Mario Jelicic[1,2], Šime Veršić[1] and Mario Mandir[2]

AGE RELATED DIFFERENCES IN ELITE YOUTH BASKETBALL PLAYERS IN SOME MORPHOLOGICAL CHARACTERISTICS AND MOTORIC ABILITIES

[1]*Faculty of Kinesiology, University of Split, Croatia, Split*
[2]*KK Zadar, Zadar*

Original research:

Abstract: Basketball requires a high level of athletic ability and optimal anthropometric dimensions crucial for achieving highly competitive efficiency. Studies have shown that in the selection process, great emphasis is placed on these dimensions of the anthropological status of basketball players. The main goal of this study was to determine the differences between basketball players of two age categories, more precisely juniors and cadets, in morphological characteristics and motor abilities. The sample of participants consisted of a total of 26 elite basketball players divided into two age categories, juniors (average 18 years old, N = 10) and cadets (average 16 years old, N = 16). The sample of variables consisted of morphological characteristics - body height, body weight, arm span, shoe size, and standing vertical reach with one and two arms, while motor abilities tests included measures of repetitive strength (push-ups, sit-ups), agility (20 yards, line agility), explosiveness (Sargent, chest ball throwing) and speed (sprint 5 meters, sprint 20 meters, sprint ¾ terrain). All data were descriptively analysed, and for the analysis of differences between the two age categories student's T-test was used. The analysis of differences showed statistically significant age differences in morphological variables in body weight ($t = 2.98$, $p = 0.01$), shoe size ($t = 2.11$, $p = 0.04$), reach with one hand ($t = 2.1$, $p = 0.05$) and two hands ($t = 2.32$, $p = 0.03$). In motor abilities, differences were observed only in tests for explosiveness, in the Sargent test ($t = 2.16$, $p = 0.04$) and in throwing the ball from the chest ($t = 2.42$, $p = 0.02$). The results of this study showed that junior and cadet basketball players differ primarily in morphological dimensions and explosive power. It is obvious that young basketball players of cadet age are still in the phase of growth and development, and that coaches at that age should expect an increase in terms of longitudinal dimensionality and, concomitantly, body weight. Also, the differences found in the explosiveness of both the lower and upper extremities are probably due to the morphological dimensions but also to the systematic explosiveness training that begins in later puberty. Basketball coaches and staff should take this knowledge into account when selecting and programming training for individual age categories.

Keywords: basketball, juniors, cadets, morphological characteristics, motor abilities

Introduction

Basketball is team sport game that requires a high level of athletic ability and optimal anthropometric dimensions, crucial for achieving highly competitive efficiency. From the aspect of kinesiological analysis, basketball is a polystructural, interval activity in which high-intensity actions and phases of rest are changing (Cui et al., 2019). These intensive actions include movements in all directions, jumps and ball handling which requires high level of technical and tactical skills and also physical abilities (Abdelkrim, Chaouachi, Chamari, Chtara, & Castagna, 2010; Sampaio, Janeira, Ibáñez, & Lorenzo, 2006; Teramoto, Cross, Rieger, Maak, & Willick, 2018).

Studies have shown that in the selection process, great emphasis is placed on these dimensions of the anthropological status of basketball players (Apostolidis & Emmanouil, 2015; Cui et al., 2019; Ostojic, Mazic, & Dikic, 2006). For example, while aerobic endurance is not significant for evaluating basketball players performance, multiple studies have proved the importance of anaerobic endurance, strength features of both, lower and upper body, and speed and power abilities (Cui et al., 2019; Köklü, Alemdaroğlu, Koçak, Erol, & Fındıkoğlu, 2011; Ostojic et al., 2006). Also, very often as a predictive factor for success in basketball, certain morphological dimensions are shown, primarily the longitudinality of the skeleton reflected through body height and limb length (Alejandro, Santiago, Gerardo, Carlos, & Vicente, 2015; Dežman, Trninić, & Dizdar, 2001).

Study that included 1051 young basketball players from Lithuania, showed that the best periods to develop dribbling and shooting skills were between 7–10 and 12–13 years, whereas defensive movements can be trained in later adolescent years (Matulaitis, Skarbalius, Abrantes, Gonçalves, & Sampaio, 2019). Study done on under-14 players showed that body height, fat-free mass and higher amount of strength, power and agility were discriminants between youth players of different qualitative level (Guimarães et al., 2019). Similar results were found in the youth female basketball with more successful players having better results in agility tests and longer arm span and body height (Garcia-Gil et al., 2018). During maturation process and puberty, youth players are experiencing hormonal and morphological changes which should be taken in to consideration during selection process and also while planning and programming training regimes (Rodríguez-Rosell, Franco-Márquez, Mora-Custodio, & González-Badillo, 2017). The study on elite young U-14, U-15 and U-16 basketball players showed that older players overperformed younger in most of the jumping and sprinting tests (Gonzalo-Skok, Serna, Rhea, & Marín, 2017).

It is very important to clearly identify which morphological characteristic to measure and which aspects of motoric abilities to train in certain age category to generate optimal development for the youth basketball players. Therefore, the main goal of this study was to determine the differences between basketball players of two age categories, more precisely juniors and cadets, in morphological characteristics and motor abilities.

Methods

Participants and Design

The sample of participants consisted of a total of 26 elite basketball players divided into two age categories, juniors (average 18 years old, N = 10) and cadets (average 16 years old, N = 16). The testing was done in September 2021, during preseason camp. All measurements were done during morning sessions, and the inclusion criterion was that players were participating at least last 14 days in the basketball team training, without any illness and/or locomotor injuries. Testing for each age category was organized during one training and specific warm up protocol preceded the measurements. The protocol consisted of 5 min jogging, 5 minutes of dynamic stretching and 10 minutes of specific athletic and basketball exercises.

Procedures

The sample of variables consisted of morphological characteristics - body height, body weight, arm span, shoe size, and standing vertical reach with one and two arms, while motor abilities tests included measures of repetitive strength (push-ups, sit-ups, pull-ups), agility (20 yards, line agility), explosiveness (Sargent, chest ball throwing) and speed (sprint 5 meters, sprint 20 meters, sprint ¾ terrain).

Morphology measures were assessed with scale, anthropometer and centimeter tape. Tests for repetitive strength were performed in 1-minute cycle (push-ups and sit-ups) or until exhaustion (pull-ups) with number of correct repetitions taken as the final result. For explosive power, participants conduct Sargent test and maximal ball throw from the chest while sitting in the chair and without moving from the chair back.

For agility assessments, Powertimer system (New test, Finland) was used. 20 yards test was performed on the 10-yard part of the court and participants had to run in maximal speed in left and right direction for 20 yards in total, starting from lateral stance in the middle position. Line agility test was performed around the paint with combination of running forward, lateral and backwards, all around cones placed at the corners of the paint. Powertimer system was used also to measure speed features that included sprinting on 5 and 10 meters and ¾ of the basketball pitch (app. 22.86 meters). All test of motoric abilities, except repetitive strength, were performed three times and the best results was taken as the final.

Statistics

All data were descriptively analysed with arithmetic means and standard deviations showed in tables, while for the analysis of differences between the two age categories student's T-test was used. Statistica 13.0 (Dell, Tulsa, OK, USA) was used for all calculations.

Results

The results of t-test showed statistically significant age differences in morphological variables in body weight ($t = 2.98$, $p = 0.01$), shoe size ($t = 2.11$, $p = 0.04$), reach with one hand ($t = 2.1$, $p = 0.05$) and two hands ($t = 2.32$, $p = 0.03$). In motor abilities, differences were observed only in tests for explosiveness, in the Sargent test ($t = 2.16$, $p = 0.04$) and in throwing the ball from the chest ($t = 2.42$, $p = 0.02$). All results are presented in Table 1.

Table 1. Descriptive statistics and T-test

	Juniors		Cadets		
Variables	AS	SD	AS		T (p)
BH	197.05	7.68	190.31	9.29	1.92 (0.07)
BW	88.36	10.46	75.90	10.31	2.98 (0.01)*
AS	199.85	8.64	193.41	8.35	1.89 (0.07)
SN	48.85	1.86	47.28	1.83	2.11 (0.05)*
REACH2	256.80	10.60	245.50	12.46	2.33 (0.03)*
REACH1	259.60	11.19	249.21	12.37	2.11 (0.05)*
SARG	313.60	14.31	294.79	24.63	2.16 (0.04)*
PP	13.54	1.07	12.24	1.43	2.42 (0.02)*
PUSH	35.70	14.59	36.64	13.15	-0.17 (0.87)
SU	47.56	5.17	44.86	14.60	0.53 (0.60)
PULL	2.30	2.67	2.00	2.15	0.31 (0.76)
20Y	4.39	0.12	4.47	0.14	-1.36 (0.19)
LA	11.48	0.42	11.58	0.35	-0.63 (0.54)
S5	0.94	0.05	0.91	0.09	0.99 (0.33)
S20	2.94	0.17	2.98	0.12	-0.69 (0.50)
S3/4	3.29	0.09	3.33	0.13	-0.71 (0.49)

Legend: BH – body height, BW – body weight, AS – arm span, SN – shoe number, REACH2 – standing reach with two arms, REACH1 – standing reach with one arm, SARG – sargent test, PP – push pass, PUSH – push ups, SU – sit ups, PULL – pullups, 20Y – 20 yards, LA – lane agility, S5 – sprint 5 meters, S10 – sprint 10 meters, S3/4 – Sprint ¾ of the court

Discussion

The results of this study showed several important findings. In general, junior and cadet basketball players differ in morphological dimensions and explosive power.

Observed results in morphology are logical and expected consequence of player's maturation process. Although there is not statistically significant difference in body height, junior players are approximately 7 cm taller. Difference is significant in all other morphological variables – body weight, standing reach with one and both arms, arm span and foot length, presented through shoe number. It is obvious that young basketball players of cadet age are still in the phase of growth and development, and that coaches at that age should expect an increase in terms of longitudinal dimensionality and, concomitantly, body weight. These results are in accordance with previous ones from similar studies (Matulaitis et al., 2019; NORTON & OLDS; Ostojic et al., 2006). Although studies reported peak height velocity in younger ages (12 and 15 years old), players in the here observed age period (between 16 and 18 years old) are also going through anthropometry changes (Matulaitis et al., 2019). Comparable situation is with body weight where maximum growth in weight is reported at about 13–15 years (Malina, Bouchard, & Bar-Or, 2004). Similar findings occurred in the study on the sample on youth rugby players aged 13-20 where authors reported annual growth rate of body height and mass up to early 20's and explained it with growth and maturation processes (Till, Scantlebury, & Jones, 2017).

Results also indicate significant differences in the power (explosiveness) of both the lower (sargent test) and upper extremities (maximal push pass). These results are probably due to the already mentioned morphological differences between observed age categories, but also due to the systematic explosiveness training that begins in later puberty. Higher amount of body mass, i.e. muscle mass in junior level players is probably influencing performance in the power tests. Although we measured vertical jumping, results of the study on young athletes performing broad jump (i.e. horizontal jumps) showed that the result in test improves linearly throughout the development process of boys until the age of 18 (Malina, Eisenmann, Cumming, Ribeiro, & Aroso, 2004). During growth and maturation process, there is qualitative and quantitative improvement in muscular and nervous system (e.g. higher muscle mass, better inter and intra muscle coordination, neural adaptation) which results in better performance in manifestation of power (explosiveness).

Study on 379 basketball players ranging from 13 to 30 years, showed increasing tendency in the height of the jumps in relation to chronological age (Kellis, Tsitskaris, Nikopoulou, & Mousikou, 1999). In the study that analysed differences between U-16 and U-14 young basketball players authors hypothesized that these differences are present more in these ages rather than between U-16 and U-18 categories as peak height velocity is achieved and the adolescents are in a post-pubertal stage (approximately at 15-16 years) (Gonzalo-Skok et al., 2017).

Although other studies also reported that the relative influence of growth and maturation is less with increasing age in later adolescence (in players 17 to 19 years old) (te Wierike et al., 2014) there is clear still age difference in this parameters. Performance in most motoric abilities, including lower and upper body power, develops during male adolescence and can largely be explained with the adolescent spurt in lean tissue and continued growth in muscle mass into later adolescence (Malina, Bouchard, et al., 2004; te Wierike et al., 2014).

Conclusion

These findings suggest that although most of athletes at age 16 passed their peak height velocity, they still going through maturation process. In many sports, and basketball in specific, maturation process has crucial influence in process of selection of talented players

and coaches should be careful when selecting players only based on anthropometric attributes, as they may simply be related to an advanced maturity status.

Elite sample of participants is one of the strengths of the study, however in future investigations, more variables should be taken into consideration, including reactive agility, endurance capacities and strength features. Also, same or similar measurements should be conducted on other age categories to get model values in most important morphology and motoric parameters and to have more insight in growth and maturation process in young basketball players.

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Corresponding author:
Šime Veršić
Kineziološki fakultet, Sveučilište u Splitu
Teslina 5, 21000 Split Croatia
e-mail: simeversic@gmail.com

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