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The Relationship Between Selected Physical and Motor Characteristics with Dribble-Shooting Performance of 9-10 Years Old Female Basketball Players

Gürol GÜNER [1A], Yeliz PEHLİVAN [2B], Murat TUTAR [3C]

[1] *Bakırköy Youth and Sports District Directorate, Istanbul, TÜRKIYE*
[2] *Istanbul Health Sciences University, Hamidiye Faculty of Life Sciences, Exercise and Sport Sciences Department, Istanbul, TÜRKİYE*
[3] *Istanbul Gedik University, Faculty of Sport Sciences, Department of Exercise And Sport Sciences, Exercise and Sport Sciences Programme Istanbul, TÜRKİYE*
Address Correspondence to Yeliz PEHLİVAN: e-mail: yeliz.yol@sbu.edu.tr

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A: Orcid ID: 0009-0002-7915-2711 B: Orcid ID: 0000-0002-0859-6238 C: Orcid ID: 0009-0009-1726-7581

Abstract

Basketball is a sport that combines physical abilities and technical skills. Dribble-shooting is one of the basic skills of this sport, and it is important to have certain physical and motor characteristics to perform it successfully. The physical development of 9-10-years-old female basketball players continues rapidly, and physical fitness levels may vary during this period. This study investigated the relationship between selected physical and motoric characteristics of 9-10-years-old female basketball players and their performance in dribble-shooting. Forty female basketball players with a mean age of 9.50±0.51 years participated in the study. The data obtained in the study were evaluated using SPSS 26.00 programme. Descriptive statistics (min., max., mean and standard deviation) were given while evaluating the data. After the normality distribution was made in the analysis of the data, the relationships between the data were evaluated by Spearman correlation since the data were not parametric. The results obtained were evaluated at $p<0.05$ significance level. After physical measurements, balance, flexibility, speed, hand grip, agility, jumping, ball throwing, and dribble-shooting performance tests were performed. No correlation was found between selected physical and motor characteristics such as age, height, body weight, flexibility, jumping, hand grip, ball throwing, agility, 20-meter sprint, balance, and arm length, with the dribble-shooting performance of 9-year-old female basketball players. As a result, there is no relationship between the selected physical and motoric characteristics of 9-10 years old female basketball players and their mobile shooting (lay-up) skills.

Keywords: Basketball, correlation, female, dribble-shooting, motoric characteristics

Özet

9-10 Yaş Arası Kız Basketbolcuların Seçili Fiziksel ve Motorik Özellikler ile Hareketli Şut (Turnike) Becerileri Arasındaki İlişki

Dribble-shooting bu sporun temel becerilerinden biridir ve başarılı bir şekilde gerçekleştirilebilmesi için belirli fiziksel ve motorik özelliklere sahip olmak önemlidir. 9-10 yaş arası kadın basketbolcuların fiziksel gelişimleri hızla devam etmekte ve fiziksel uygunluk düzeyleri bu dönemde değişkenlik gösterebilmektedir. Bu çalışmada 9-10 yaş arası kadın basketbolcuların seçilmiş fiziksel ve motorik özellikleri ile top sürme performansları arasındaki ilişki araştırılmıştır. Çalışmaya yaş ortalaması 9.50±0.51 yıl olan 40 kadın basketbolcu katılmıştır. Çalışmada elde edilen veriler SPSS 26.00 programı kullanılarak değerlendirilmiştir. Veriler değerlendirilirken tanımlayıcı istatistikler (min., max., ortalama ve standart sapma) verilmiştir. Verilerin analizinde normallik dağılımı yapıldıktan sonra, veriler parametrik olmadığı için veriler arasındaki ilişkiler Spearman korelasyonu ile

değerlendirilmiştir. Elde edilen sonuçlar $p<0.05$ anlamlılık düzeyinde değerlendirilmiştir. Fiziksel ölçümlerin ardından denge, esneklik, sürat, el kavrama, çeviklik, sıçrama, top atma ve top sürme-şut atma performans testleri uygulanmıştır. Yaş, boy, vücut ağırlığı, esneklik, sıçrama, el kavrama, top fırlatma, çeviklik, 20 metre sprint, denge ve kol uzunluğu gibi seçilmiş fiziksel ve motorik özellikler ile 9 yaşındaki kadın basketbolcuların top sürme-şut atma performansı arasında bir ilişki bulunamamıştır. Sonuç olarak, 9-10 yaş grubu kadın basketbolcuların seçilen fiziksel ve motorik özellikleri ile hareketli şut (turnike) becerileri arasında bir ilişki yoktur.

Anahtar Kelimeler: Basketbol, kız, korelasyon, motorik özellik, turnike.

INTRODUCTION

Basketball, a dynamic and complex sport that combines cyclic and acyclic movement structures, has gained worldwide popularity (10,18). The aim of the basketball game is basically to score by putting the ball into the basket as many times as possible and to prevent other teams from scoring during the given time. Therefore, players need to have 6 individual technical skills for many basketball movements with or without the ball during a match. These are dribbling, shooting, passing, rebounding, defensive and offensive skills (24). The fact that each shot to the basket in basketball brings points shows that shooting techniques are dominant for this branch and play a vital role in games. In particular, the dribble-shooting technique is a very basic technique in basketball games because the number of points scored from a dribble-shooting performance is the highest compared to other types of shots such as free throws or three-pointers (5,8,19).

The successful and efficient realization of all movements in basketball, especially the dribble-shooting performance, depends on the motor and functional skills of the players. Motor skills play an important role in the selection of young basketball players and in the progression of their game performance. This is especially true for innate abilities that are difficult to reach the high-quality level required by modern basketball through training alone (11). The necessity of physical conditioning components for each sport varies according to the characteristics or characteristics of that sport and is orientated towards the demands of the sport. The explosive power of the leg muscles is a physical conditioning component that cannot be ignored. The explosive power and take-off power of the leg muscles are needed when making a dribble-shooting or putting the ball in the opponent's basket. In addition, the strength of the arms and shoulder girdle, agility, coordination, balance, flexibility, speed of cyclic and acyclic movements, anaerobic lactate and alactate capacities, shooting accuracy and ball handling ability are other important elements in basketball (20,22,30,36). Basketball is a complex sport that requires a high level of motoric skills. The development of these skills at a young age is critical for future sporting success. The age group of 9-10 years is a period of rapid development of motoric skills and the skills acquired during this period can significantly affect the performance of athletes in later ages (37). Balance plays an important role in basketball, especially in defensive and offensive positions. Balance development in children aged 9-10 years is closely related to the development of the central nervous system and musculoskeletal system. Children in this age group show significant improvements in static balance tests such as standing on one leg (38). Studies have reported that initiating balance training at an early age can be effective in improving overall motoric performance (39). Flexibility is important for preventing injuries and increasing the range of movement. Flexibility of muscle and connective tissues develops rapidly in this age group (40). Flexibility, which is evaluated by tests such as sit-and-reach, should have an important place in the training programmes of female basketball players. In the literature, it is emphasised that regular stretching exercises are effective in the development of flexibility. Speed is associated with the ability to change direction suddenly and react quickly in basketball (41). In children aged 9-10 years, sprint development is influenced by genetic and environmental factors. Short distance sprint tests are commonly used to assess sprint performance in this age group. Muscle fibre type composition and contractile properties change rapidly in children aged 9-10 years, with a transition from slow to fast in the vastus lateralis between 6-10 years (42). In 9-year-old children, muscle differentiation develops rapidly with a higher percentage of fast-twitch muscle fibres and higher muscle activation (43). Research shows that regular speed training contributes to speed development in this age group. Hand grip strength is critical for ball control and passing ability in basketball. In this age group, hand grip strength is considered as an indicator of general muscle strength (44). Jumping plays an important role especially in offensive and defensive rebounding. Vertical jump tests are used as an indicator of explosive strength. In the 9-10 age group, jumping ability increases in parallel with neuromuscular development (45).

To date, many studies have investigated the performance parameters and physical characteristics of male and female basketball players in various age groups (2,7,28,46).

However, studies investigating the relationship between the physical and motoric characteristics and dribbling-shooting of female basketball players aged 9-10 years are limited in the literature. Therefore, the aim of this study was to investigate the relationship between selected physical and motoric characteristics and dribbling-shooting performances of 9-10 age group female basketball players. Our hypothesis is that there will be a positive and significant relationship between selected physical and motoric characteristics such as balance, flexibility, speed, handgrip strength, agility and jumping, and mobile shooting (lay-up) skills of 9-10 years old female basketball players.

METHOD

Participants

The participants consisted of 40 female athletes playing basketball regularly for at least 1 year. Before the study, the participants and their parents were informed about the structure of the study, possible risks, and that they could leave the study at any time, and their written consent was obtained that they voluntarily agreed to participate. Athletes who had any injury, injury or medical procedure in the last three months were excluded from the study.

Study protocol

In the study, body composition measurement, balance test, flexibility test, handgrip strength test, sprint test, agility test, vertical jump test, and mobile throw (tourniquet) test were performed in one day respectively. In the second repetition of the same movement, 2 min rest and 10 min rest between the stations were given.

Ethical approval and institutional permission

It was approved by the Scientific Research Ethics Committee that the research design was in compliance with the Helsinki Declaration on Ethical Principles in Medical Research on Humans (2023/06).

Height and Body Weight Measurement

The body height, using a wall-mounted stadiometer (Holtain, UK) with an accuracy of ±0.1 mm, and the body weight, using the electronic laboratory scale (Seca, Vogel & Halke, Hamburg) with an accuracy of ±0.1 kg was measured.

Sit and Reach Test

The athlete sat without shoes on the flexion board with the soles of both feet placed on it. With her knees tense, bending at the hip joint, she tried to take the ruler standing on the flexion board to the farthest point. He was made to wait for a few seconds at the last point he reached. After resting for 5-10 seconds, the second measurement was made and the best score was recorded.

Arm Length

The athlete sat in a chair with the trunk and head upright and knees at 90 degrees. The telescopic meter was adjusted so that it was at the level of the athlete's shoulder head. The athlete positioned her arms parallel to the floor with the palms facing forward. The athlete's stroke length was measured by pushing the middle fingers of both hands with the telescopic meter.

Vertical Jump

The athlete was asked to jump on a Microgate witty, wirelles trainig timer (China) jump mat with feet apart and upright to the highest point she could reach. The measurement was done 2 times and the best degree was recorded.

Hand Grip Strength

To calculate the athlete's hand grip strength, a Baseline Smedley spring dynamometer (electronic-90 kg) was used with the clamping lever spacing adjusted to the second knuckle of the fingers of each athlete. The athlete made a trial by lightly squeezing the dynamometer once. At the end of the trial, they rested for 5-10

seconds. Then, in a standing position, he held the dynamometer downwards so that the arm was tense. He squeezed once with her left hand and once with her right hand with all her strength. The measured values were noted.

Speed (20 m Sprint Test)

Participants performed a maximum sprint of 20 meters starting from a stationary standing position. To avoid a premature start, they placed their forefoot on an additional line placed 20 cm behind the photocell. Sprint times were measured with an accuracy of 0.01 s using three 1.2 m high and 1.5 m wide photocells (Microgate, Bolzano, Italy).

Pro Agility Test

The pro agility test was marked with two guide funnels set up 4m 57cm to the left and right of the start/finish photocell. The athlete stood ready with her feet 50 cm behind the funnel. The choice of stance and direction was left to the participant's preference. When the start command was given, she touched the marked target with her hand, then ran towards the start, turned quickly and ran in the opposite direction of the second marked target, touched it with her hand, turned again and quickly crossed the starting line and finished the test. Before starting the test, the athletes were instructed to complete the set targets, run fast and maintain their speed until the finish line was crossed (21).

Throwing the Ball Back

The athlete's legs are shoulder-width apart, and her back is facing the throwing area. They were asked to throw the ball with both hands in front of them without falling backwards. After slightly bending their knees, they quickly straightened their bodies and threw the 1 kg ball backwards with both hands. Uncontrolled hits were not taken into account. Two throws were made. The best score was recorded.

Star Balance Test (SEBT)

The test was performed using a 2x2 m flat dry surface, a flat adhesive tape, and a meter. On the designated floor, 4 strips cut 2 m long were glued so as to form 45-degree angles between them. The athlete was shoeless for the test. The test was performed separately for the right and left feet. If the right foot was used, the test was performed clockwise; if the left foot was used, the test was performed anti-clockwise. The athlete's hands were on her waist throughout the test. The athlete reached the last point she could reach with her feet and lightly touched the strip with her toe tip. Then she returned to the starting position (hands on the waist, foot in the air, on one foot). A total of eight lines were completed in this way. Each time, the test administrator made a mark with a pencil at the maximum point that the test participant could reach in order to be able to measure it later. Participants were allowed to practice reaching in each of the eight directions six times to minimize the learning effect (12,16). Following a 5-min rest period, participants performed three trials in each of the eight directions. The best result was recorded. At the conclusion of all trials, the investigator measured the distances of each excursion with a standard tape measure.

Dribble-Shoot Test

The first funnel was placed at a distance of 6 meters from the starting line and the other 3 funnels were placed at equal intervals, 4.5 meters ahead of the first funnel. With the command, the athlete behind the starting line was asked to move between the funnels and reach the basket. On the first shot, the player was asked to shoot a right or left dribble-shooting from close range. If she was not successful, she was asked to take the ball and make a dribble-shooting from any point. The movement continued until a successful point was made. The time between starting and scoring was measured and recorded. This test is a method used to evaluate the dribble-shooting in basketball (27).

Data Analysis

The data obtained in the study were evaluated using SPSS 26.00 program. Descriptive statistics (min., max., mean and standard deviation) were given while evaluating the data. After the normality distribution was made in the analysis of the data, the relationships between the data were evaluated by Spearman correlation since the data were not parametric. The results obtained were evaluated at $p<0.05$ significance level.

FINDINGS

Table 1. Descriptive Statistics of the Participants (Mean± SD)

	N	Min.	Max.	Mean±SD
Age(year)	40	9	10	9.50±0.51
Height (cm)	40	124	151	139.0±0.08
Body Weight (kg)	40	24	44.5	33.41±4.86
Sit and reach (cm)	40	10	29	20.85±5.46
Arm length (cm)	40	117	152	136.6±8.48
Jumping (cm)	40	10.0	34.0	21.36±6.70
Hand grip (right)	40	8.10	19.0	12.07±2.65
Hand grip (left)	40	7.20	16.10	11.30±1.94
Ball throwing (cm)	40	2.76	4.90	3.89±0.56
Agility (sec)	40	4.56	7.80	6.42±0.91
20-m sprint (sec)	40	4.10	6.30	5.16±0.54
Dribble-shooting (sec)	40	14.63	56.0	26.23±9.01
Star balance (cm)	40	57	90	70.95±8.63

Min: Minimum, Max: Maksimum, SD: Standart Deviation

The minimum, maximum, mean, and standard deviation of the physical and motor performance parameters of the participants are presented in Table 1.

Table 2. The Relationship Between the Physical and Performance Parameters of The Participants and Dribble-Shooting Value

	Height (cm)	Body Weight (kg)	Arm length (cm)	Jumping (cm)	Hand grip (right)	Hand grip (left)	Ball throwing (cm)	Agility (sec)	20-m sprint (sec)	Dribble-shooting (sec)	Star balance
Age (year)	.237	-.215	**.446****	**.711****	.311	.165	.152	**-.709****	-.095	-.085	.284
Height (cm)		**.694****	**.918****	.286	**.333***	**.318***	**.669****	-.175	**-.562****	-.080	**.950****
Body Weight (kg)			**.594****	-.073	.278	**.480****	**.645****	.201	**-.417****	.174	**.606****
Sit and reach (cm)			.134	.043	.216	**.432****	.114	-.076	-.285	-.023	-.065
Arm length (cm)				**.452****	**.382***	**.419****	**.650****	**-.400***	**-.520****	-.017	**.860****
Jumping (cm)					.233	.063	.185	**-.877****	-.268	.197	.292
Hand grip (right)						**.642****	**.534****	-.284	-.203	.088	**.320***
Hand grip (left)							**.570****	-.117	-.288	.124	.242
Ball throwing (cm)								-.252	**-.572****	.028	**.566****
Agility (sec)									.203	-.100	-.189
20-m sprint (sec)										.061	**-.459****

***: p<0.05, **: p<0.01**

When the relationship between the physical and performance parameters of the participants and dribble-shooting values was examined, no statistically significant correlation was found between the parameters. There was a positive correlation between age and arm length and jump parameter, while there was a negative correlation between age and agility parameter. A positive correlation was found between height and body weight, arm length, hand grip (right-left), ball throwing, 20 m sprint and balance parameters. There was a positive correlation between body weight and arm length, hand grip (left), ball throwing and balance parameter, while a negative correlation was found in the 20 m sprint parameter. There was a positive

correlation between sit and reach and hand grip (left) parameter. Arm length was correlated with all parameters except dribble-shooting performance score. A negative correlation was found between jump height and agility. There was a positive correlation between hand grip strength-right and hand grip-left, ball throwing and balance. There was a positive correlation between hand grip left and ball throwing. A negative correlation was found between 20 m sprint and balance (Table 2).

DISCUSSION AND CONCLUSION

In this study, the relationship between selected physical and motoric characteristics of 9-10 years old female basketball players and the dribble-shooting performance was investigated.

The dribble-shooting is the most frequently used scoring method in basketball games (34). The dribble-shooting consists of three stages. These are approach, jump and release phases. Therefore, for a successful dribble-shooting performance, the explosive power of the leg muscles is needed in the transition from the approach phase to the jump phase. Since the dribble-shooting is made by jumping on one foot, the balance must be developed, and the joints must have flexibility capacity. Because when sending the ball to the hoop, the feet and hands are expected to move in a flexible structure (31,35). Candra (4), in a study conducted on secondary school basketball players, shows that there is a strong relationship between flexibility and dribble-shooting performance (r=0.934). A significant relationship was found between speed endurance and height in female volleyball players aged 11-13 (47). However, unlike this study, no significant correlation was found between flexibility and dribble-shooting performance in our study ($p>0.05$). The reason for the difference in this study may be that the age scale of the population was older than our study.

Another important factor for basketball performance is dynamic balance. Studies have shown that basketball players with better dynamic balance tend to have better performance in various physical characteristics such as height, sitting height, body weight, lean body weight, upper body strength, lower body muscular endurance, lower body muscular strength, speed and agility (3,6,13,14,15). In our study, significant correlations were found between balance and height, body weight, arm length and upper extremity strength. Therefore, it can be said that the results of our study support the above study. There is a lack of studies investigating the relationship between dynamic balance and basketball performance. It is important for basketball players to have good dynamic balance because it can contribute to their overall stability, coordination and ability to maintain control during dynamic movements on the court.

In sports where the ball is played with the hand, the player needs to achieve optimum coordination to generate maximum speed in the throwing performance of the upper arm, and when performing the throw, the player must use all body parts from ankle to wrist when ready to throw. The ball throwing process starts with the movement of the legs and ends with the rapid movement of the torso and arms together and the ball leaving the throwing hand (25). When the relationship between ball throwing and hand grip strength as the throwing performance of the upper arm was examined, a significant positive correlation was found between ball throwing and hand grip strength (right/left) ($r=0.534$, $p<0.05$; $r=0.570$, $p<0.05$, respectively). Similar to our study, a high positive correlation was found between ball throwing and hand grip strength (right/left) ($r = .906$, $p<0.01$; $r= .874$, $p<0.01$, respectively) in handball players.

Finally, when sprint and agility performance were evaluated as the characteristics affecting performance in basketball, no significant relationship was found between sprint and jump performances ($r=-.268$, $p>0.05$). Studies investigating the relationship between sprint and lower extremity muscle strength performance have different limitations and have so far reported only weak or no relationship (1,29). Body size is very important for basketball players, especially for centers, and may be one of the reasons for the lack of a relationship between strength and single sprint performance. In the present study, height ($r=-.562$) and body weight ($r=-.417$) were negatively correlated with 20 m sprint performance.In contrast to this study, Taşkın et al. (32) found a significant positive correlation ($p<0.05$) between age and height of soccer players and 20 m sprint performance ($r=0.287$; $r=0.430$, respectively). Rios et al. (2023) found direct relationships between height, arm span, jumping performance and body mass index of 9-10 years old Portuguese female handball players (48).

Hoffman et al. (17) stated that "differences in power produced by simultaneous or sequential movement of the legs, or by active or passive upper body musculature, can have a profound effect on power expression". The relationship between linear sprint and agility performance has been examined by few studies (23,26,33).

Therefore, our discussion is limited. "Since sprint requires the development of muscle strength along with the development of the nervous system, it may not make a great progress until adolescence (9). Furthermore, the main energy sources used during sprint performance are ATP and PC. In children and young people, the capacity of these energy sources is generally lower than in adults. Another reason for this low capacity is the limited muscle strength of young people. Over time, as muscle strength increases with age, sprint performance usually improves." However, longitudinal and more comprehensive studies are needed.

Differences in these studies may be due to limitations such as sample size, number of trials performed, testing participants at only one level, time of year when data was collected, and age group. The fact that this age group is the period when muscle fibril types are just becoming apparent and the development of acceleration is not yet complete may also be the reason for the differences in the study.

CONCULUSION

As a result, no correlation was found between selected physical and motor characteristics such as age, height, body weight, flexibility, jumping, hand grip, ball throwing, agility, 20-meter sprint, balance, and arm length, with the dribble-shooting performance of 9-10 years-old female basketball players.

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