reason for having higher anaerobic power values in the males rather than the females is that the males are more advantageous for muscle mass, muscle fibre, type, dimension and electro-mechanical aspects rather than the females. Also, the males' capacity for using glycogen is higher than the females; this makes males more favorable (Bell & Jacobs, 1986).

In conclusion, recreational sportive activities affect development of aerobic capacity, depending on this, aerobic capacities of the students having education at the physical education and sport teaching department are more advanced than the students of the business management department due to applied courses included in the curriculum, in addition to recreational activities, genetic factors are determinants of anaerobic capacities.

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