JOURNAL OF ATHLETIC PERFORMANCE AND NUTRITION

http://www.dergipark.ulakbim.gov.tr/japn

Original Article Journal of Athletic Performance and Nutrition

Volume: 1 Issue: 1 pp: 1-9 2014

General Anthropometric and Selected Motor Skills of Elite Young Male Basketball Players According to Position on the Court of Players

Emre EROL[1] , Gökmen ÖZEN[2], Hürmüz KOÇ[3]

[1] Gazi University, School of Physical Education and Sport, Ankara/Turkey.
[2] Inonu University, School of Physical Education and Sport, Malatya/Turkey.
[3] Erciyes University, School of Physical Education and Sport, Kayseri/Turkey.

Abstract

Physical attributes and physiological performance are important in determining success in basketball. Despite the significance of physical fitness features of young basketball players, they are poorly evaluated. Thus, in the present study, we compared the anthropometric, physiological and motor characteristics of elite young basketball players for three basic playing types of players and the relationship between these parameters. The research was done on the sample of 30 (10 centers, 10 forwards, 10 guards) elite young male basketball players, ranging in age from 13 to 14 from candidates for Turkish U15 national team squad. This study included anthropometric measurements and physical fitness tests. This study showed that a significant difference was found for body height, body weight, body mass index, arm length, leg length, hand length, upper body length, arm span, hand width, body fat free mass and anaerobic power at the $p<0.05$ level for the three groups.This study provided a brief screening for profiles and attributes of elite young male basketball players for three playing potions. The main finding of this research was that guards were significantly smaller and lighter than forwards and centers, but these differences were more than in previous researches.

***Keywords**:* Basketball, Physical fitness, Anthropometric Characteristics, Athletes.

Introduction

Basketball has gained worldwide popularity and famous players and spectators with its dynamic characteristics as a team sport, especially among youth (Hoffman & Maresh, 2000). It is a multifaceted and complex team game that combines cyclic and acyclic movement structures (Erčulj & Bračič, 2010). The movement structures consist of movements with the ball and without it. In this sport, players cover about 4500–5000m during a 40-min game with a variety of multidirectional movements such as short sprints, abrupt stops, fast changes in direction, acceleration, different vertical jumps (Crisafulli et al., 2002).

Physical attributes and physiological performance are important in determining success in basketball (Carvalho et al., 2011). Types of players are groups of players made up on the basis of their most similar attributes and abilities that enable them accomplishing one, two or even three roles in the game. There are three basic types of players in basketball: guards, forwards and centers, distinguished among themselves by certain abilities, attributes, knowledge and skills (Dežman et al., 2001). A good player can read the game fast, react in unexpected changes in game situation roles and move quickly to a new place what the new game situation role requires (Sevim 1997; Kiiskinen 2005). Therefore, basketball is characterized by highly developed motor skills such as coordination, speed and agility, endurance, reaction speed, as well as explosive power (Sevim 1997).

In the last few decades, basketball has developed significantly enough, thus the number of adolescents involved in the sport significantly increased. Because of the large number of adolescents involved in the sport, selection of the most skilled is necessary (Marić et al., 2013). Motor abilities play an important role in the selection of young basketball players and the progress in their playing performance. This is particularly true of those abilities that are mainly innate and difficult to develop through training alone to the high level of quality required by modern basketball. The physical and physiological characteristics as well as the on-court performances of basketball players have recently been reviewed (Dawood, 2014; Torres-Unda, et al., 2013; Silva, et al., 2013); all of these features are to some extent affected by the anthropometric characteristics of athletes (Popovic, et al., 2013; Marić, et al., 2013; Paulauskas, 2013).

It is important to predict with high degree of probability whether or not a young player will be able to achieve excellence in performance in basketball (Gangta and Singh, 2011). At international level, there has been increasing thrust on research to study and predict physical, physiological, and anthropometric performance factors in basketball. It is necessary, not only for proper selection of players, who are most promising for the game, but also to select most viable tools of training to help players achieve their optimal capacities. Despite the significance of physical fitness features of young basketball players, they are poorly evaluated. In the relevant literature, it seems that there is limited information available concerning the motor abilities and specific anthropometric characteristics of young basketball players (Torres-Unda., et al., 2013; Marić, 2013). Not enough research has concentrated on prediction of performance factors in the game of basketball. Thus, in the present study, we compared the anthropometric, physiological and motor characteristics of elite young basketball players for three basic playing types of players and the relationship between these parameters.

Methods

The research was done on the sample of 30 (10 centers, 10 forwards, 10 guards) elite young male basketball players, ranging in age from 13 to 14 from candidates for Turkish U15 national team squad. They were divided into 3 groups according to playing position: guards (position 1), forwards (positions 2 and 3), and centers (positions 4 and 5). The players were participating in national competitions, and all of them were at the end of the regular season. For all the participants, formal consent was given by their parents or guardian before the investigation. All the tests were performed under the supervision of the Ethics Committee of the Faculty of Sport and Physical Education, University of Erciyes.

Procedure

Anthropometric Measurements

Measurements were conducted on a sport laboratory premises by two field experts. All measurements were performed after an overnight fasting (12 h). The measurements included skinfold thicknesses, circumferences, length, widths and body fat percentages (legs, arms and trunk). The height of the basketball players was measured with a portable stadiometer accurate to within 0.1 cm (SECA, Germany), while electronic scales (Tanita BC 418MA, Japon) accurate to within 0.1 kg were used to measure their weight, body mass and body fat percentages (Lohman ve ark., 1988). The participants were told to take off their shoes and socks. Then tester has to input the subject's sex, age and height to the machine. Normal mode was chosen and 0.5 kg was deducted for the weight of their clothing. Participants stood on the foot pad on the machine with bare foot and eyes looking forward. The results were printed out after. A Lafayette anthropometer was used, by a single investigator, to obtain all skeletal dimensions, with measurements made to the nearest millimeter. Because between the right and left extremites length of the research group was no difference (p>.05), all length measurements were taken only on the right side. All measures were taken three times and a reliability analysis was performed. The reliability of tests was confirmed with a Cronbach's alpha coefficient > 0.8 for each anthropometric variable. Anthropometric variables consisted of seventeen variables: Body weight (BW), body height (BH), body mass index (BMI), body fat percentage (BF), body fat mass (BFM), body free fat mass (BFFM) arm span (AS), arm length (AL), leg length (LL), upper body length (UBL), hand length (HL), hand width (HW), biceps circumference (BC), calf circumference (CC), triceps-skinfold (TRSF), supraspinal-skinfold (SSF), calf-skinfold (CSF) and subscapular-skinfold (SSSF).

Testing protocols

After standard anthropometric tests, all players warmed up for 15 minutes, then the testing session began with the vertical jump followed by standing long jump and at the end 20 m sprint run test.

20 m sprint

Electronic photocells (Brower timing system, USA) were placed at the start and 20 m. The sprint test from a standing position required subjects to run as fast as possible for a total distance of 20 m and they stood with one foot at the starting line. Measurements were done with photocells placed on the starting and ending points of 20 meter running. The test was made twice with 3-minute rest intervals and the best result was used for the analysis in this study.

Standing long jump

The standing long jump assessed the explosive power of the lower limbs. The subjects stood on the jumping line and jumped as far as they could. Subjects were allowed the use of counter movement with the arms and legs. Measurements were recorded in meters from the line of takeoff to the back of the heel of the foot landing nearest the jumping line. Three jump trials are given with the best trial used (Markovic et al., 2004).

Vertical jump

The vertical jump test is measured by Vertec (Sports Imports Inc, Columbus, OH), the most common apparatus for measuring vertical jump. The tests were administered in random order for all subjects. The subjects then stands with both feet together and flat on the ground and the dominant arm near the device. Then take the standing height of the subject with one arm fully extended upward, then have the subject jump-up and touch the highest possible vane. The difference in distance between the standing reach height and the jump height is the score. Three jump trials are given with the best trial used. It was recorded in inches (in) to the closest 0.5 in, and then converts to centimetres to the closest 1cm. (Adams & Beam, 2008).

Anaerobic Power

One of the most popular power prediction equations used with the vertical jump is the Lewis formula: $(P = \sqrt{4{,}9}\ (\text{Body Mass(kg)})\ \sqrt{D})$ (Manning et al., 1988).

Statistical analysis

Data analysis was performed with the SPSS (SPSS Inc., Chicago, IL, USA) version 17 statistical package. Means (SD) were calculated for measured and calculated variables. Values are reported as means ± SD. Descriptive statistics were used for demographic variables such as age, weight, and BMI. The Shapiro–Wilk's *W* test was used to assess normal distribution of the variables. As variances show a normal distribution, differences between playing positions were analysed with one-way analysis of variance (ANOVA). Posthoc tests were calculated with Tukey test for multiple comparisons if significant differences were found in the ANOVA. A p level of 0.05 or less was considered significant for all analyses.

Table I. Descriptive and ANOVA analyses of players according to positions on the court.

Demographic and Anthropometric (Mean ± Standard Deviation)					
Variables	**Guards**	**Forwards**	**Centers**	**Total**	**ANOVA**
Age (years)	13.4 ± 0,5	13.6 ± 0,5	13.5 ± 0,5	13.5 ± 0.5	*p<0.05
BH (cm)	156,9 ± 4.8	168,8 ± 3.2	176,7 ± 3.7	167.5 ± 9.1	*p<0.05
BW (kg)	50,1 ± 5.8	59.14 ± 11.6	65.0 ± 6.7	58.1 ± 10.2	*p<0.05
BMI (kg/m2)	20.3 ± 2.1	20.6 ± 3.4	21.0 ± 2.6	20.6 ± 2.6	p>0.05
Skinfold					
TRSF (mm)	13.7 ± 4.0	11.7 ± 5.3	13.9 ± 5.0	13.11 ± 4.8	p>0.05
SSF (mm)	9.9 ± 5.4	11.3 ± 6.0	11.9 ± 3.8	11.05 ± 5.0	p>0.05
CSF (mm)	14.7 ± 4.1	13.4 ± 8.3	16.9 ± 6.0	14.98 ± 6.3	p>0.05
SSSF (mm)	8.5 ± 1.8	8.8 ± 3.2	11.1 ± 3.6	9.44 ± 3.1	p>0.05
Circumference					
BC (cm)	24.8 ± 1.5	26.1 ± 4.1	26.9 ± 2.5	25.91 ± 2.9	p>0.05
CC (cm)	32.6 ± 3.7	35.8 ± 3.1	36.4 ± 2.3	34.95 ± 3.4	*p<0.05
Lenght/Width/Span					
AL(cm)	67.3 ± 2.3	71.7 ± 1.6	78.1 ± 6.2	72.39 ± 5.9	*p<0.05
LL (cm)	91.1 ± 9.5	102 ± 2.4	105 ± 8.6	99.7 ± 11.5	*p<0.05
HL (cm)	18.6 ± 2.6	20.8 ± 0.8	21.6 ± 0.9	20.33 ± 2.0	*p<0.05
UBL (cm)	82.8 ± 2.6	87.8 ± 2.4	91.3 ± 2.8	87.32 ± 4.4	*p<0.05
AS (cm)	160.5 ± 5.7	173.9 ± 3.3	180.4 ± 5.7	171.6 ± 9.7	*p<0.05
HW (cm)	7.39 ± 0.4	7.94 ± 0.3	8.01 ± 0.2	7.78 ± 0.4	*p<0.05
Motor Tests					
Vertical Jump (cm)	32.3 ± 5.8	35.7 ± 6.6	32.6 ± 7.6	33.53 ± 6.7	p>0.05
Long Jump (cm)	153.4 ±34.3	153.8 ± 20.3	164.1 ±12.4	157.1± 23.4	p>0.05
20m sprint (s)	3.75 ± 0.2	3.77 ± 0.3	3.85 ± 0.2	3.79 ± 0.2	p>0.05
Anaerobic power (kgm/s)	62.5 ± 7.4	78.1 ± 18.5	81.6 ± 11.9	74.08 ± 5.4	*p<0.05
Tanita Measurements					
% BF	18.2 ± 3.1	18.8 ± 3.8	18.9 ± 4.6	18.64 ± 4.9	p>0.05
BFM (kg)	9.2 ± 2.6	11.1 ± 4.3	12.6 ± 4.4	10.97 ± 4.4	p>0.05
BFFM (kg)	40.9 ± 3.3	48.1 ± 3.7	52.4 ± 3.8	47.1 ± 6.7	*p<0.05

Results

The anthropometric and physical fitness profile of elite young male basketball players grouped by playing position are summarised in Table I and Table II Descriptive statistical analyses can be shown in Table I.

Table II. Results of Post Hoc Tukey Analyses

Variable	Position	F	Difference
BH (cm)	Guards Forwards Centers	61.15	1 < 2** 2 < 3** 1 < 3**
BW (kg)	Guards Forwards Centers	7.93	1 < 3*
CC (cm)	Guards Forwards Centers	4.31	1 < 3*
AL(cm)	Guards Forwards Centers	19.33	1 < 2* 2 < 3** 1 < 3**
LL (cm)	Guards Forwards Centers	6.03	1 < 2* 1 < 3**
HL (cm)	Guards Forwards Centers	8.86	1 < 2** 1 < 3**
UBL (cm)	Guards Forwards Centers	25.74	1 < 2** 2 < 3** 1 < 3**
AS (cm)	Guards Forwards Centers	39.73	1 < 2** 2 < 3** 1 < 3**
HW (cm)	Guards Forwards Centers	8.59	1 < 2** 1 < 3**
Anaerobic power (kgm/s)	Guards Forwards Centers	5.74	1 < 2* 1 < 3**
BFFM (kg)	Guards Forwards Centers	14.43	1 < 2** 1 < 3**

An analysis of Table I displays that basketball players groups in the research. As it showed in Table I, there were differences between players playing different positions, but statistically significant differences have only eleven variables. There was no significant difference in TRSF, SSF, CSF, SSSF, BC, BF, BFM, vertical and long jump among the groups, while a significant difference was found for BH, BW, BMI, AL, LL, HL, UBL, AS, HW, BFFM and anaerobic power at the $p<0.05$ level for the three groups. Age was not different within playing positions; therefore subsequent analyses were not corrected for age. For those parameters found significant difference by ANOVA, Post hoc Tukey test was carried out to detect the difference for each playing position. Results of post-hoc tests were shown in Table II. The Turkey Post Hoc test indicates that centers had significantly the highest BH, BW, CC, AL, LL, HL, UBL, AS, HW, BFFM and anaerobic power. In addition, the values of guards' BH, AL, LL, HL, UBL, AS, HW, BFFM and anaerobic power were significantly lower than forwards, while there was not any difference for BW and CC between guards and forwards. These analyses also shows that in the between forwards and centers would not revealed any significant difference for BW, CC, LL, HL, HW, BFFM and anaerobic power.

Discussion

It is very important to have certain anthropometric attributes to succeed in any sport discipline (Ziv and Lidor, 2009). Previous researches have indicated that physical fitness and anthropometric characteristics may determine the selection of athletes in many sports (Hasan et al., 2007). However, individual and training characteristics may be associated with physical fitness and anthropometric characteristics. Therefore, the aim of this study provided a brief screening for anthropometric profiles and attributes of elite young male basketball players for three playing positions. The results from this study demonstrated that physical fitness components and anthropometric measurements are generally better in centers compared to guards. Results of guards' 20m sprint were better than centers, but it were no statistically significant difference. Generally, some of these differences can be explained by the strategies and training method difference between the players and also the training environment, the results do have important influence in talent selection.

The main finding of this research was that guards were significantly smaller and lighter than forwards and centers, but these differences were more than in previous researches (Bavlı 2008; Ostojic et al., 2006; Vanderlei et al., 2013). Our findings supported by results of previous studies. In the research of Ostojic et al., (2006), it indicated that centers were taller and heavier than guards and forwards, whereas forwards had significantly higher height and weight than guards. In another research on physiological differences in professional basketball players, Sallet et al., (2005) noted that centers were significantly taller and heavier than forwards and guards. Moreover, in research of Bale (1991), the centers had the largest measures of physique and body composition followed by the forwards and then the guards. The centers were much taller, had longer limb lengths, hip widths and were more muscular. In this context, a lighter body mass reduces the force output in muscle that would be required to sustain position and maintain performance. This could result in a slower rate of fatigue in smaller players than centers. On the other hand, if guards wish to improve their playing performance, they should compensate for their height deficiency with a higher level of motor skills and technical knowledge. BH and longer extremities are a significant factor of playing performance in basketball (Karpowicz 2006), so it is highly possible that taller young basketball players have priority in the selection for basketball clubs and for the national team

As expected, the centers in this study had significantly highest AS, AL, LL, HL, UBL, CC followed by the forwards and then the guards. Possession of a long reach relative to height is thought to have a positive influence on basketball performance. Anthropometric evaluation of male basketball players of mean age 14 (Jakovljevic et al., 2012) yielded the following results: mean height 186.2 cm ± 9.40; mean weight 68.8 kg ±10.90. However, development and genetic differed considerably: the 13-14 years old group in the present study had a mean weight of 58.1 kg and a mean height of 167.5 cm ± 9.14. Regarding the physiological tests, in the research of Ostojic et al. (2006) pointed out that centers had more body fat as compared with forwards and guards. Many researches found out similar results in the BF, BFF and BFFM (Ziv and Lidor, 2009; Torres-Unda, et al., 2013), but in the present research found only significantly different in the BFFM. Another important difference between player groups was anaerobic power performance. Considering that the majority of energy in basketball performance is generated from anaerobic sources (Stauffer et al., 2010), the implementation of tests that assess anaerobic attributes of basketball players would be of great value. In this study fond out that guard had lower anaerobic power performance than fordwards and centers respectively. Because the estimation equation used to determine anaerobic power based on vertical jump height also used height and weight as variables, this results suggests that players taller and/or heavier would be estimated to a have higher anaerobic power output. The lack of a significant difference between elit adolescent basketball players for all skinfold, vertical and long jump, 20 m running, is supported by our earlier research (Koc et al., 2011; Korkmaz and Karahan. 2012). No other data are available to enable comparison with other basketball players of the same ages.

Conclusion

Adolescent elite basketball players' antropometric and physical characteristics were generally similar to other non-elite basketball players of the same ages. Finally, it is important to note that players assessment must not be based merely on the assessment of situation related antropometric characteristics and motoric abilities, but also on the whole set of an athlete's specific personality traits which enable performance cosistency and sport achievement. This study provided a brief screening for profiles and atribudes of elite young male basketball players for three playing potions. The conclusions of this study lead to a better understanding of physical profiles and antropometric characteristics of 13 and 14 years old basketball players. This also applies to improvements in the technical and tactical training of 13 and 14 years old basketball players in the specifying of these attributes.

References

Adams,G.M. & Beam,W. C. (2008). Exercise Physiology: Labortory Manual. (5th ed). New York: McGraw-Hill.

Apostolidis, N., Chatzicharistos, D., & Bolatoglou, T. (2013). Passing efficacy of young basketball players: test or observation? *International Journal of Performance Analysis in Sport*, *13*(2), 403-412.

Bale P. (1991). Anthropométrie body composition and performance variables of young elite female basketball players. *Journal of Sports Medicine and Physical Fitness, 31(2)*, 173-177.

Bavlı, Ö. (2008). Comparison the structural and biomotorical features of adolescent basketball players according to playing position. *Nigde University Journal of Physical Education And Sport Sciences*, *2*(3).

Carvalho, H. M., Coelho-e-Silva, M. J., Gonçalves, C. E., Philippaerts, R. M., Castagna, C., & Malina, R. M. (2011). Age-related variation of anaerobic power after controlling for size and maturation in adolescent basketball players.*Annals of Human Biology*, *38*(6), 721-727.

Crisafulli, A., Melis, F., Tocco, F., Laconi, P., Lai, C., & Concu, A. (2002). External mechanical work versus oxidative energy consumption ratio during a basketball field test. *Journal of sports medicine and physical fitness*, *42*(4), 409-417.

Dawood, M. (2014). Effect of specific exercises to develop of motor coordination for junior basketball players 13-15 year. *International Journal of Advanced Sport Sciences Research*, *1*(3).

Dežman, B., Trninić, S., & Dizdar, D. (2001). Expert model of decision-making system for efficient orientation of basketball players to positions and roles in the game Empirical verification. *Collegium antropologicum*, *25*(1), 141-152.

Erčulj, F., & Bračič, M. (2010). Differences between various types of elite young female basketball players in terms of their morphological characteristics. *Kinesiologia Slovenica*, *16*.

Gangta, K. S.,& Singh, T. N. (2011). A study of selected anthropometric physical and physiological parameters as predictors of performance in female volleyball Players.

Marić, K., Katić, R., & Jeličić, M. (2013). Relations between Basic and Specific Motor Abilities and Player Quality of Young Basketball Players. *Collegium Antropologicum*, *37*(2), 55-60.

Hasan, A. A. A., Rahaman, J. A., Cable, N. T., & Reilly, T. (2007). Anthropometric profile of elite male handball players in Asia. *Biology of sport*,*24*(1), 3.

Jakovljevic, S. T., Karalejic, M. S., Pajic, Z. B., Macura, M. M., & Erculj, F. F. (2012). Speed and agility of 12- and 14-year old elite male basketball players. *The Journal of Strength & Conditioning Research*, *26*(9), 2453-2459.

Karpowicz, K. (2006). Interrelation of selected factors determining the effectiveness of training in young basketball players. *Hum Mov*, 7(2), 130–146.

Koç, H., Pulur, A., & Karabulut, E. O. (2011). Comparison Of Some Motor Abilities Of Male Basketball and Handball Players. *Nigde University Journal of Physical Education And Sport Sciences*, *5*(1), 21-27.

Korkmaz, C., & Karahan, M. (2012). A comparative study on the physical fitness and performance of male basketball players in different divisions. *Nigde University Journal of Physical Education And Sport Sciences, 6 (1), 16-23.*

Ostojic, S. M., Mazic, S., & Dikic, N. (2006). Profiling in basketball: Physical and physiological characteristics of elite players. *The Journal of Strength & Conditioning Research*, *20*(4), 740-744.

Manning, J. M., Dolly- Manning, C., & Perrin, D. H. (1988). Factor Analysis of Various Anaerobic Power Tests. *J. Sports Med. Phys. Fitness*, 28(2), 138-144.

Marić, K., Katić, R., & Jeličić, M. (2013). Relations between basic and specific motor abilities and player quality of young basketball players. *Collegium Antropologicum*, *37*(2), 55-60.

Markovic, G., Dizdar, D., Jukic, I., & Cardinale, M. (2004). Reliability and factorial validity of squat and countermovement jump tests. *The Journal of Strength & Conditioning Research*, *18*(3), 551-555.

Paulauskas, R., (2013). Anaerobıc power and muscle work capacıty of Lithuanian basketball players. *Lase journal of sport scıence is a Scientific Journal published two times per year in Sport Science LASE Journal for sport scientists and sport experts/specialists*, 215.

Popovıc, S.; Akpınar, S.; Jaksıc, D.; Matıc, R. & Bjelıca, D., (2013). Comparative study of anthropometric measurement and body composition between elite soccer and basketball players. *Int. J. Morphol.*, *31(2)*:461-467.

Sallet, P., Perrier, D., Ferret, J. M., Vitelli, V., & Baverel, G. (2005). Physiological differences in professional basketball players as a function of playing position and level of play. *The journal of sports medicine and physical fitness*, *45*(3), 291-294.

Sevim, Y., (1997). *Basketball:* Technical and Tactical Training. Tutibay Publishing, Ankara.

Silva, D. A. S., Petroski, E. L., & Araujo Gaya, A. C. (2013). Anthropometric and physical fitness differences among Brazilian adolescents who practise different team court sports. *Journal of human kinetics*, *36*(1), 77-86.

Stauffer, K., Nagle, E., Goss, F., & Robertson, R. (2010). Assessment of Anaerobic Power in Female Division I Collegiate Basketball Players. *Journal of Exercise Physiology Online*, *13*(1).

Torres-Unda, J., Zarrazquin, I., Gil, J., Ruiz, F., Irazusta, A., Kortajarena, M., & Irazusta, J. (2013). Anthropometric, physiological and maturational characteristics in selected elite and non-elite male adolescent basketball players. *Journal of sports sciences*, *31*(2), 196-203.

Vanderlei, F. M., Bastos, F. N., de Lemes, Í. R., Vanderlei, L. C., Júnior, J. N., & Pastre, C. M. (2013). Sports injuries among adolescent basketball players according to position on the court. *International archives of medicine*, *6*(1), 5-5.

Ziv, G., & Lidor, R. (2009). Physical attributes, physiological characteristics, on-court performances and nutritional strategies of female and male basketball players. *Sports Medicine*, *39*(7), 547-568.