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Modelling Youth Basketball Performance Profile in European Championships

Ovidijus Kokanauskas[1], Tomas Bietkis[1], Jorge Arede[2], Nuno Leite[2]

Abstract

The current study aims to identify differences in the individual profiles of youth basketball players (U-16, U-18, U-20) as well as to understand if this variation is affected by player-related variables or team final classification. To this end, archival data from 2016-2017 to 2018-2019 (n=1152 game box scores) European youth championships is analysed. First, a discriminant analysis is carried out to examine the individual game-related statistics (mean ± SD). Secondly, after determining the normality of the data, Kruskal-Wallis is performed to compare differences in performance profiles between different age-groups, teams' final classification and according to players' position on the court. The resulting findings show significant differences between the playing positions as well as between different age-groups and considering teams' final standing position. Older age-groups accumulate higher number in field goals scored, field goal percentage, 3-points scored, efficiency and points scored comparing to younger age-group players. Teams' final classification also has a significant influence on performance profiles of the players. In both cases, the players from the best teams performed better in most of the statistical variables when compared to bottom-4 teams. Results of the present investigation can help coaches differentiate performance indicators of playing positions and predict how it can change throughout age groups. These findings can be used to optimize preparation for individual players and team's performance.

Keywords: game statistics, player position, player related variables

Introduction

Basketball is a team sport characterized by the execution of series of skills in multiple situations occurring across the game. Coaches and scouts are constantly searching for better methods of player evaluation and basketball is no exception. There are many aspects of an elite player that an analyst must consider when performing their analysis: offensive and defensive ability, personality, among others. Many of these skills, especially those pertaining to offense and defense, can be quantified using statistical measures (Piette, Anand, & Zhang, 2010). Often, players are subject to defensive pressure and the more skilled and experienced players might be able to anticipate events and perform unhurried actions as a result of their improved ability to "read the game" (Sampaio, Godoy, & Feu, 2004). The use of performance analysis in sports with the determination of the most important game related statistics during the game aims to improve the team performance, increasing the knowledge of the performance of each player. Specifically, game-related statistics are key tools for basketball coaches providing reliable information about teams' performance such as those distinguishing between successful and unsuccessful teams. (Lorenzo, Lorenzo, Conte, & Giménez, 2019).

Dežman with colleagues (2001) suggest that the specific position of basketball players are traditionally determined by their weight and height. Specifically, the tallest and heaviest players tend to play the role of the key positions close to the basket, while smaller players are placed in perimeter positions (Ostojic, Mazic, & Dikic, 2006; Sallet, Perrier, Ferret, Vitelli, & Baverel, 2005). The findings of Sampaio and colleagues are in line with several studies (Erčulj & Štrumbelj, 2015; Sampaio, Ibáñez, Lorenzo, & Gómez, 2006) suggesting that the tallest and heaviest players are highly specialized in rebounding, blocking and inside shooting, likely because the use of 1-on- situations to solve the possessions with players close to the basket is required.

Basketball performance depends primarily on shooting 2-point field-goals and on securing defensive rebounds. In close contested games however, fouls and free-throws exhibit increased importance for determining game outcome than for lesser contested games (Sampaio & Janeira, 2003). Other remaining game statistics such as offensive rebounds, turnovers, steals and assists are not reported consistently as discriminating performance variables for winning and losing. When contrasting the best and worst teams, the best performance variables for long term success are related to assists, steals and blocks, denoting the importance of passing skills and of defensive skills along outside and inside court positions (Ibanez et al., 2008). In regards to basketball, previous studies suggest that early sport experiences may affect basketball skill acquisition (Santos, Mateus, Sampaio, & Leite, 2017).

An analysis of the senior and junior (U-18) world

[1] Lithuanian Sports University, Kaunas, Lithuania

[2] Research Center in Sports Sciences, Health Sciences and Human Development, CIDESD, University of Trás-os-Montes and Alto Douro, Vila Real, Portugal

Corresponding Author: Jorge Arede, MSc

Research Center in Sports Sciences, Health Sciences and Human Development, CIDESD, University of Trás-os-Montes and Alto Douro, Quinta de Prados, Apartado 202, 5001-911 Vila Real, Portugal, Phone: +351967585894, Email: jorge_arede@hotmail.com

championships shows differences between the expert and novice players (Sampaio et al., 2004). For this study, all performance indicators of junior and senior World Championship have been collected. Discriminant analysis highlights the importance of the greater number of assists and the fewer turnovers of the senior players. Senior players are able to read the game situation and context better and make suitable decisions on the spur of the moment, together with having higher technical skills than the junior counterparts. Therefore, they lose fewer balls and are able to pass the ball to the team mate who is in the best position to score, thus helping team perform better. The same has been found in junior categories; the U-16 players have better decision-making skills and technical skills than the U-14s (García, Ibáñez, Parejo, Feu & Cañadas, 2011).

The aim of this study has been to identify differences in the individual profiles of basketball players in youth European championships (U-16, U-18, U-20) and understand, if this variation is affected by players' court position, or teams final standing position. In this study, we are expecting to observe the variation of performance profiles: across age groups (U-16, U-18, U-20); considering teams final standing position; considering players position on the court (PG, SG, SF, PF, C); when considering playing position/final team standing position as a co-variable.

Methods

Sample

Archival data is obtained from the publically accessible official FIBA basketball box scores of years: 2016, 2017, 2018 and 2019 (available at http://www.fiba.basketball). Data of male basketball players (n=2181) that competed in European youth basketball championships in age categories: U-16 (n=732), U-18 (n=718), U-20 (n=731). A total of 1,152 games box scores have been used to collect the data.

The variables analysed are divided into three groups and defined as follows: (i) player-related: players' age, court-position (point guard, shooting guard, small forward, power forward, center; based on the information provided on the official websites); (ii) game related variables: minutes, field goals scored and attempted, field goal percentage, 2-point scored and attempted, 3-point scored and attempted, free throws scored and attempted, offensive rebounds, defensive rebounds, assists, fouls, turnovers, steals, blocks, efficiency and points scored; (iii) team related variables: team's classification in the tournament (Top-4, if team finished between 1st and 4th (n=537); Medium-high, if team finished 5th to 8th (n=516); Medium-low, if team finished 9th to 12th (510); Bottom-4, if team finished 13th to 16th (n=619). The players whose average time played is <5 min have been excluded from the analysis.

Procedures and Data Analysis

Statistical analysis is performed using SPSS Statistics version 23, IBM Corporation, USA. First, a discriminant analysis has been carried out to explore the game-related statistics among players (mean ± SD). Secondly, after determining the normality of the data, the Kruskal-Wallis test is performed to compare differences in performance profiles between different age-groups, teams' final classification and according players' position on the court. Level of significance is set at $p \leq 0,05$.

Results

The results of the analysis according to the age-groups, teams' final standings position, and playing position are displayed in Tables 1, 2 and 3 respectively.

Table 1

Descriptive and inferential analysis of the game-related statistics according to the age-groups.

Game-related statistics	U-16 (n=732)		U-18 (n=718)		U-20 (n=731)
Minutes p/game	18,2± 7,0		18,7± 7,4		18,5 ± 7,1
FG scored	2,3 ± 1,6	1a,2a	2,5 ± 1,7		2,5 ± 1,9
FG attempted	6,0 ± 3,5		6,0 ± 3,6		5,9 ± 3,4
FG%	36,2±12,3	1c,2c	39,5±13,0		40,5 ± 13,3
2pt scored	1,7 ± 1,4		1,8 ± 1,4		1,8 ± 1,4
2pt attempted	3,9 ± 2,5		3,9 ± 2,6		3,7 ± 2,6
3pt scored	0,6 ± 0,6	2c	0,6 ± 0,7	3a	0,7 ± 0,7
3pt attempted	2,1 ± 1,8		2,1 ± 1,9		2,2 ± 1,9
FT scored	1,2 ± 1,2		1,2 ± 1,1		1,2 ± 1,4
FT attempted	1,8 ± 1,6		1,8 ± 1,5		1,8 ± 1,6
Offensive rebounds	1,2 ± 2,0	2b	1,1 ± 0,9	3b	0,9 ± 0,8
Defensive rebounds	2,4 ± 1,6		2,3 ± 1,5		2,3 ± 1,5
Assists	1,4 ± 1,2		1,5 ± 1,3		1,5 ± 1,3
Fouls	1,8 ± 0,8		1,9 ± 0,8		1,9 ± 0,6
Turnovers	1,5 ± 0,9	2a	1,5 ± 1,0		1,4 ± 0,9
Steals	0,9 ± 0,7	2b	0,9 ± 0,7	3a	0,8 ± 0,6
Blocks	0,3 ± 0,5		0,3 ± 0,4		0,3 ± 0,4
Efficiency	6,4 ± 5,0	1b,2b	6,9 ± 4,9		7,1 ± 6,3
Points p/game	6,3 ± 4,4	2a	6,7 ± 4,4		6,8 ± 4,5

1: significant differences between U-16 and U-18; 2: significant differences between U-16 and U-20; 3: significant differences between U-18 and U-20. Significant differences set at a= p ≤ 0,05; b= p ≤ 0,01; c=p ≤ 0,001

Table 2

Descriptive and inferential analysis of game-related statistics according to the final classification.

Game-related statistics	Top-4: 1st to 4th (n=537)		Medium high: 5th -8th (n=516)		Medium low: 9th -12th (n=510)		Bottom-4: 13th-16th (n=619)	
Minutes p/game	18,4 ± 7,4		18,2 ± 6,8		18,9 ± 7,5		18,5 ± 7,1	
FG scored	2,5 ± 2,1	3a	2,4 ± 1,5	5a	2,4 ± 1,7		2,5 ± 1,9	
FG attempted	5,9 ± 3,5		6,0 ± 3,4		6,1 ± 3,6		5,9 ± 3,4	
FG%	40,4 ± 13,1	3c	39,9 ± 12,0	4a,5c	38,1 ± 13,1		40,5 ± 13,3	
2pt scored	1,9 ± 1,5	3a	1,8 ± 1,3	5b	1,8 ± 1,4	6a	1,8 ± 1,4	
2pt attempted	3,9 ± 2,6		3,9 ± 2,5		3,9 ± 2,6		3,7 ± 2,6	
3pt scored	0,6 ± 0,7		0,6 ± 0,6		0,6 ± 0,7		0,7 ± 0,7	
3pt attempted	2,1 ± 1,9		2,1 ± 1,8		2,1 ± 1,9		2,2 ± 1,9	
FT scored	1,3 ± 1,4		1,2 ± 1,1	5a	1,2 ± 1,2		1,2 ± 1,4	
FT attempted	1,9 ± 1,6		1,9 ± 1,6		1,8 ± 1,6		1,8 ± 1,6	
Offensive rebounds	1,1 ± 0,9	3a	1,1 ± 0,9	5b	1,2 ± 2,3	6a	0,9 ± 0,8	
Defensive rebounds	2,4 ± 1,6	3b	2,3 ± 1,4		2,4 ± 1,7		2,3 ± 1,5	
Assists	1,5 ± 1,4	3a	1,5 ± 1,2	5b	1,4 ± 1,3		1,5 ± 1,3	
Fouls	1,8 ± 0,8	3a	1,8 ± 0,8		1,9 ± 0,8		1,9 ± 0,6	
Turnovers	1,4 ± 0,9	2a,3b	1,4 ± 0,9	5a	1,5 ± 0,9		1,4 ± 0,9	
Steals	0,8 ± 0,6		0,9 ± 0,6	5a	0,8 ± 0,7		0,8 ± 0,6	
Blocks	0,3 ± 0,5	2a,3a	0,3 ± 0,5		0,3 ± 0,5		0,3 ± 0,4	
Efficiency	7,6 ± 5,3	2a,3c	7,1 ± 4,6	5c	6,8 ± 5,2	6b	7,1 ± 6,3	
Points p/game	6,8 ± 4,6	3a	6,7 ± 4,2	5b	6,6 ± 4,6		6,8 ± 4,5	

1: significant differences between Top-4 and Mid-high; 2: significant differences between Top-4 vs. Mid-low; 3: significant differences between Top-4 vs. Bottom-4; 4: significant differences between Mid-high vs. Mid-low; 5: significant differences between Mid-high vs. Bottom-4; 6: significant differences between Mid-low vs. Bottom-4. Significant differences set at a= p ≤ 0,05; b= p ≤ 0,01; c= p ≤ 0,001

Table 3

Descriptive and inferential analysis of game-related statistics according to the playing position

Game-related statistics	PG (n=500)		SG (n=520)		SF (n=520)		PF (n=477)		C (n=307)
Minutes p/game	19,3 ± 6,9	3b,4c	19,0 ± 7,2	6b,7c	18,5 ± 7,4	9c	17,9 ± 6,9	0b	16,7 ± 7,3
FG scored	2,3 ± 2,0	1a	2,5 ± 1,6		2,4 ± 1,6		2,4 ± 1,6		2,5 ± 1,8
FG attempted	6,1 ± 3,4	1c,3b,4c	6,6 ± 3,6	5b,6c,7c	6,1 ± 3,7	9c	5,6 ± 3,3	0a	5,0 ± 3,3
FG%	35,1 ± 11,4	2c,3c,4c	35,6 ± 11,7	5a,6c,7c	37,1 ± 12,1	8c,9c	41,5 ± 11,6	0c	47,5 ± 15,5
2pt scored	1,5 ± 1,1	2a,3c,4c	1,6 ± 1,2	6c,7c	1,7 ± 1,3	8a,9c	2,0 ± 1,5	0b	2,4 ± 1,7
2pt attempted	3,5 ± 2,2	3b,4c	3,5 ± 2,4	6b,7c	3,7 ± 2,5	9c	4,1 ± 2,7	0a	4,6 ± 3,0
3pt scored	0,8 ± 0,7	1c,2a,3c,4c	0,9 ± 0,7	5c,6c,7c	0,7 ± 0,7	8c,9c	0,4 ± 0,5	0c	0,1 ± 0,3
3pt attempted	2,6 ± 1,8	1c,2a,3c,4c	3,1 ± 1,9	5c,6b,7c	2,4 ± 1,8	9c	1,5 ± 1,4	0c	0,4 ± 0,9
FT scored	1,2 ± 1,1		1,2 ± 1,1		1,2 ± 1,1		1,2 ± 1,1		1,3 ± 1,8
FT attempted	1,7 ± 1,4	4a	1,7 ± 1,5	7a	1,8 ± 1,5		1,8 ± 1,6		2,1 ± 1,8
Offensive rebounds	0,6 ± 0,5	1c,2c,3c,4c	0,7 ± 0,5	5c,6c,7c	1,1 ± 0,8	8c,9c	1,5 ± 2,4	0c	1,7 ± 1,1
Defensive rebounds	1,9 ± 1,2	2c,3c,4c	2,0 ± 1,2	5c,6c,7c	2,5 ± 1,6		2,7 ± 1,6		2,8 ± 1,9
Assists	2,4 ± 1,6	2c,3c,4c	1,5 ± 1,1	5c,6c,7c	1,2 ± 1,0	8c,9c	1,0 ± 0,8	0c	0,7 ± 0,6
Fouls	1,8 ± 0,7	3c,4c	1,7 ± 0,8	6c,7c	1,8 ± 0,8	8c,9c	2,0 ± 0,8	0a	2,1 ± 0,9
Turnovers	1,9 ± 1,0	1c,2c,3c,4c	1,5 ± 1,0	6b,7c	1,4 ± 0,9	9b	1,3 ± 0,7		1,2 ± 0,8
Steals	1,1 ± 0,7	1a,2c,4c	0,9 ± 0,6	6c,7c	0,9 ± 0,6	8c,9c	0,7 ± 0,5	0c	0,5 ± 0,4
Blocks	0,1 ± 0,2	1c,2c,3c,4c	0,2 ± 0,3	5c,6c,7c	0,3 ± 0,4	8c,9c	0,4 ± 0,5	0c	0,6 ± 0,6
Efficiency	6,2 ± 4,5	3c,4c	6,2 ± 4,4	6c,7c	6,8 ± 4,9	9a	7,3 ± 5,0		8,0 ± 6,0
Points p/game	6,4 ± 4,2	1b	7,1 ± 4,5	6b,7b	6,6 ± 4,6	9c	6,3 ± 4,3	0b	6,3 ± 4,7

1: significant difference PG vs. SG; 2: significant difference PG vs. SF; 3: significant difference PG vs. PF; 4: significant

difference PG vs. C; 5: significant difference SG vs. SF; 6: significant difference SG vs. PF; 7: significant difference SG vs. C; 8: significant difference SF vs. PF; 9: significant difference SF vs. C; 0: significant difference PF vs. C. Significant difference: a= $p \leq 0,05$; b= $p \leq 0,01$; c= $p \leq 0,001$

Discussion

The aim of this study has been to identify differences in individual profiles of basketball players in youth European championships and understand, if this variation is affected by players' court position, or teams' final classification. Statistical analysis allows us to determine game indicator differences between players from different age-groups, players' position on the court and between players according to the final standing position of the team.

Comparing performance profile among ages-groups, U-16 differs from other groups in lower number of field goals scored, lower field goal percentage and efficiency. Higher performance indicators are steals and offensive rebounds. These indicators can be influenced by physical factors (strength, power, and fitness). U-20 group lead in 3 points scored, that can be explained with more experienced players having better understanding and technical skills of game.

Comparing performance profiles according to the final standing position, the results show that Top-4 teams differ from other teams in turnovers, blocks, and efficiency. Our results show different statistical values than (Sampaio, Drinkwater, & Leite, 2010) study, they have identified that strong teams outperform weak teams in terms of two-point field goals and passes, which means that best players from strong teams possibly get better control of the game pace and utilize more passes to complete technical and tactical strategies instead of covering more distance.

Collected data shows that part of the statistics of different position basketball players significantly differ, similar differences are found by other authors (Sindik & Jukić, 2011) in their research. Results show that point guards lead in minutes, assists, turnovers and steals. This position is one of the most important on the court, Sampaio et al. (2004), suggests that assists are indicators of players' maturity and experience, increasing in number as the player acquires a better ability to read the game as a result of years of playing experience.

Shooting guards lead team in field goals scored, 3 points scored and 3-point attempts. In fact, guards play a central role in ball-handling and distribution in the NBA league, especially in game pace control, passing and organizing offensive tactics, and keeping a higher long-range shooting ability (Fewell, Armbruster, Ingraham, Petersen, & Waters, 2012); Gomez et al., 2016; Sampaio et al., 2009).

Centers lead in these performance indicators: field goals scored, field goal percentage, 2 points scored and attempted, offensive, defensive, and total rebounds, personal fouls and blocks. Such finding may be due to their roles, that are more so based on rough behaviors (e.g., boxing-out and gaining advantageous positions inside the restricted area) and decision-making during particular actions (e.g. anticipate shot-blocking chances and rebounding situations), rather than athleticism (Mateus et al., 2020).

Comparing performance profiles according age groups by playing position the players from U-16 age group differ from other age groups in these statistical variables: field goals percentage, offensive rebounds and steals. U-20 differs from other age groups in 3 points scored. Comparing performance profiles according age group by final classification, the players from U-16 age group differ from other age groups in these variables: field goal percentage and steals. The limitation of the study could be that the number of players per position is different (i.e., from SG (n=520) to C (n=307). This could have a potentially negative impact on the study outcomes/results.

Conclusions

Performance profiles vary across different age groups. Older age group players show increasing number in field goals scored, field goal percentage, 3 points scored, efficiency and points scored comparing to younger age group players. Moreover, offensive rebounds, turnovers and steals have decreased in the older age groups. Teams' final standing position also has a big influence on performance profiles of the players. Both, the players from Top-4 and Mid-high, perform better in most of the statistical variables when comparing them to Bottom-4. However, only turnovers, blocks, more or less and efficiency variables are significantly different when comparing Top-4 with Mid-low. Mid-high players show better performance in field goal percentage and more or less statistical variables than the players whose teams finished Mid-low. Even the players from Mid-low teams show better performance in 2 points scored, offensive rebounds, total rebounds, and efficiency, than the players from Bottom-4.

The determined performance indicators of basketball players, who competed in different positions, differs as there are statistically significant differences in the comparison of positions.

In both of the added co-variables, when comparing age-groups, less significant differences in performance profiles are found, than just comparing the age-groups alone. Result of our investigation can help coaches in differentiating performance indicators of playing positions and predicting how it can change throughout age-groups. These findings can be used to optimize preparation for individual players and team's performance.

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