The Journal of Eurasia Sport Sciences & Medicine

ISSN: 2687-265X

J Eurasia Sports Sci Med
http://dergipark.gov.tr/jessm

Volume 2, Issue 1
April 2020, 10-16

ORIGINAL RESEARCH

A Comparison of Physical Structure and Motoric Characteristics in Basketball by Age Categories

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Received: 16.06.2020

Accepted: 26.06.2020

Abstract

The purpose of this study is comparing physical and motoric characteristics in youth basketball players according to age categories. The study included 80 male basketball players belonging to three different categories (n_{junior}: 13, n_{youth}: 36, n_{little}: 31) as volunteers. Before the research, parents' consent documents were obtained from the parents of the players. In the study, body height, body weight, 20m sprint, Illinois agility test and horizontal and vertical jump tests were applied. One-way analysis of variance was used to determine the differences between categories. Measurement values that provide variance homogeneity were evaluated by Tukey statistics ($p<0.05$). A significant difference was found between the little team and other teams in all parameters ($p<0.05$). In this study, sprint, agility and jumping performance, and physical characteristics were significantly different between groups in the junior, youth and little categories. These data provide basketball coaches with information about the physical and motoric characteristics of the specified categories.

Keyword: basketball, speed, agility, jumping, age categories.

To cite this article; Cengizel, Ç.Ö., Öz, E., & Cengizel, E. (2020). A comparison of physical structure and motoric characteristics in basketball by age categories. J Eurasia Sports Sci Med, 2(1), 10-16.

This article was orally presented in International Sports and Wellness for All Congress.

INTRODUCTION

In recent years, the monitoring of sports performance, especially the monitoring and evaluation of physical and motoric development of youth athletes have become increasingly more important. Coaches monitor their athletes' performance in objective ways, rather than subjective ways, through performance tests and a number of physical measurements. While providing this, coaches need quantitative data on the development of different age categories.

Basketball is a sport that requires all of the basic motoric characteristics such as strength, speed, endurance, mobility and coordination all together (Canlı, 2017) and involves high-intensity activities such as jumping (rebounds, blocks, and shots), rolls, dribbling, sprinting, and screen (Delextrat & Cohen, 2009). It is a competitive team sport that has its own technical and tactical foundations and is played by considering the limits of the players' time, place and participation (Ferreira & De Rose, 2003).

Performance in basketball not only depends on technical, tactical and psychological characteristics, but also on anthropometry (Bayios, Bergeles, Apostolidis, Noutsos, & Koskolou, 2006) and physical fitness (jumping strength, agility with and without ball, etc.) (Erčulj, Blas, Čoh, & Bračič, 2009; Ziv & Lidor, 2009). Moreover, longer height and body size make important contributions to high performance in basketball (Ziv & Lidor, 2009, 2010). Especially in youth basketball players, being tall offers more advantages against the opponents. Therefore, it would not be wrong to state that somatic characteristics are an important and reliable indicator of basketball players' performance (Drinkwater, Pyne, & Mckenna, 2008).

Motor skills play an important role in the selection of young basketball players and their progress in game performances (Erčulj, Dežman, & Vučković, 2003). Although it is accepted that motoric characteristics are at the forefront of basketball, it is not correct to connect success to a single criterion (Savaş, Yüksel, & Uzun, 2018). Ball games are a comprehensive whole that includes physical, technical, mental and tactical characteristics (Tsunawake et al., 2003).

Competitions within the scope of basketball activities are separated by age categories defined by the Turkish Basketball Federation. 12 to 18 years of age is the transition period between childhood and adulthood (Dolezajova, Gallova, & Lednicky, 2019). The physical structure of a child develops depending on his/her age. With age, the size of the body grows, the functions of the internal systems develop, and the maturation process of the organism progresses (Witkowski, Piepiora, Migasiewicz, Maśliński, & Salachna, 2018). During development around this time, there is a rapid improvement in physical performance, with sudden increases in size and weight, mainly due to hormones and maturation (Torres-Unda et al., 2016). Performance is improved during adolescence and youth with appropriate training and is raised to higher levels in adulthood (Tsunawake et al., 2003). In order to reach high performance, it is important to monitor the physical and motoric characteristics of the athletes in the age categories and to determine the differences. The purpose of this study is, therefore comparing physical and motoric characteristics in youth basketball players according to age categories.

METHOD

Subjects

The study included 80 male basketball players belonging to three different categories (n_{junior}: 13, n_{youth}: 36, n_{little}: 31) as volunteers. The age groups were determined as Under 14 Little, Under 16 Youth, and Under 18 Junior categories as indicated by the Turkish Basketball Federation's Basketball Domestic Leagues instructions (TBF, 2019). Before the research, parents' consent documents were obtained from the parents of the players. Before the study started, the subjects were informed about the purpose of the study, the tests to be applied, and possible risks. Athletes who have had injury and/or surgery in the last six months, do not regularly continue training in team groups, belong to a the minor age group, and did not complete all tests or voluntarily dropped them were not included in the research. All measurements were made in Ankara Çankaya High School's rubber floor basketball court accompanied by three supervisor coaches.

Research Design

In the study, body height, body weight, 20m sprint, Illinois agility test and horizontal and vertical jump tests were applied. Measurements were conducted on two different days. On the first day, physical characteristics of the subjects, age and years of experience, vertical jump and 20 m sprint tests were completed. On the second day of measurement, horizontal jump and agility test were applied. A rest day was given between the measurement days and a full rest between the tests. A standard 25-minute general and special warm-up protocol was applied before the tests were performed. During the measurements, athletes were encouraged verbally. Subjects who could not apply the test protocol correctly were given another chance to try after full rest.

Vertical jump test: To perform the test, a 200 cm long, 60 cm wide white plate was mounted on the wall with a height of 155 cm from the floor. The participant was first asked to touch the highest point he could reach out by extending his arm while standing and then touch the highest point he could reach by jumping. The distance between the height that the participant could reach while standing and the point he could touch by jumping was measured in cm. This score was determined as the vertical jump value of the subjects. This test was repeated three times with rest intervals and the best result was recorded as score (Kamar, 2008).

Horizontal jump test: The participant's toes were behind the starting line and the subject was allowed to bend his knees, arms, waist. With the command heard, the subject, pulling the arms backwards, tried to jump as far as possible from the starting line. The distance between the start line and the participant's closest heel to this line was recorded as the score of the participant. The participant had two trials and the one with the best result was recorded as the subject's horizontal jump score (Kamar, 2008).

20 m sprint test: Speed performance was determined by Newtest Powertimer 2000 photocell. A 20 m sprint distance was determined in the basketball court. Subjects performed warm-up and stretching exercises before the test started. The test was repeated twice and the best value was recorded in the form of measurement in seconds. Full rest was given between repetitions.

***Illinois agility test*:** Agility performance was determined by Newtest Powertimer 2000 photocell. An Illinois agility test parkour (5 m wide, 10 m long and consisting of three cones

lined up on a straight line at 3.3 m intervals in the middle section) was set up in the basketball court. Subjects left the starting line of the test parkour, lying face down and hands on the floor at shoulder level. The test was run once. When there were faulty applications, the test was terminated and the subject was asked to re-perform after complete rest. Time to finish the parkour was recorded in seconds.

Data Analysis

Analysis of data obtained as a result of measurements was realised with Sigma Plot 11.0 (Systat Software, Inc) software. All data are presented as average±standard deviation One-way analysis of variance was used to determine the differences between categories. Measurement values that provide variance homogeneity were evaluated by Tukey statistics ($p < 0.05$).

FINDINGS

In our study, there are 80 male basketball players from three different age categories. Junior and youth team's body height and body weight were found to be significantly higher than little team basketball players (Junior team 183.2 ± 5.6 cm & 80.0 ± 9.5 kg, youth team 179.6 ± 7.7 cm & 72, 9 ± 10.6 kg, little team 167.3 ± 9.4 cm & 58.3 ± 12.4 kg). It was determined that there was an increase in size and weight with increasing age (Table 1).

Table 1. Characteristics of the Subjects

	Junior [(a)] (n=13)	**Youth[(b)] (n=36)**	**Little [(c)] (n=31)**
Age (year)	16.2 ± 0.4	14.5 ± 0.5	12.6 ± 0.5
Training Age (years)	6.1 ± 1.9	6.8 ± 2.0	6.7 ± 1.9
Height (cm)	183.2 ± 5.6[c]	179.6 ± 7.7[c]	167.3 ± 9.4[a, b]
Body weight (kg)	80.0 ± 9.5[c]	72.9 ± 10.6[c]	58.3 ± 12.4[a, b]

[a]: Significant difference with the junior team, [b]: Significant difference with the youth team, [c]: Significant difference with the little team, $p<0.05$

Comparing some motoric characteristics of the subjects by age categories (Table 2), there was a significant difference between the little team and other teams in all parameters ($p < 0.05$). With the increase in age, the jump performance of the subjects increased and an improvement in agility and speed performance was also determined.

Table 2. Some Motoric Characteristics of Subjects in Different Age Categories

	Junior [(a)] (n=13)	**Youth[(b)] (n=36)**	**Little [(c)] (n=31)**
Vertical jump (cm)	49.0 ± 5.9[c]	46.4 ± 6.6[c]	36.9 ± 8.6 [a, b]
Horizontal jump (cm)	211.5 ± 17.3[c]	197.1 ± 24.1[c]	182.8 ± 26.2 [a, b]
20 m sprint (sec)	3.39 ± 0.17[c]	3.37 ± 0.19[c]	3.67 ± 0.28 [a, b]
Agility (sec)	16.85 ± 0.81[c]	17.16 ± 0.56	17.81 ± 1.07 [a]

[a]: Significant difference with the junior team, [b]: Significant difference with the youth team, [c]: Significant difference with the little team, $p<0.05$

DISCUSSION and CONCLUSION

In this study, the physical and some motoric characteristics of male basketball players playing in three different categories (junior, youth and little) were compared. It has been determined that with increasing age, physical properties increase and jump, speed and agility performances rise. The increase in physical and motor performance in junior and youth team athletes was found to be statistically significant when compared with little team athletes.

Preparing athletes for competitions involves the development of physical, technical, tactical and psychological characteristics (Ziv & Lidor, 2009). It is not known which of these characteristics has the greatest impact on match performance. It is also unclear whether the results of the physical fitness tests can predict successful performance throughout the season. This does not make it less important to keep track of physical and motoric characteristics. In a study conducted to determine the relationship between seasonal basketball performance and motoric characteristics of athletes by Fort-Vanmeerhaeghe ve et al. (2016) a significant relation was determined between steal and assist performance of youth and junior basketball players and speed, agility, and jumping. In the same study, the researchers compared the physical and motoric characteristics of the youth and junior teams. They did not find any significant differences in body height and body weight, speed, agility and jump performances of the youth and junior team athletes. This finding coincides with our study.

Gencer & Asma (2017) determined the vertical jump of the average 11-year-old basketball players as 35.33 ± 4.84 cm. Savucu ve et al.(2004), in their study to which a total of 98 basketball players from the little, youth and junior categories participated, found 20 m speed performances as 3.15 ± 0.21 sec, 2.88 ± 0.11 sec, 2.75 ± 0.11 sec, respectively. Vertical jump data were determined as 36.75 ± 3.82 cm, 45.55 ± 4.03 cm, 50.83 ± 5.26 cm, respectively. With age, a decrease of 20 m sprint and an increase in vertical jump performance were observed. These findings confirm the increasing acceleration of motoric performance in the age groups of our study.

Speed and agility significantly affect efficiency and performance in basketball and players who are not fast enough cannot succeed in modern high-level basketball (Jakovljević, Karalejić, Ivanović, Štrumbelj, & Erčulj, 2017). Players with well-developed speed and agility can execute elements of modern basketball technique and tactics more efficiently (Harley, Doust, & Mills, 2008). In our study, we determined that speed and agility, which are frequently used as a necessity of basketball, develop with age and differ statistically significantly from the youth team onwards. Çetinkaya (2019), comparing the motoric features according to age categories, found significant results between minors and littles in vertical jump test in male athletes and between littles and youths in speed test ($p < .05$), whereas no significant results were found between youths and the juniors in the applied tests ($p > .05$).

Bilim, Çetinkaya, & Dayı (2016) found that girls and boys between the ages of 12-17 doing sports have their physical fitness status and body composition values significantly better than their non-sports peers. In the data presented in this study, the parameters of boys of the same age group who do sports and do not do sports were found to be lower than the parameters of the boys in our study who play basketball. This is thought to show how basketball differs in terms of physical and motoric features.

In this study, sprint, agility and jumping performance, and physical characteristics were significantly different between groups in the junior, youth and little categories. These data provide basketball coaches with information about the physical and motoric characteristics of the specified categories. Our study reveals how some of the motoric characteristics of youth basketball players proceed in a quantitative value from the little team to the junior. It is thought that these data will provide a point of reference for basketball coaches together with other data found in the literature. In addition, the study provides information about the physical and motoric characteristics of youth athletes.

Acknowledgements

This research was presented as an oral presentation at the International Sports and Wellness for All Congress held in 2018.

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