Analysis of Body Mass Components in Young Basketball Players

Lj. Efremovska[1], S. Nikolic[1], V. Maleska-Ivanovska[1], J. Pluncevic-Gligorovska[1],
L. Todorovska[1], I. Karagjozova [1], E. Ivanovska[2]
[1] Department of Physiology, Medical Faculty, Skopje, R. Macedonia;
[2] PZU Promedica, Medical Prima, Skopje, R. Macedonia

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Abstract

Introduction: The aims of the study were to present the body composition of young male basketball players and to show the differences in respected age groups.

Material and methods: This study included a total of 96 male basketball players, divided into four groups according to age: group under 12 (10.0±1.14), under 14 (12.8±0.82), group under 16 (14.67±054) and group under 18 years old (16.7±0.54). In different age groups some body mass components were monitored using the Mateigka's methods.

Results: The estimation of three body mass components – the muscular component (MM %), the bone component (BC %) and the body fat (BF %) showed that in the first group body mass of young athletes had an average value of MM=50.29±4.56 %; BM =19.94±2.21% and BF=16.90±2.88%. The second group had MM=51.32±2.99%; BM =19.90±1.92% and FM=15.89±3.26%. The third group had average values of MM=52.08±3.67%; BM =18.28±1.53% and FM=15.43±2.5%. The fourth group showed the following mean values for body mass components: MC=53.7±3.16%; BC =18.33±1.88% and FM=15.24±1.64%. We observed significant differences in body composition parameters of young basketball players.

Conclusion: Comparison between age groups showed that FM% was lower in group aged under 18 vs. group under 14 and 16, and under 12 years. The obtained data could be used as standard values for Macedonian young basketball players and other athletes.

Key words: body components, basketball players, anthropometry

Introduction

The study of athlete's anthropometric and/or morphological characteristics contributes significantly to understanding the overall concept of performance in most sports. Basketball is a team sport involving several types of players who differ in terms of body height and other morphological dimensions which have both strong indirect and direct influences on athletes' performance (1). It is a sport requiring great body height and other longitudinal dimensions. These dimensions therefore largely differentiate basketball players from non-athletes and also from athletes in most other sports. This sport has a remarkable level of popularity all over the world with both men and women. The game is physically demanding, requiring players to participate in repeated bouts of intense actions (e.g., sprinting, shuffling, and jumping) separated by short bouts of low-intensity activity (e.g., walking, jogging) and recovery (2,3).

Detailed information about anthropometric characteristics of athletes is certainly important in modern sports and they have long been studied by sports scientists. It is a well-known fact that most of the anthropometric characteristics are almost exclusively genetically determined (4). In the international scientific literature many studies address the physical characteristics of men and women playing basketball of different competitive levels (5,6,7).

All ball games require comprehensive abilities including physical, technical, mental and tactical abilities. Among them, physical abilities of the players are more important as these have marked effects on the skill of players and the tactics of the teams because ball games require repeated maximum exertion such as dashing and jumping. Such physical abilities are important for basketball players to achieve higher levels of performance (8).

To evaluate these physical abilities, the anthropometric measurements, parameters of the body composition such as the percent body fat (% FAT), fat-free mass (FFM) and somatotype components are often used. Studies on the physical characteristics of the human body to-date indicate that the morphological characteristics of athletes successful in a specific sport differ in somatic characteristics from the general population. Basketball players are typically taller than the players of other games (9). Basketball requires handling the ball above the head; therefore, having a greater height is an advantage in this sport. Various researchers suggested that different body size, shape and proportions are beneficial in different physical activities (10).
The purpose of the present study was to present the body composition, to compare the anthropometric and physiological characteristics and to show the differences in respected age groups of young basketball players of different age. A working hypothesis assumed the existence of physical and physiological differences related to age among basketball players. Information in this regard may be helpful to trainers for enhancing players' specific performance and talent selection.

Methods and subjects

A non-experimental, cross-sectional design was used in this research. The present study was conducted on 96 male basketball players from different basketball clubs in Skopje, divided into four groups according to age: group aged under 12 (10.0±1.14), under 14 (12.8±0.82), group under 16 (14.67±054) and group under 18 years (16.7±0.54). In different age groups some body mass components were monitored using the Mateigka's methods during the regular check-ups in the Laboratory of Sports Medicine at the Institute of Physiology, Medical Faculty, Skopje. Participants were familiarized with the testing procedures used in this study. The investigation was performed in accordance with the ethical standards of the Helsinki Declaration.
All measurements were made by a highly trained and an experienced technician. Height and body mass were measured using a stadiometer (SECA, Leicester, UK) and an electronic scale (HD-351, Tanita, Illinois, USA). Skin folds were measured using John Bull callipers. Circumferences were measured using sliding Vernier outside callipers (GPMc). We measured: four diameters (elbow, wrist, knee and ankle), five circumferences (upper arm, both relaxed and flexed, forearm, the calf and the thigh) and seven skin folds (biceps, triceps, forearm, thigh, calf, subscapular and supra-iliac). All anthropometric parameters were analyzed by a special software program that utilizes all Mateigka's formulas intended for calculations of all body components (11).

Statistical analysis

Statistical analysis was performed using the statistical software Statistics 7. The data were presented as mean ±SD. Data sets were checked for normality using the Shapiro-Wilks normality test and visual inspection. Association between body composition measures and age was examined by Pearson's correlation coefficient (r). One-way analysis of variance was employed to test differences between different age groups. The significance level was set at p=0.05.

Results

Table 1 shows the descriptive statistics for general parameters (age, height and weight) and body mass components (muscle, bone and fat components and body mass index) of basketball players in different groups.

Group	up to 12 (N=18)			up to14 (N=24)		
	mean±SD	min	max	mean±SD	min	max
Age	10.0±1.14	8	11	12.8±0.82	12	14
Height cm)	147.69±8.9	131.5	161.5	167.19±11.6	131.5	161.5
Weight (kg)	42.52±8.29	25	54.5	57.62±13.75	30	87.5
MM %	50.29±4.56	42.2	56.6	51.32±2.99	46.4	56.0
MM(kg)	26.93±4.95	21.17	39.41	26.65±5.95	18.84	41.18
BM %	19.94±2.21	16.04	23.94	19.90±1.92	15.32	23.17
BM (kg)	10.87±1.82	6.9	13.63	11.72±2.62	7.84	16.62
FM %	16.90±2.88	12.13	21.78	15.89±3.26	12.05	23.25
FM(kg)	9.20±2.03	5.68	12.3	8.75±2.68	5.31	14.33
BMI	19.32±2.35	14.46	23.56	20.21±3.11	14.34	27.01

Group	up to 16 (N=28)			up to 18 (N=27)		
	mean±SD	min	max	mean±SD	min	max
Age	14.67±054	14	16	16.7±0.54	16	18
Height cm)	179.09±10.0	161	197	184.4±10	167.5	208
Weight (kg)	69.0±10.52	50	93	75.2±11.1	58	108
MM %	52.08±3.67	46.1	59.49	53.7±3.16	42.4	58.8
MM(kg)	33.20±6.17	24.18	44.1	37.14±5.86	22.75	48.4
BM %	18.28±1.53	14.8	21.7	18.33±1.88	15.7	23.8
BM (kg)	11.56±1.72	8.28	14.62	12.46±1.99	7.84	15.59
FM %	15.43±2.5	12.58	23.07	15.24±1.64	12.83	18.5
FM(kg)	10.28±3.51	6.92	19.15	11.36±2.63	5.68	18.98
BMI	21.60±2.89	16.8	28.72	22.03±2.01	18.87	27.97

Table 1. *Physical characteristics and body mass components of basketball players in different groups*

In the present study body mass components (muscle, bone and fat components and body mass index) of basketball players in different groups were controlled by using ANOVA and post hoc Turkey HSD test and these results are shown in Table 2.

The absolute muscle mass (MM kg), which represents part of the body mass expressed in kg was substantially different between the age intervals of basketball players, for F= 7.0822 and p= 0.000. In the group aged under 12 years there was a significantly lower absolute muscle mass compared to the group aged under 16 (p= 0.002) and the group aged under 18 years (p= 0.0017). The analyses of the inter-class differences of the relative muscle mass (MM %) showed that there was also a significant difference between the basketball players in different age groups (F= 3.64, p= 0.015). Such substantial difference was observed between the group aged under 12 years and the group aged under 18 years (p= 0.013) and the group aged under 14 and the group aged under 18 years (p= 0.09).

The analyses of the inter-class differences of the relative bone mass (BM %) showed that there was a substantial difference between the age intervals for F= 5.942 and p= 0.000. The examined individuals from the group aged under 12 (p<0.02) and under 14 years (p< 0.01) showed a significantly higher relative bone mass vs. oldest groups aged under 16 and under 18 years. There was no significant difference of the absolute bone mass between the players from different age groups.

Basketball players showed significant difference of the absolute fat mass (FM) between the age intervals for F= 3.2512 and p= 0.02.

	F	p
MM %	3.6386	0.01
MM(kg)	7.0822	0.000
BM %	5.9426	0.000
BM (kg)	1.9497	0.12
FM %	1.6918	0.17
FM(kg)	3.2512	0.02
BMI	4.887	0.003

Table 2. *ANOVA and post hoc Turkey HSD test of body mass components of players in different groups. Effects are significant at p< 0.05.*

Table 3 shows the correlations between the body components and the age of the basketball players.

	Correlation	p
MM % vs. age	r= 0.3291	0.001
MM(kg) vs. age	r= 0.4635	0.000
BM % vs. age	r= - 0.3077	0.002
BM (kg) vs. age	r= 0.3027	0.010
FM % vs. age	r= - 0.2184	0.032
FM(kg) vs. age	r= 0.3073	0.009

Table 3. *Pearson coefficient between body mass components and age of players. Effects are significant at p< 0.05.*

With increasing of the age, there was a significant correlation between age and the examined body mass components: MM kg (r= 0.46 and p=0.000), MM% (r= 0.329 and p=0.001), BM kg (r= 0.3027 and p=0.010), BM% (-r= 0.3077 and p=0.002), FM kg (r= 0.3073 and p=0.009) and FM% (-r= 0.2184 and p=0.032).

Discussion

All high demanding sports impose permanent need of monitoring of all parameters that are important for every sport performance (12). Among a few factors (players abilities), which make influence on success in basketball, anthropometric characteristics are very important. Anthropometric characteristics of athletes determine the success in particular sport events in various ways. The knowledge of these characteristics is necessary to establish their importance for the competitive success. The research on the influence of these characteristics in sports and games is of particular complexity, because the success in the game depends, among other things, on how the individual characteristics of some players fit into the whole, thus creating a coherent team (13). In the present study the anthropometric characteristics of the basketball players have been evaluated in relation to their age. This study has indicated the existence of differences among the players of different age groups and illustrated the development of the trend towards an increase in height. It is important to underline which method has been applied when comparing the results obtained from body composition analyses and how the method itself corresponds with other available and known methodologies. The overall results show that our basketball players were taller and heavier as compared to the basketball players in the studies of Kamble (14), Drinwater (15) and Tsunawake (8), but they were considerably shorter and lighter when compared to Greek players (16), American (17) and Tunisian elite basketball players (18). Our results are similar with those of the Turkish players (4).

Morphological features and sport performances in players are thoroughly studied, but in spite of the fact that there is a positive correlation between them, this association still remains speculative. In order to present more evidence on the association of the physical performance and the body composition, much research has been done in deferent sports (19).

Our data regarding the body fat percentage of basketball players are approximately within the reference range of 6-15% (20, 21). Body fat in Bosnian basketball players was lower than in our basketball players (22). The basketball players were also reported to have lower body fat percentage and FM kg in England, Greece, USA and Tunisia as compared to our players (14, 16, 17, 18). On the other hand, our results are similar to the results of Tsunawake and Gaurav (8,10). This discrepancy in the proportional portion of the fat component might be due not to the fact that our players are fatter, but rather to the different method applied for its estimation. It might be hypothesized that an increase in body fat would have a negative impact on athletes' performance, but we have no such approval in our study (23).

Regarding the muscle body component, our basketball players from different age groups were homogeneous and had excellent amount of muscle mass, about 52 % (from 50.29% in group up to 12 to 53.7% in group up to 18 years old). The biggest absolute muscle mass, expressed in kg, was registered in the group up to 18 years old (37.14 kg).

Although the absolute bone mass statistically increases with age, the relative bone mass decreases. In our examined groups, the relative bone mass showed values from 19.94% in the youngest group (up to 12 years old) to 18.33% in the oldest one. This is in agreement with the reference values for relative body mass calculated by Matiegka's formula, which is characteristic for young individuals who have not finished with their growth (greater than 18%) (11). The bone mass percentage, which is a more representative indicator of the portion of bone mass in the whole body mass, was significantly higher in the youngest group than in the group aged up to 18 years. The higher bone mass in this group reflects their bigger capacity for growth, which is unfinished.

In the examined age span (10 -18 years), with increasing of the age, significant increase of all absolute body components (muscle, bone, fat) was registered. The biggest increase from the absolute value was measured in the muscle mass, followed by the bone component that could be considered as anthropometric indicators of active growing process. Regarding morphological characteristics in adolescence, it is sometimes difficult to separate the effects of biological growth from those of training (e.g. in muscle tissue percentage). Nevertheless, data on the profile and intensity of the morphological characteristics of different types of young basketball players from different countries of this age are clearly very important for both basketball theory and practice (1).

Conclusion

In summary, comparison between age groups showed that the biggest increase from the absolute value of body components was measured in the muscle mass, followed by the bone component that could be considered as anthropometric indicators of active growing process. Regarding the muscle body component, our basketball players from different age groups were homogeneous and had excellent amount of muscle mass, about 52 %. Comparison between age groups showed that FM% was lower in the group aged under 18 years vs. the group under 14 and 16, and under 12 years. Although the absolute bone mass statistically increases with age, in our examined groups the relative bone mass decreased from 19.94% in the youngest group (up to 12 years) to 18.33% in the oldest one, which is in agreement with the reference values for relative body mass in young individuals who have not finished with their growth.
The obtained data could be used to establish standard values for Macedonian young basketball players and other athletes, which can be useful for the design of better conditioning in young talented players. The results of our study also provide information to physicians about the importance of the physique and body composition variables, which should be considered during the selection process.

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