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Physical and physiological characteristics of baseball trained adolescents

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ABSTRACT

Aydın, G., Çakır Atabek, H., & Yılmaz, İ. (2015). Physical and physiological characteristics of baseball trained adolescents. *J. Hum. Sport Exerc., 9*(Proc1), pp.S169-S175. The aim of the study is to contrast the physical characteristics of 13-16 years old baseball trained adolescents with the same age sedentary adolescents. Baseball trained adolescents (n=10), who were trained approximately 45 ± 10.67 month, and inactive adolescents (n=14) participated in this research voluntarily. Sit and reach flexibility test, 10-20-30 meter sprint test, active and squat jump tests, hand grip strength test, Wingate anaerobic power test were used to evaluate the physical characteristics of baseball trained adolescents and sedentary adolescents. As a result of the research there is no significant difference between the sedentary adolescents' and baseball trained adolescents' age, height, body mass, BMI, body fat percentage and sit-reach flexibility test values. There is a significant difference between the sedentary adolescents' and baseball trained adolescents' active and squat jump test, 10-20-30 meter sprint test, left and right hand grip strength test values ($p \leq 0.05$). Baseball play trained adolescents' active and squat jump test, 10-20-30 meter sprint test, left and right hand grip strength test values were found statistically higher than values of sedentary adolescents. Baseball trained adolescents' absolute peak power and absolute average power were determined higher than sedentary adolescents but no difference was found between the relative peak power, relative average power. **Key words**: BASEBALL, FLEXIBILITY, ANAEROBIC POWER, STRENGTH.

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INTRODUCTION

Baseball contains game stages with high angular body speeds (Whiteley, 2007). Body composition is the basic necessity for baseball skills and performance. It was pointed out that the best performance can be provided with the low body fat mass and high fat free mass with the researches about baseball (Spaniol, 2007). There are several components of fitness that are important for success for all players. One of the most important skill in baseball is explosive strength (http://www.ncaa.org/news). Baseball requires quick and fast starts, sudden stops and direction changing, speed, power (Axe, 1998; Andrews et al., 1998; Coleman, 2000; Walter, 2002), reaction time (Martinez, 2007), flexibility, agility, balance, strength and coordination especially upper body force, running speed, acceleration skills (Axe,1998; Andrews et al., 1998; Coleman, 2000; Walter, 2002). So it is recommended that baseball players have less body fat, more fat free mass and plan a training program to develop their strength, power baseball skills (www.nsca-lift.org/perform). But it was determined that long time plan and program models were developed for children and youths (Bompa, 1999). Therefore it is important to determine the physiological characteristics of athletes and to plan training program according to these data.

Baseball is the most favourite sport in United States and five million children is playing baseball each year (Mungin, 2006) but it has been played in Turkey for last 5 years. This research is important for Turkey because baseball is a new sport for Turkey so there has been no research about baseball in Turkey. Therefore, the purpose of the study was to contrast the physiological characteristics of 13-16 years old baseball trained adolescents with the same age sedentary youth.

MATERIAL AND METHODS

Participants

Baseball play trained adolescents (n=10), trained approximately 45 ± 10.67 month, and sedentary male adolescents (n=14) participated in this research voluntarily. Baseball trained adolescents, trained a total of eight hour and twice in a week for special fundamental skills and drills of baseball.

Measurements

The information was given to them as having breakfast, not drinking tea, coffee, milk, coke before the test, not eating something 2 hours before the test. A permission paper was signed by their parents that subjects participate to research voluntarily. Sit and reach flexibility test, 10-20-30 meter sprint test, vertical jump test, hand grip strength test, Wingate anaerobic power test were used to evaluate the physiological characteristics of baseball trained adolescents and sedentary adolescents

Body composition

Body composition data was taken before the tests in the morning using skinfold measurements obtained with a Holtain skinfold caliper (Holtain Ltd., UK). Yuhazs formula was used to calculate the body fat percentage.

Hand Grip Test

The subject holds the dynamometer in the hand with the arm at right angles, the elbow by the side of the body and the other body parts don't move. The handle of the dynamometer is adjusted according to subjects. The subjects squeeze the dynamometer with maximum isometric effort for about 5 seconds.

Wingate Anaerobic Power Test

A Wingate cycle ergometer test protocol was used to determine peak power output for each subject. Subjects were seated on a Monark cycle ergometer (Monark 814E) with the seat adjusted to a corresponding knee angle of approximately 10° when one leg was in the extended position (Kraemer et al., 2000). Subjects warm-up on ergometer without resistance for 5 minutes. The ergometer load setting was determined according to subject's body weight (70 gr/kg) (Inbar, 1996). Load was applied to the ergometer after subjects attained the fastest possible pedaling rate. Test was performed for 30 seconds. Each subject maintained her maximal pedaling rate throughout the 30-second test (Kraemer et al., 2000). The subjects were motivated during the test.

Vertical Jump Height Measurement

Squat jump and countermovement jump tests were performed on an electronic jumping mat (MPS-501 Multi-Purpose Measurement System) and chronometer (Sport Expert).

Squat Jump Test: The squat jump was performed from a squatting position with the knees extended to approximately 90°. The participants were asked to hold this position for 3 seconds and then, upon the command. Subjects jumped vertically for maximal height without moving upper body (Byrne, 2002).

Countermovement Jump Test: The participants started from an erect standing position with knees fully extended approximately 180° and hands are on waist. Upon the verbal command, they made a downward countermovement to the same starting position as the squat jump (knee=90°) and then jumped vertically for maximum height in one continuous movement (Byrne, 2002).

Sprint Test

Subjects performed three maximal indoor short sprint trials on a tartan floor 1 meter before the starting line (Erden, 2005). The time required to cover 10, 20, 30 meters was recorded indoors with photoelectric cells (SETX-01) and chronometer (MPS-501 Multi-Purpose Measurement System). The timer is automatically activated when the subject crossed the first cell, and stopped when the subject crossed the second cell. The subjects were encouraged to run as fast as they could. A standing start was used and the best of the three trials was selected as the representative value of this test (Gomez, 2008).

Flexibility Test

Flexibility was measured by using the sit-and-reach test with sit-and-reach box (Lafayette Instrument Company, Model 01285A). Logical validity has been claimed and it is also reported to have measured validity figures of up to .76 (Liemohn, 1994) with very high reliability values of up to .99 (Patterson, 1996). Each subject sat with legs fully extended with the bare soles of the feet placed flat against sit-and-reach box, arms evenly stretched and palms down. The subjects pushed the sliding marker along the scale with the fingertips as far as possible, maximum trunk flexion was held for about two seconds. The test was repeated three times and best of the three trials was selected as the representative value of this test.

Data Analysis

SPSS 13, arithmetic mean, standard deviation were used for statistical analysis and paired-t test was applied to demonstrate the differentiations between the physical characteristics of baseball trained adolescents and sedentary adolescents because of the equal variances and quantitative data (Özdamar, 1999).

RESULTS

Table 1. M ± SD, t-test results of baseball trained adolescents' and sedentary adolescents' physical characteristics

Physical characteristics	Baseball trained adolescents N=10	Sedentary adolescents N=14		
	M ± SD	M ± SD	t	*p*
Age (year)	14.60 ± 0.84	14.14 ± 1.46	.967	.34
Training year (month)	45 ± 10.67	-	-	-
Height (cm)	166.60 ± 9.61	161.28 ± 5.79	1.690	.10
Body mass (kg)	55.08 ± 14.11	47.17 ± 6.95	1.821	.08
% body fat	12.20 ± 4.41	13.14 ± 2.74	-.646	.52
BMI (kg/cm^2)	19.70 ± 4.35	17.72 ± 2.34	1.44	.16

As it was seen in table 1 there isn't a significant difference between the baseball trained adolescents' and sedentary adolescents' age, height, body mass, % body fat and BMI (p>0.05).

Table 2. Vertical jump test results of baseball trained adolescents and sedentary adolescents

Jump Test Results	Baseball trained adolescents N=10	Sedentary adolescents N=14		
	M ± SD	M ± SD	t	*p*
Squat jump (cm)	26.70 ± 4.34	21.00 ± 2.74	3.944	.001**
Active jump (cm)	31.60 ± 5.73	23.86 ± 2.59	3.985	.002**
Squat jump – Active jump (cm)	4.90 ± 2.28	2.86 ± 2.24	2.181	.040*

*** p≤ .001, ** p≤ .01, * p≤ .05

T-test results showed that significant difference between the baseball trained adolescents and sedentary adolescents for the vertical jump test results in table 2 (p<0.05).

Table 3. Sprint test results of baseball trained adolescents and sedentary adolescents

Sprint Tests	Baseball trained adolescents N=10	Sedentary adolescents N=14		
	M ± SD	M ± SD	t	*p*
10 meter (sec.)	1.76 ± 0.07	2.14 ± 0.12	-8.343	.000***
20 meter (sec.)	3.15 ± 0.16	3.85 ± 0.22	-8.371	.000***
30 meter (sec.)	4.57 ± 0.21	5.65 ± 0.40	-7.617	.000***

*** p≤ .001, ** p≤ .01, * p≤ .05

Table 4. Hand grip, sit and reach test results of baseball trained adolescents and sedentary adolescents

Handgrip Tests Sit and Rich Test	Baseball trained adolescents N=10	Sedentary adolescents N=14		
	M ± SD	M ± SD	t	*p*
Right hand strength (kg)	32.34 ± 8.96	23.79 ± 4.79	3.030	.006**
Left hand strength (kg)	30.87 ± 9.97	22.22 ± 4.02	2.593	.025*
Sit and rich test (cm)	20.70 ± 3.72	19.28 ± 4.25	0.845	.407

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$

As it was seen in table 3 and table 4 there is a significant difference between the baseball trained adolescents' and sedentary adolescents' sprint test results, handgrip test results ($p<0.05$) but there isn't a significant difference between their sit and rich test results ($p>0.05$).

Table 5. Wingate anaerobic test results of baseball trained adolescents and sedentary adolescents

Wingate Anaerobic Power Test	Baseball trained adolescents N=10	Sedentary adolescents N=14		
	M ± SD	M ± SD	t	*p*
Absolute peak power (W)	449.74 ± 132.03	312.90 ± 57.02	3.079	.01**
Relative peak power (W/kg)	8.17 ± 1.54	7.11 ± 1.14	1.952	.06
Absolute average power (W)	358.56 ± 95.45	261.86 ± 36.57	3.048	.01**
Relative average power (W/kg)	6.51 ± 0.85	5.85 ± 0.71	2.025	.06

*** $p \leq .001$, ** $p \leq .01$, * $p \leq .05$

According to t-test results there is a significant difference between the baseball trained adolescents' and sedentary adolescents' absolute peak power, average power ($p<0.05$) but there isn't a significant difference between their relative peak power, average power in table 5 ($p>0.05$).

DISCUSSION

As a result of the research there is no significant difference between the sedentary adolescents' and baseball trained adolescents' age, height, body mass, BMI, body fat percentage and sit-reach flexibility test values. There is a significant difference between the sedentary adolescents' and baseball trained adolescents' active and squat jump test, 10-20-30 meter sprint test, left and right hand grip strength test values ($p \leq 0.05$). Baseball trained adolescents' active and squat jump test, 10-20-30 meter sprint test, left and right hand grip strength test values were found statistically higher than values of sedentary adolescents.

Baseball trained adolescents' active and squat jump test values were found statistically higher than values of sedentary adolescents. Squat jump evaluates the maximal strength transferring to explosive strength. Countermovement jump gives knowledge about elastic and explosive strength (Köklü, 2009). So baseball trained adolescents' elastic strength, explosive strength maximal strength transferring to explosive strength were determined higher than sedentary adolescents.

It was determined that there is no difference between the flexibility characteristics of baseball trained adolescents and sedentary adolescents but baseball play trained adolescents' left and right hand handgrip strength are higher than sedentary adolescents.

Peak power gives knowledge about explosive power and average power gives knowledge about maintenance of explosive power in 30 seconds maximal effort (Bencke, 2002; Rowland, 1996). Baseball trained adolescents' absolute peak power and absolute average power were determined higher than sedentary adolescents but no difference was found between the relative peak powers, relative average power.

Benche et al., reported absolute peak power values and relative peak power values of approximately 12 years old boy who were swimmers, tennis players, gymnast as 355 W, 365 W, 287 W, 8.8 W/kg, 8,6 W/kg, 8.1 W/kg. It was determined that absolute and relative average power values of swimmers, tennis players, gymnasts are 319 W, 7.7 W/kg, 314 W, 7.4 W/kg, 234 W, 7.3 W/kg. (Benche, 2002). In another study, absolute and relative peak power values of 12 years old marathon runner were reported as 388 W, 9.1W/kg. Absolute and relative average power values were determined as 320 W, 7.6 W/kg (Güvenç, 2003). It was determined that aerobic capacity and power of children, participating to sport activities and having higher physical activity levels, are higher than their inactive peers (Eriksson, 1973; Loko, 2003).

CONCLUSIONS

As a conclusion baseball skill training was effective for development of physiological characteristics and motor abilities such as strength, flexibility, power and speed. These findings provide normative data and performance standards for the same age baseball play trained adolescents. These data will be useful as reference for other groups of baseball players for comparisons with similar studies.

Limitations and future research

The current study was focused only 10 baseball trained adolescents, who are 13-16 years old and were trained approximately 45 ± 10.67 month. Future studies would obviously yield even more meaningful results with the development of baseball in Turkey.

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