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EXAMINING THE EFFECTS OF HAND ANTHROPOMETRIC MEASUREMENTS, GRIP STRENGTH AND BALANCE SKILLS ON SHOT PERFORMANCE IN ELITE FEMALE BASKETBALL PLAYERS

Serdar Gür[1i],
Mehmet Soyal[2]
[1]Istanbul Gelisim University,
Vocational School,
Turkey
[2]Istanbul Gelisim University,
School of Physical Education and Sports,
Turkey

Abstract:
This study aims to examine the effects of elite female basketball players' hand anthropometric measurements, hand-grip strength and balance skills on their shooting performance. The age, height, weight, body mass index and hand anthropometric values, hand-grip strength and balance of the athletes were measured, and Aahperd shot tests were applied. Data analysis was performed through SPSS 24 package program. Data analyses included the Shapiro-Wilk Test applied to determine whether there is a normal distribution, and Pearson correlation analysis used to evaluate the correlation status of the parameters with the normal distribution of the data. The average age of the 12 female athletes participating in the study was 21.83 ± 4.407 years, the average height was 171.50 ± 6.95 cm, the average body weight was 68.60 ± 17.96 kg and the mean Body Mass Index was 23.99 ± 4.72. has been determined. It was determined that the average right hand grip strength of 12 female athletes participating in the study was 35.92 ± 6.127 kg and the average left hand grip strength was 32.92 ± 5.807 kg. Among the balance parameters, the balance mean deviation value was determined as 07 ±, 048, the balance average speed value as 42 ± 119, the balance path length value as 12.19 ± 3.473 and the balance area value as 02 ±. The Aahperd shot test mean value was also determined to be 18.67 ± 2.425. The analyses regarding the hand anthropometrics parameter of the 12 athletes indicate that there is no significant correlation between shot performance and hand length, width, palm length, third finger length, hand shape index, finger index and hand surface area. Besides, it is determined that there is no significant correlation between the hand grip strength and balance test results and shooting performance. The data revealed that the

[i] Correspondence: email segur@gelisim.edu.tr

dominant hand measurements, test values and shooting performance of the athletes are not significantly correlated.

Keywords: evaluation, training, stability, gripping force, shooting precision

1. Introduction

Considering the offensive and defensive actions in basketball, it is observed that it includes technical actions such as dribbling, passing, shooting, rebound, sprinting, changing direction and defensive slipping that players try to implement successfully (Krause and Nelson, 2018). It is widely stated that one of the most important technical actions in basketball is the shooting skill (Erculj and Supej, 2009; Okazaki et al. 2007). Although shooting is the most difficult and complex skill to develop among the physical skills utilized in a basketball match, it is one of the most important factors determining the score superiority in a game and the winning side (Malone et al. 2002). It is known that as a result of the developments in training science, the quality of different training methods has increased and thus reflected on physical performance. During the competition, it is possible to mention that the accuracy of the shooting percentage may increase with the extra shooting training of the athletes with advanced motoric features (Savas et al. 2018).

Considering these and similar statements in the literature about shooting skill in basketball, we can say that there are many parameters that are likely to affect the athlete's shooting performance during the match. One of the parameters we examine in this study is the anthropometric measurement and values of the hand. In basketball, athletes' long hand fingers can positively affect shooting performance, and athletes with long fingers and a large hand surface are likely to have more hand grip strength (Visnapuu and Jurimae, 2007).

One of these parameters is hand grip strength, since the wrist and finger flexors constantly display manipulative skills, such as holding, catching, shooting in basketball, which is a game played by hand (Visnapuu and Jurimae, 2007; Cortis et al. 2011).

Hand grip strength is a measure of hand grip strength governed by many muscle groups in the hand and forearm. The muscles in this region, while enabling daily activities such as holding or manipulating objects in different situations, play an important role in performing the necessary manipulation for basketball to throw the ball in the desired direction at the right angle (Bassey and Harries, 1993).

Another parameter that is likely to affect shooting performance that we examined in this study is balance skill. Balance feature is one of the most important coordination skills for basketball (Kostopoulos et al. 2012). In basketball, it is very necessary to maintain balance and maintain this balance in technical actions such as dibling, passing, shooting, etc Kaushik and Sharma, 2013).

When the literature is examined, it is seen that there are few studies that examine the three parameters that are likely to affect the shot performance discussed in this study.

Due to the scarcity of resources in the literature, the aim of this study is to examine the effects of seven different anthropometric measurements of the hand, hand grip strength and static balance skill on shooting performance in elite female basketball players.

2. Material and Methods

2.1 Research Model

The correlational survey model of the quantitative tradition was applied. The correlational survey model is a survey model that aims to determine the covariance between two or more variables and its degree (Karasar, 2011).

2.2 Research Group

The study sample comprises 12 female athletes licensed to the Çeşme Basketball Sports Club (A team) competing in the TBF Women 1st League.

The study was conducted in a manner that respected the principles established by the Declaration of Helsinki and it was approved by the Ethics Committee of the University.

2.3 Data Collection Tools

12 elite female basketball players aged 17 and over at Çeşme Basketball Sports Club voluntarily participated in the study. A written consent form was obtained from the club administration, and the measurements were performed within this framework. All the information about the measurements was provided to the athletes, and all athletes had the choice to try the measurements beforehand to provide equal skill right. An electronic digital caliper with 150 mm, 0.01 mm/0.0005-inch precision was used for hand anthropometric measurements, a hand dynamometer to measure hand grip strength, and the Sigma Balance Platform to measure balance. The Aahperd shooting test was applied to determine the participants' shooting performance. First, age, height and body weight were documented for the entire athlete group.

a. Height Measurements

The height of the athletes was measured with a tape measure fixed on the wall with the zero indicator touching the ground. The measurements were performed with athletes on bare feet. The values obtained were recorded in "cm" (Lohman et al. 1988).

b. Weight Measurements

Athlete weights were measured using a digital scale. The athletes participated in the measurement only with shorts and t-shirts. The values obtained were recorded in "kg" (Lohman et al. 1988).

c. Body Mass Index Measurements

The height and weight data were used to calculate the "Body Mass Index", which explains the weight distribution according to the height (Lohman et al. 1988) . Body Mass Index (BMI) = Weight / Height (m^2).

d. Hand Anthropometric Measurements

The hand anthropometric measurements were performed with a "Shan" brand (150 mm) electronic digital caliper with 0.01 mm/0.0005 inch precision. The hand length, width, palm length and third finger lengths were measured distinctly for right and left hand. The measurement was performed from the palmar side with the 2^{nd}-5^{th} fingers in adduction and the thumb in some extension, maintaining a position with the fingers stretched in contact with a flat and hard surface (Kulaksız, 2001). Moreover, the formulas below were used to obtain the shape index, finger index and hand surface area values from the data.

The hand length measurement was performed while the midpoint on the distal line (plica carpalis distalis) that forms the boundary between the hand and the wrist was taken as the basis, and the distance to the tip of the middle finger was recorded (Kulaksız, 2001; Hall et al. 1999; Pheasant, 1990).

The hand width measurement was conducted through the distance formed between the proximal ends of the 2^{nd} and 5^{th} metacarpophalangeal joints (Kulaksız, 2001; Hall et al. 1999; Pheasant, 1990).

The palm length measurement through recording the distance between the midpoint of the proximal line (plica digitopalmaris) that separates the root of the middle finger from the palm and the midpoint of the distal line (plica carpalis distalis) that forms the boundary between the hand wrist (Kulaksız, 2001; Hall et al. 1999; Pheasant, 1990).

The third finger length was measured from the middle point on the proximal line (plica digitopalmaris) that separates the root of the finger from the palm of the middle finger as the basis, and the distance to the tip of the middle finger was recorded (Kulaksız, 2001; Hall et al. 1999; Pheasant, 1990).

The shape index was calculated through the formula as (hand width x 100) / hand length. High unit values in this index, which enables the hand shape evaluation, indicate that the person has a large hand structure, and the low unit values indicate that the person has a delicate hand structure (Kulaksız, 2001; Napier, 1990).

The finger index is measured with the formula as (3^{rd} finger length x 100) / hand length. The ratio of the third finder length to the hand length was considered as the finger index. Higher values of finger index show that the finger length is longer compared to the hand length. Moreover, it provides the information that these people have more grip ability. Low finger index values indicate strong hands (Kulaksız, 2001).

It is a measurement obtained by multiplying the hand length and hand width of athletes in $inch^2$. This value is also important regarding its relation to the hand grip strength. Hand Surface Area ($inch^2$) = Hand Length (inch) x Hand Width (inch) (Agarwal and Sahu, 2010).

e. Hand Grip Strength Measurement

"Saehan" brand hydraulic hand dynamometer was used to measure the grip strength. The test was performed by measuring the grip strength for both hands during the grip strength measurement with this tool. Measurements were recorded in the elbow flexion position with two trials for both right and left hands. The higher value of these two measurements was recorded in kg. The dynamometer was calibrated and adjusted according to the athletes' hand while measuring grip strength (Tamer, 2000; Kamar, 2003).

f. Balance Test

A double leg static balance test was performed using the computer-aided stabilometer device Sigma Digital Balance Platform. Special attention was paid to the air condition of the measurement environment, and it was sufficiently quiet during the balance measurements. The athletes started the test on the Sigma Digital Balance Platform with bare feet, and they were asked to balance on the platform for 30 seconds without touching the ground. The measurement was repeated twice, and the best result was recorded (Zemková, 2011).

g. Aahperd Shot Test

The Aahperd shooting test aims to measure the shooting skills of the athletes**.** The zones where the shooting will take place are measured 4.57 meters away from the projection of the hoop, through 5 equally distanced training plates placed from the projection of the center of the hoop and marked on the ground. The subjects were asked to shoot from the first point to the hoop and shoot again from the other points after taking the ball and dribbling to the next point within 1 minute. It was ensured that at least one shot was thrown from each of the 5 shooting points and that at least one foot was behind the marked shooting areas. The test subjects were allowed to attempt a lay-up with the ball they received after missed shots on the conditions that they do not take consecutive lay-ups and that do not try them more than 4 times. Subjects continued to shoot or took lay-ups from the 5 shooting points until a stop warning was blown. The shooting test was ended when the one minute time has elapsed. Each successful shot is scored as 2 points, and missed shots were counted as 1. If the lay-up is successful with a ball returning from the hoop, it is scored as 2 points. If two successful lay-ups are made in a row, the second one is not scored. No points were awarded for shots made with violations in dribbling, ball handling and the shooting line (Mülazımoğlu, 2012).

2.4 Statistical Analysis

The data regarding each athlete recorded in the subject evaluation form was analyzed through the SPSS 24 package program.

Descriptive statistics were used to determine the data averages, and the results obtained were presented as average (X) ± standard deviation (SD). The Shapiro-Wilk test was applied to determine whether the data show a normal distribution, and the skewness

and kurtosis coefficients were found to be in the range of±3. Kalaycı et al., argued that coefficient values in the range of±3 might be considered as acceptable (Büyüköztürk, 2007). Pearson's correlation analysis was applied to assess the correlation status of the parameters with a normal distribution of the data. The variable averages and standard deviations of all athletes were calculated, and values below $p<0.05$ were considered statistically significant.

3. Results

Table 1: Demographic Features of the Participants

Variables	n	X±SD	Minimum	Maximum
Age (year)	12	21,83±4,407	17	35
Height (cm)	12	171,50±6,95	163	182
Weight (kg)	12	68,60±17,96	51	115
BMI (kg/m²)	12	23,99±4,72	18,98	35,43

Table 1 shows that the average age of 12 female athletes was 21.83±4.407, average height was 171.50±6.95 cm, while mean body weight was 68.60±17.96 kg and mean Body Mass Index was 23.99±4.72.

Table 2: Right Hand Anthropometric Measurements

Variables	n	X±SD	Minimum	Maximum
Right Hand Length (cm)	12	18,50±1,352	17	21
Right Hand Width (cm)	12	7,43±,634	7	9
Right Hand Palm Length (cm)	12	10,74±,686	10	12
Right Hand Third Finger Length (cm)	12	7,78±,735	7	9
Right Hand Finger Index	12	42,20 ±1,501	40	45
Right Hand Shape Index	12	40,108±2,126	37,37	44,5
Right Hand Surface Area	12	138,17±20,899	115,60	178

Table 2 shows that the average right hand length of the 12 female athletes was 18.50±1.352 cm, width mean 7.43±.634 cm, the average palm length was 10.74±, 686 cm, and the mean third finger length was 7.78±.735 cm. Furthermore, the other anthropometric parameters of the hand were determined as the average right hand finger index was 42.2025±1.50192, the mean shape index was 40.10800±2.12623, and the average hand surface area was 138.1792±20.89926.

Table 3: Left Hand Anthropometric Measurements

Variables	n	X±SD	Minimum	Maximum
Left Hand Length (cm)	12	18,45 ±1,343	17	21
Left Hand Width (cm)	12	7,33 ± ,566	7	9
Left Hand Palm Length (cm)	12	10,73 ± ,680	10	12
Left Hand Third Finger Length (cm)	12	7,81 ± ,665	7	9
Left Hand Finger Index	12	42,30±1,310	40	45
Left Hand Shape Index	12	39,78±1,918	37,64	43
Left Hand Surface Area	12	135,84±19,664	115,60	172

Table 3 presents that the average left hand length of 12 female athletes was 18.45±1.343 cm, the mean left hand width was measured as 7.33±, 566 cm, the average palm length was 10.73±, 680 cm, and the average third finger length was 7.81±, 665 cm. Moreover, the other anthropometric parameters of the hand were determined as the mean left hand finger index was 42.3025±1.31052, the average shape index was 39.7800±1.91869, and the average hand surface area was 135.8492±19.66429.

Table 4: Right-Left Hand Grip Strength,
Balance Parameters and Aahperd Shot Test Values

Variables	**n**	**X±SD**	**Minimum**	**Maximum**
Right Hand Grip Strength (kg)	12	35,92±6,127	24	44
Left Hand Grip Strength (kg)	12	32,92±5,807	24	42
Balance Standard Deviation	12	,07±,048	0	0
Balance Average Speed	12	,42±,119	0	1
Balance Path Length	12	12,19±3,473	6	17
Balance Area	12	,02±,009	0	0
Aahperd Shot Test (score)	12	18,67±2,425	15	22

Table 4 illustrates that the average right hand grip strength of 12 female athletes was 35.92±6.127 kg, left hand grip strength mean was measured as 32.92±5.807 kg. The balance parameters were calculated as the balance standard deviation value was 07±, 048, the balance average speed value as 42±119, the balance path length value as 12.19±3.473, and the balance area value as 02±.009. The Aahperd shot test mean score was calculated as 18.67±2.425.

Table 5: The Correlation between Right Hand
Anthropometric Measurements and Aahperd Shot Test Results

Variables		**1**	**2**	**3**	**4**	**5**
Right Hand Length	r	1				
	p	-				
Right Hand Width	r	,769	1			
	p	,003*	-			
Right Hand Palm Length (cm)	r	,963	,699	1		
	p	,000**	,011	-		
Right Hand Third Finger Length (cm)	r	,915	,768	,798	1	
	p	,000	,004*	,002*	-	
Aahperd Shot Test	r	-,180	-,181	-,286	-,177	1
	p	,575	,573	,367	,582	-

*p<0,05 **p<0,001

Table 5 reveals no significant correlation between the Aahperd shot test results and the right hand anthropometric parameters of length, width, palm length, third finger length measurements of the 12 female athletes (p>0,05).

Table 6: The Correlation between Left Hand Anthropometric Measurements and Aahperd Shot Test Results

Variables		**1**	**2**	**3**	**4**	**5**
LHL	r	1				
	p	-				
Left Hand Width	r	,788	1			
	p	,002*	-			
Left Hand Palm Length (cm)	r	,910	,664	1		
	p	,000**	,019	-		
Left Hand Third Finger Length (cm)	r	,935	,832	,749	1	
	p	,000**	,001*	,005	-	
Aaahperd Shot Test	r	-,201	-,044	-,171	-,178	1
	p	,531	,892	,595	,579	-

*p<0,05 **p<0,001

Table 6 showed no significant correlation between the Aahperd shot test results and the left hand anthropometric parameters of length, width, palm length and third right finger length measurements of the 12 female athletes (p>0,05).

Table 7: The Correlation between Athletes' Right Hand Finger Index, Shape Index, Surface Area and Aahperd Shot Test Results

Variables		**1**	**2**	**3**	**4**
Right Hand Finger Index	r	1			
	p	-			
Right Hand Shape Index	r	,156	1		
	p	,629	-		
Right Hand Surface Area	r	,292	,237	1	
	p	,358	,458	-	
Aaahperd Shot Test	r	-,107	-,040	-,179	1
	p	,741	,902	,578	-

*p<0,05 **p<0,001

Table 7 illustrated no significant correlation between the Aahperd shot test results and the right hand anthropometric parameters of finger index, shape index and surface area values of the 12 female athletes (p>0,05).

Table 8: The Correlation between Athletes' Left Hand Finger Index, Shape Index, Surface Area and Aahperd Shot Test Results

Variables		**1**	**2**	**3**	**4**
Left Hand Finger Index	r	1			
	p	-			
Left Hand Shape Index	r	,295	1		
	p	,351	-		
Left Hand Surface Area	r	-,116	,093	1	
	p	,718	,775	-	
Aaahperd Shot Test	r	-,043	,244	-,116	1
	p	,895	,445	,718	-

*p<0.05 **p<0.001

Table 8 shows no significant correlation between the Aahperd shot test results and the left hand anthropometric parameters of finger index, shape index and surface area values of the 12 female athletes (p>0,05).

Table 9: The Correlation between Balance Parameters, Right-Left Hand Grip Strengths and Aahperd Shot Test Results

Variables		**1**	**2**	**3**	**4**	**5**	**6**	**7**
Balance Standard Deviation	r	1						
	p	-						
Balance Average Speed	r	,486	1					
	p	,109	-					
Balance Path Length	r	,493	,999	1				
	p	,104	,000**	-				
Balance Area	r	,632	,667	,651	1			
	p	,027	,018	,022	-			
Right Hand Grip Strength (kg)	r	,099	-,414	-,387	-,265	1		
	p	,759	,181	,214	,405	-		
Left Hand Grip Strength (kg)	r	,348	-,349	-,339	-,106	,779	1	
	p	,268	,266	,280	,744	,003*	-	
Aaahperd Shot Test	r	-,084	-,102	-,123	,194	-,363	-,041	1
	p	,795	,753	,704	,545	,246	,900	-

*p<0,05 **p<0,001

Table 9 revealed no significant relationship between the Aahperd shot test results and balance parameters, right-left hand grip strength values of 12 female athletes (p>0,05).

4. Discussion

This section presents the test results of previous studies in the same direction within a comparative tradition.

The average age of 12 elite female athletes in this study was 21.83±4.407, as the average height was 171.50±6.95 cm, mean body weight was 68.60±17.96 kg and mean Body Mass Index was 23.99±4.72.

Acar (2016), conducted a study on the effects of flexibility in basketball on motor properties in 20 athletes competing in the 2nd League and determined an average age of the athletes as 19.00±3.83, mean height as 170.20±9.31 cm, and body mass index as 20.86±2.67. Pazaröz yurt and İnce (2009), examined the anthropometric features of vertical jump and spine flexibility in 41 elite female basketball players by playing positions and found that the mean age was 24.21±5.48 and the average height was 179±0.08 cm. Şen, Durgun and Kozanoğlu (2007), evaluated the upper extremity morphological characteristics of 40 athletes (15 male, 25 female) playing basketball in a league with away games by playing positions. The average age of female athletes was 19.0±2.07, with an average height of 172.0±0.51 cm, and a bodyweight of 62.7±6.85 kg. This study's sample comprised 12 female athletes competing in Turkey Women's Basketball 1st League, and it

can be asserted that the average age, body weight, height and body mass index values are similar to the previous results reached by contemporary studies.

This study found no statistically significant correlation between the hand anthropometric parameters of right hand length, width, palm length, third finger length, shape index, finger index, surface area values and Aahperd shot test results ($p>0.05$).

Furthermore, it was discovered that there is no statistically significant correlation between the hand anthropometric parameters of left hand length, width, palm length, third finger length, shape index, finger index, surface area values, and Aahperd shot test results ($p>0.05$).

Teramoto, Cross, Rieger, Maak, and Willick (2018), used the NBA Draft Combine measurements to examine the correlation between hand length and 2-point shot percentage in their study on the correlation between anthropometric properties and shooting performance. It was found that there was a significant correlation between hand length and two-point shooting performance and no significant correlation between hand length and 3-point shot percentage. Barut, Demirel, and Kıran (2008), used hand length measurements and 2-point field goals made in their study and revealed a weak correlation between hand length and the percentage of 2-point shot accuracy. Barut et al. (2008), sampled 145 basketball, 96 handball players and 133 volleyball players aged between 9 and 18. The measurements applied to basketball athletes revealed no correlation between the hand measurements and the 2-point shot percentage. Ziv and Lidor (2009), conducted tests on performance indicators of statistical parameters related to competitions besides the physical and anthropometric parameters and found no statistically significant correlation between hand length and shooting performance. Teramoto et al. (2018), compared the anthropometric properties and shooting performance using the NBA Draft Combine measurements, and there was no significant correlation between the hand difference measurements and the 2-point shot percentage. Şen et al. (2007), examined the correlation between hand width measurements and 2 point shot percentage and found a statistically weak correlation between them. Teramoto et al. (2018), used the NBA Draft Combine measurements for a study on anthropometric properties and shot performance and found a weak correlation between hand width and 2-point shot percentage as it was stated that there was no significant correlation between hand width and 3-point shot percentage. Barut et al. (2008), revealed a weak correlation between hand width and 2-point shot percentage as there was no significant correlation between hand width and 3-point shot percentage. The contemporary scholarship hints at results indicated correlations between hand anthropometric measurements and shooting performance which confirms the study results.

Kulaksız (2001), found the mean right hand shape index as 45.2934±2.0408 and an average left hand shape index as 44.6750±2.0730 in the study on hand anthropometric measurements. Demirel (2005), conducted a study on hand anthropometric measurements and examined three different age categories in the basketball branch. The mean right finger index in the junior category was 42.66±1.26, as the right finger index in the stars category was 43.51±1.66, and the right finger index in the youth category was

43.39±1.20. Attila (2019) studied the correlation between hand anthropometric measurements and shooting performances in elite basketball players. The author detected a weak correlation between the hand surface area and the 2-point shot percentage and no significant relationship between the hand surface area and the 3-point shot percentage. The contemporary study results regarding the correlation between the hand anthropometric parameters of hand shape index, finger index and hand surface area and shot performance confirms the results of this study.

It was found that there was no statistically significant correlation between the hand grip strength, and the Aahperd shot test results in this study ($p>0.05$).

A similar study by Cicioğlu, Günay and Gökdemir (2000), examined and compared the hand grip strength of 111 elite female athletes from three different branches (41 basketball, 34 volleyball and 36 handball players). The average right hand grip strength was 27.28±5.24 kg, and the mean left hand grip strength was 25.39±5.67 kg of elite female athletes in basketball, volleyball and handball branches. The right hand grip strength mean was 30.91±4.92 kg, and the mean left hand grip strength value 27.31±3.73 kg for handball players. Moreover, the mean right hand grip strength was 31.09±3 67 kg and the mean left hand grip strength was 30.48±3.60 kg for volleyball players. Gür, Kılınç, Ayhan, and Tunay (2017), showed that right and left hand grip strength affects the shot accuracy without specifying the dominant hand. Kinnunen, Colon, Mathilde, Overby, and Lewis (2001), conducted a study on 33 female basketball players aged between 8 and 11 without specifying the dominant hand and found a statistically significant correlation between free throw values and hand grip strength measurements ($p<0.05$). Hung, Chen, Lin, and Chung (2017), found that hand, palm and finger pressure significantly affect shooting accuracy. Gencer, Iğdır, Temur, Sarıkaya, and Seyhan (2019), conducted a study on 40 male- right-handed basketball players between the ages of 13-17 who play professional basketball in Van province. They stated that the non-dominant shot hand's grip strength does not affect the shooting accuracy the dominant shooting hand grip strength may increase shot accuracy and the success in the competitions. The results in relevant studies on the correlation between hand grip strength measurements and shooting performance show no consensus on this puzzling question. The reasons behind this are rooted in the age difference among the athletes, the examined league levels, the variety of training methods, and the anthropometric and conditional differences.

The correlation between the balance test and the Aahperd shot test results revealed that there was no statistically significant correlation between them ($p>0.05$).

Çetinkaya (2019), conducted a study on 92 athletes, 48 females and 44 males, from 4 amateur basketball clubs competing in Çanakkale province. The flamingo balance test showed that the average for females in the star category was 4.00±2.45, and the average in the junior category was 3.10±2.02, while the Aahperd shot test was applied to determine the shot accuracy. The shooting test concluded that the average score of basketball players in the female stars category was 12.50±2.27, while the average score in the youth category was 16.70±3.43. The statistically compared results revealed that the more successful group in the balance test did not exhibit the same rates in shooting

performance which shows that the balance performance did not contribute positively to the shooting performance. Tetik, Koç, Atar, and Koç (2013), compared the balance performance and game scores of the 1st and 5th teams that took part in an intercollegiate basketball tournament as it was stated that the balance and game score performance of the 1st team was better than the 5th team in the tournament. Considering these results on the correlation between balance test and shooting performance, the results are divergent from the results of this study. Thus, it can be asserted that similar studies reached different results while this study's results show similarities and differences in certain aspects.

5. Conclusions

The study reached contradictory results with its hypotheses, and the reason behind such a result may be that there are several factors effecting an accurate shot in basketball. Accurate shooting performance can be associated with anthropometric and conditioning factors and sociological and psychological status in particular. One factor affecting shooting accuracy is found to be the fans pressure, while other factors are specified as the athlete's self-confidence, comfort and responsibility to shoot. The minutes an athlete plays in a game, the league level, percentage of repetitive field goals made or missed shots are influential in the shooting dynamics. Another factor may be the anxiety about the future of the leagues, the suspensions of training and competitions due to the Covid-19 process. In light of these findings, three parameters that could affect the shot performance examined in this study revealed that various hand anthropometric measurements, hand grip strength and balance ability were not significantly correlated with the shooting performance.

Conflict of Interest Statement

The authors declare no conflicts of interests.

About the Authors

Serdar Gür has a BS degree in physical education and a MA degree in Movement and Training Sciences. He works as a lecturer at Istanbul Gelisim University and his main branch is basketball. https://orcid.org/0000-0003-1562-9090; segur@gelisim.edu.tr Istanbul Gelişim University Vocational School İstanbul/Turkey.
Mehmet Soysal has a BS degree in physical education and a MA degree in Physical Education and Sports and a PhD in Physical Education and Sports Education. http://orcid.org/0000-0001-6528-0275; msoyal@gelisim.edu.tr; Coaching Department, School of Physical Education and Sport, Istanbul Gelisim University.

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