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STATISTICAL ANALYSIS OF BALANCE AND ANTHROPOMETRIC VARIABLES OF MALE BASKETBALL PLAYERS, AGES 9-11

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Abstract

Basketball is a physically demanding team game, utilizing dynamic movements, such as jumping, shooting, passing, dribbling, rebounding, defending and running at different intensities and lengths of times. In order to effectively coordinate these movements and to achieve maximum potential, players must master balance, which is essential for success in any sport. Furthermore, anthropometric characteristics are one of the most significant factors that affect body movements and sports performance. The purpose of this study is to determine whether there is a relationship between body fat percentages and extremity segmental lengths with balance in 26 players, ages 9 to 11, of the Gazi University Junior Male Basketball team.

Each subject performed six different equilibrium measurements: 1) the transfering of weight from left foot to right foot and from right foot to left foot, 2) height, 3) weight, 4) skin fold measurements taken from 7 different body points, 5) length of full arm and leg, and 6) length of overarm. Body fat percentages were calculated according to the "Zorba Formula" (BF% = 0.99 + 0.0047 (body mass) + 0.132 (body fat thickness from 7 different points). Body fat measurements were taken with a Holtain brand skin fold calipper, length measurements with a Holtain tape measure and equilibrium measurements with a Lafayatte 16020 IRF/E stabilometer. By means of a statistical analysis (mean values, maximum and minimum values, and standard deviation), the results showed that anthropometric measurements highly affect balance parameters.

To determine the parameters of balance and to develop training systems to minimize negative factors affecting balance, this study analyzed whether body fat ratios and extremity length of junior basketball team players of the Gazi University Sport Club were related with balance levels.

Key Words: Balance, Anthropometric, Basketball

Introduction

Basketball is a physically demanding team game with a variety of movements played by both sexes of all ages (H. Wissel, 2004, E. Uzicanin, 2008). These movements are based on running at different intensities and lengths of times, with sudden fluctuations in direction and speed, fast hand and feet movements, different kinds of jumps, throwing and catching the ball (S. Hatchell, 2006), as well as sudden stopping and starting. Moreover, these dynamic movements form the basis of fundamental basketball skills, such as shooting, passing, dribbling, rebounding, defending and moving both with and without the ball, all of which individual players must master to be successful in a team (H. Wissel, 2004). In order to effectively coordinate these movements and to achieve the maximum potential, athletes must master balance, which is essential for success in any sport (C. Sigmon, 2003, T. Emma, 2006).

Static balance can be defined as "…the ability to maintain a base of support with minimal movement" and dynamic balance as "...the ability to perform a task while maintaining a stable position" (D.A. Winter, A.E. Patla, J.S. Frank, 1990). In short, good balance means that an athlete's body is in control and has the capacity to make quick movements (M.P. Reiman, R.C. Manske, 2009). Balance is one of the most important attributes a player can possess (H. Wissel, 2004). After balance skills are mastered, other features, such as speed, agility, and explosiveness can be trained and developed to the fullest (T. Emma, 2006).

Anthropometric characteristics are also among one of the most significant factors that affect body movements and sports performance. In performance sports, such as basketball, physical characteristics particularly play a significant role in athletes and team success (C. Şen, C. Durgun, M.E. Kozanoğlu, 2007). The purpose of this study is to determine whether there is a relationship between body fat percentages and extremity segmental length (upper and lower) with balance in players, ages 9 to 11, of the Gazi University Junior Male Basketball Team.

Material and Methods
Results

Measurements

- Heights of athletes were measured using the Lafeyette measurement tool band on bare foot.
- Body weight measurements were taken using the Tanita brand scale, where, athletes only wore shorts.
- 3 variables: arm span, arm and leg were measured in centimeters using the Lafeyette measurement tool band.
- Skinfold measurements were taken using the Holtain brand skinfold caliper.
- Balance measurements were taken using the Lafayatte 16020 IRF/E stabilometer.

Measurement Methods

Skinfold Measurements:

Skinfold measurements were taken from 7 different areas: Triceps, Biceps, Chest, Scapula, İliac, Abdomen and Femur. Body fat percentages were calculated with the "Zorba" Formula (VY% = 0.99 + 0.0047 (body weight) + 0.132 (skinfold of 7 regions).

Anthropometry Measurements:

Anthropometry measurements were taken from 3 areas: Arm Span, Arm and Leg.

Balance Measurements:

Balance measurements involved the transfer of weight from right foot to left foot and left foot to right foot. These were repeated 3 times, the first one being the trial measurement. For these 3 measurements, the trial measurement for each direction was not taken into account and the greatest values of the latter 2 measurements were used in analysis of this study.

The measurements were recorded by reading the digital indications on the balance device. Each measurement took 30 seconds and the time during which the athlete was in balance was recorded in unit of seconds. Loss of balance measurements were calculated by subtracting the duration of maintained balance from 30 seconds, the maximum period.

Statistical Analysis

Data was analyzed with SPSS v16.0, 2 sampling t-test, Pearson's correlation coefficient and descriptive statistics analysis methods.

Table 1: Minimum, maximum, mean and standard deviation values of each subject's height, weight, arm span, arm, leg, triceps, biceps, chest, scapula, iliac, abdomen and femur.

	Minimum	Maximum	Mean Values	Standart Deviation
Height	130	165	147.92	9.81
Weight	27.5	63.5	42.83	11.46
Arm Span	130	164	147.08	8.96
Arm	54	74	64.69	4.83
Leg	70	102	83.03	7.68
Triceps	5.1	29	14.65	6.46
Biceps	3.3	17.3	8.82	4.14
Chest	4.1	27	13.06	6.99
Scapula	4.2	29	11.95	6.94
Iliac	3.2	23	11.48	6.22
Abdomen	5	30	18.08	7.22
Femur	9.4	37	23.27	7.56

	Minimum	Maximum	Mean Values	Standard Deviation
Height	130	165	147.92	9.81
Weight	27.5	63.5	42.83	11.46
Arm Span	130	164	147.08	8.96
Arm	54	74	64.69	4.83
Leg	70	102	83.03	7.68
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Biceps	3.3	17.3	8.82	4.14
Chest	4.1	27	13.06	6.99
Scapula	4.2	29	11.95	6.94
Iliac	3.2	23	11.48	6.22
Abdomen	5	30	18.08	7.22
Femur	9.4	37	23.27	7.56

As indicated in the Table 1, the mean height of the subjects is 147.92 (cm), the mean weight is 42.83 (kg), the mean arm span is 147.08 (cm), the mean arm length is 64.69 (cm), the mean leg length is 83.03 (cm), the mean triceps is 14.65 (mm), the mean biceps is 8.82 (mm), the mean chest is 13.06 (mm), the mean scapula is 11.95 (mm), the mean iliac is 11.48 (mm), the mean abdomen is 18.08 (mm) and the mean femur is 23.27 (mm).

Table 2: Minimum, maximum, mean and standard deviation values of DMB (the duration of maintaining balance) and LOB (loss of balance) measurements of the subjects starting balance transfer from the right foot.

Starting Balance Transfer from the Right Foot ($n = 26$)				
	Minimum	**Maximum**	**Mean Values**	**Standart Deviation**
DMB	**10.43**	**27.9**	**16.01**	**4.4**
LOB	**2.1**	**19.57**	**13.99**	**4.4**

The mean DMB of the subjects who started the balance transfer from the right foot was 16.01 and the mean LOB was 13.99.

Table 3: Minimum, maximum, mean and standard deviation values of DMB and LOB measurements of the subjects who started the balance transfer from the left foot.

Starting the Balance Transfer from the Left Foot ($n = 26$)				
	Minimum	**Maximum**	**Mean Values**	**Standart Deviation**
DMB	**12.64**	**28.14**	**19.01**	**4.27**
LOB	**1.86**	**17.36**	**10.99**	**4.27**

The mean DMB of the subjects transferring the balance from the left foot was 19.01 and the mean LOB was 10.99.

Table 4: Minimum, maximum, mean and standard deviation values of DMB and LOB measurements of the subjects irrespective of the foot direction for the balance transfer.

Irrespective of the Foot Direction for the Balance Transfer ($n = 26$)				
	Minimum	Maximum	Mean Values	Standart Deviation
DMB	12.03	28.02	17.52	4.12
LOB	1.98	17.97	12.48	4.12

The mean DMB of the subjects irrespective of the foot direction for the balance transfer was 17.52 and the mean LOB was 12.48.

Table 5: The relationship between DMB of the subjects who started the balance transfer from the right foot and the other parameters.

Starting the Balance Transfer from the Right Foot ($n = 26$)			
	Pearson Coefficient (ρ)	p	Results
DMB-Height	-0.693	0.000	There is a relationship between two parameters
DMB-Weight	-0.521	0.006	There is a relationship between two parameters
DMB-Arm Span	-0.625	0.001	There is a relationship between two parameters
DMB-Arm	-0.668	0.000	There is a relationship between two parameters
DMB-Leg	-0.698	0.000	There is a relationship between two parameters
DMB-Triceps	-0.340	0.090	There is no relationship between two parameters
DMB-Biceps	-0.243	0.231	There is no relationship between two parameters
DMB-Chest	-0.234	0.250	There is no relationship between two parameters
DMB-Scapula	-0.326	0.104	There is no relationship between two parameters
DMB-Iliac	-0.424	0.031	There is a relationship between two parameters
DMB-Abdomen	-0.229	0.261	There is no relationship between two parameters
DMB-Femur	-0.383	0.054	There is no relationship between two parameters

In the table above there was a negative significant relationship between DMB starting the balance transfer from the right foot and Height (0.000), Weight (0.006), Arm Span (0.001), Arm (0.000), Leg (0.000) and Iliac (0.031).

Table 6: The relationship between LOB of the subjects who started the balance transfer from the right foot and the other parameters

Starting the Balance Transfer from the Right Foot ($n = 26$)			
	Pearson Coefficient (ρ)	p	Results
LOB-Height	0.693	0.000	There is a relationship between two parameters
LOB-Weight	0.521	0.006	There is a relationship between two parameters
LOB-Arm Span	0.625	0.001	There is a relationship between two parameters
LOB-Arm	0.668	0.000	There is a relationship between two parameters
LOB-Leg	0.698	0.000	There is a relationship between two parameters
LOB-Triceps	0.340	0.090	There is no relationship between two parameters
LOB-Biceps	0.243	0.231	There is no relationship between two parameters
LOB-Chest	0.234	0.250	There is no relationship between two parameters
LOB-Scapula	0.326	0.104	There is no relationship between two parameters
LOB-Iliac	0.424	0.031	There is a relationship between two parameters
LOB-Abdomen	0.229	0.261	There is no relationship between two parameters
LOB-Femur	0.383	0.054	There is no relationship between two parameters

In the table above there was a positive strong relationship between LOB starting the balance transfer from the right foot and Height (0.000), Weight (0.006), Arm Span (0.001), Arm (0.000), Leg (0.000) and Iliac (0.031).

Table 7: The relationship between DMB of the subjects who started the balance transfer from the left foot and the other parameters

Starting the Balance Transfer from the Left Foot ($n=26$)			
	Pearson Coefficient (ρ)	p	Results
DMB-Height	-0.691	0.000	There is a relationship between two parameters
DMB-Weight	-0.653	0.000	There is a relationship between two parameters
DMB-Arm Span	-0.663	0.000	There is a relationship between two parameters
DMB-Arm	-0.683	0.000	There is a relationship between two parameters
DMB-Leg	-0.697	0.000	There is a relationship between two parameters
DMB-Triceps	-0.579	0.002	There is a relationship between two parameters
DMB-Biceps	-0.495	0.010	There is a relationship between two parameters
DMB-Chest	-0.469	0.016	There is a relationship between two parameters
DMB-Scapula	-0.546	0.004	There is a relationship between two parameters
DMB-Iliac	-0.672	0.000	There is a relationship between two parameters
DMB-Abdomen	-0.509	0.008	There is a relationship between two parameters
DMB-Femur	-0.595	0.001	There is a relationship between two parameters

In the Table 7, a negative relationship was seen between DMB measurements of the subjects who started the balance transfer from the left foot and all parameters.

Table 8: The relationship between LOB of the subjects who started the balance transfer from the left foot and the other parameters

Starting the Balance Transfer from the Left Foot ($n=26$)			
	Pearson Coefficient (ρ)	p	Results
LOB-Height	0.691	0.000	There is a relationship between two parameters
LOB-Weight	0.653	0.000	There is a relationship between two parameters
LOB-Arm Span	0.663	0.000	There is a relationship between two parameters
LOB-Arm	0.683	0.000	There is a relationship between two parameters
LOB-Leg	0.697	0.000	There is a relationship between two parameters
LOB-Triceps	0.579	0.002	There is a relationship between two parameters
LOB-Biceps	0.495	0.010	There is a relationship between two parameters
LOB-Chest	0.469	0.016	There is a relationship between two parameters
LOB-Scapula	0.546	0.004	There is a relationship between two parameters
LOB-Iliac	0.672	0.000	There is a relationship between two parameters
LOB-Abdomen	0.509	0.008	There is a relationship between two parameters
LOB-Femur	0.595	0.001	There is a relationship between two parameters

Table 8 revealed a relationship between LOB measurements of the subjects who started the balance transfer from the left foot and all parameters.

Table 9: Comparison of DMB values of the subjects irrespective of the foot direction for the balance transfer and height, weight, arm span, arm, leg, triceps, biceps, chest, scapula, iliac, abdomen and femur variables.

Irrespective of the Foot Direction for the Balance Transfer ($n=26$)			
	Pearson Coefficient (ρ)	p	Results
DMB-Height	-0.727	0.000	There is a relationship between two parameters
DMB-Weight	-0.616	0.001	There is a relationship between two parameters
DMB-Arm Span	-0.676	0.000	There is a relationship between two parameters
DMB-Arm	-0.710	0.000	There is a relationship between two parameters

DMB-Leg	-0.733	0.000	There is a relationship between two parameters
DMB-Triceps	-0.481	0.013	There is a relationship between two parameters
DMB-Biceps	-0.386	0.051	There is no relationship between two parameters
DMB-Chest	-0.368	0.065	There is no relationship between two parameters
DMB-Scapula	-0.457	0.019	There is a relationship between two parameters
DMB-Iliac	-0.574	0.002	There is a relationship between two parameters
DMB-Abdomen	-0.386	0.052	There is no relationship between two parameters
DMB-Femur	-0.512	0.007	There is a relationship between two parameters

In the table above there was a negative significant relationship between DMB values and Height (0.000), Weight (0.001), Arm Span (0.000), Arm (0.000), Leg (0.000), Triceps (0.013), Scapula (0.0199), Iliac (0.002) and Femur (0.007).

Table 10: Comparison of LOB values of the subjects irrespective of the foot direction for the balance transfer and height, weight, arm span, arm, leg, triceps, biceps, chest, scapula, iliac, abdomen and femur variables.

Irrespective of the Foot Direction for the Balance Transfer ($n=26$)			
	Pearson Coefficient (ρ)	p	Results
LOB-Height	0.727	0.000	There is a relationship between two parameters
LOB-Weight	0.616	0.001	There is a relationship between two parameters
LOB-Arm Span	0.676	0.000	There is a relationship between two parameters
LOB-Arm	0.710	0.000	There is a relationship between two parameters
LOB-Leg	0.733	0.000	There is a relationship between two parameters
LOB-Triceps	0.481	0.013	There is a relationship between two parameters
LOB-Biceps	0.386	0.051	There is no relationship between two parameters
LOB-Chest	0.368	0.065	There is no relationship between two parameters
LOB-Scapula	0.457	0.019	There is a relationship between two parameters
LOB-Iliac	0.574	0.002	There is a relationship between two parameters
DK-Abdomen	0.386	0.052	There is no relationship between two parameters
LOB-Femur	0.512	0.007	There is a relationship between two parameters

Table 10 showed a significant relationship between LOB values and Height (0.000), Weight (0.001), Arm Span (0.000), Arm (0.000), Leg (0.000), Triceps (0.013), Scapula (0.0199), Iliac (0.002) and Femur (0.007).

Table 11: Minimum, maximum, mean and standard deviation values of body weight percentages of the subjects

	Range	Minimum	Maximum	Mean Values	Standart Deviation
Body Weight Percentages (n=26)	20.36	5.89	26.25	14.56	5.68

In the table above, the mean body fat percentage of the subjects were 14.56. These mean values are consistent with literature data.

Table 12: The relationship between DMB and LOB with the body fat percentage of the subjects who started the balance transfer from the right foot.

Starting the Balance Transfer from the Right Foot ($n=26$)			
	Pearson Coefficient (ρ)	p	Results
Body Fat Percentage DMB	0.337	0.093	There is no relationship between two parameters
Body Fat Percentage LOB	0.337	0.093	There is no relationship between two parameters

As indicated in the table above, there was no relationship between the body fat percentage and the balance.

Table 13: The relationship between DMB and LOB with the body fat percentage of the subjects who started the balance transfer from the left foot.

Starting the Balance Transfer from the Left Foot ($n=26$)			
	Pearson Coefficient (ρ)	p	Results
Body Fat Percentage DMB	-0.592	0.001	There is a relationship between two parameters
Body Fat Percentage LOB	0.592	0.001	There is a relationship between two parameters

In the table above, there was a significant relationship between DMB and LOB values with the body fat percentages of the subjects who started the balance transfer from the left foot.

There was a reverse relationship between the duration of maintaining balance and the body fat

Discussion and Conclusion

Height, Weight and Body Fat Percentage

In this study, Gazi University Sports Club Male Junior Basketball Team players had the mean height of 147.92 cm, weight of 42.83 and body fat percentage of 14.56. The findings obtained in the study are consistent with the literature. In this study, the mean body fat percentages were calculated using the "Zorba Formula".

Balance and Correlation

The mean DMB of the subjects who started the balance transfer from the right foot was 16.01 and the mean LOB was 13.99. The mean DMB of the subjects who started the balance transfer from the left foot was 19.01 and the mean LOB was 10.99.

Irrespective of the foot direction for the balance transfer, the mean DMB of the subjects was 17.52, and the mean LOB was 12.48.There was a negative significant relationship between DMB of the subjects who started the balance transfer from the right foot and height (0.000), weight (0.006), arm span (0.001), arm (0.000), leg (0.000) and iliac (0.031). There was a positive significant relationship between LOB of the subjects who started the balance transfer from the right foot and height (0.000), weight (0.006), arm span (0.001), arm (0.000), leg (0.000) and iliac (0.031). There was a negative relationship between DMB measurements of the subjects who started the balance transfer from the left foot and all parameters; however there was a positive relationship between LOB measurements and all parameters.

Irrespective of the foot direction for the balance transfer, there was a negative significant relationship between DMB values of the subjects and height (0.000), weight (0.001), arm span (0.000), arm (0.000), leg (0.000), triceps (0.013), scapula (0.0199), iliac (0.002) and femur (0.007).

Irrespective of the foot direction for the balance transfer, there was a positive relationship between LOB values of the subjects and height (0.000), weight (0.001), arm span (0.000), arm (0.000), leg (0.000), triceps (0.013), scapula (0.0199), iliac (0.002) and femur (0.007). No relationship was found between DMB and LOB starting the balance transfer from the left foot with the body fat percentage and the balance.

It was found that there was a significant difference between DMB and LOB values and the body fat percentages of the subjects who started the balance transfer from the left foot. There was a reverse correlation between the DMB and the body fat percentage of subjects who started the balance transfer from the left foot; there was a positive relationship between the LOB and the body fat percentages. As the body fat percentage of the subjects, who started the balance transfer from the left foot, increased, DMB decreases and LOB increases.Under light of the results

percentage of the subjects who started the balance transfer from the left foot; and there was a positive relationship between LOB and the body fat percentages. As the body fat percentage of an athlete, who started the balance transfer with the left foot, increased, DMB decreases and LOB increases.

of this study, it was observed that anthropometric measurements such as height and weight had a significant effect on the balance parameters.

As indicated in the result section, as the height, weight, arm, leg and arm span length are increased, LOB in the body increases. In addition to being one of the motoric parameters, balance is important due to the characteristics of basketball. Therefore, it can be concluded that the athletes with higher extremity length should be subject to special balance trainings.

There was a relationship between the skinfold measurements and the balance parameter. Regional excessive weight has a negative effect on the balance. For this reason, the trainings should aim to give the athletes a more homogenous physical structure so that an increase can be observed in balance skill.

Pınar et al. studied balance on dancers (S. Pinar, L. Tavacioğlu, O.E. Atilgan, 2006, 259-265, S. Pinar, L. Tavacioğlu, O.E. Atilgan, 2006, 297-302). The findings of Pinar's study are consistent with the results of this study. The researchers reported that there was a positive relationship between the height and the static balance levels of the dancers (S. Pinar, L. Tavacioğlu, O.E. Atilgan, 2006, 259-265, S. Pinar, L. Tavacioğlu, O.E. Atilgan, 2006, 297-302). It was found that as the height of the dancers decreased, duration of maintaining the balance increased; in other words, it was concluded that the height and the balance were reversely correlated. Based on the data obtained from these two studies, it can be suggested that height factor has a significant effect on the balance.

T. Tot (2009) found a significant relationship between the weight and the balance measurements on elite male basketball players. The findings of Tot are consistent with the results of this study. As the weight of athletes increased, the balance levels decreased. Based on these findings it can also be suggested that the weight affects the balance at all ages. Therefore, maintaining fitness levels of athletes is also important for balance (T. Tot, 2009).

The ability of balance shows individual variations. As a result of the balance measurements at certain intervals, learning factor become active and affects balance skill. In this study, it was also found that, in general terms, among three measurement values taken from the subjects, the highest measurements were the third measurements.

Balance activities should be given importance at young ages, because an athlete starts his/her sports career at a very young age.

As balance is a motor characteristic, balance trainings at young age increase balance levels of the athletes and this has a positive effect on future performances of athletes (I. Holm, N. Vøllestad, 2008).

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THE COMPARATIVE STUDY OF ANTHROPOMETRICAL CHACACTERISTICS IN TABRIZ ELITE FOOTBALL AND VOLLEYBALL PLAYERS

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Abstract

The purpose of this study is comparing the anthropometrical Characteristic of Tabriz elite sportsmen in two courses of Football and Volleyball.

Methods For this purpose 40 Sportsmen (football and volleyball) who participated in the National championships were selected as samples. Twenty eight different Anthropometrics indexes were measured in this research, the variables was Consisted of Age, Wight, Sport Experience, and Height, Sitting height, Upper extremities, Opened hand length, Arm length and …, which of the Anthropometrical Characteristics were measured by Anthropometrics standards methods. After collecting, the data were analyzed using the statistical software, SPSS, and t-student tests ($p \leq 0.05$).The results demonstrated that there is significantly difference between the Heights, Sitting height, Upper extremities, opened hand length, Fat Triceps amount, in samples within two Courses of Football and Volleyball. There is no significant difference between other variables in two groups.

Key words: Anthropometrical Characteristics, Football player, Volleyball player.

Introduction

One of the fields that have drawn the attention of the experts in sports for researches is to find a relation between the physical specifications and skills and sport success. To be successful in a field does a person need special physical specifications? Or any person could be successful in any sport type by his own physical specification? Do any type of sport need special structural, functional and skill specifications?

Measuring and collecting information about the physical condition of the successful athletes in one filed, and analyzing the physical specification and typological dimensions of the individuals averagely, a skillful coach must have some information to select the talented ones for special fields.

Some of the young athletes lose their opportunities to increase their abilities or to achieve the rank of a good athlete because of lack of information about the special features and are not guided towards the blossoming in that filed. In sport, discovering the talents, and selecting in younger ages, controlling, and evaluating their abilities to achieve the highest level of skill is very important. Thus, the main aim of finding the suitable bodies and talents is to select the athletes