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USEFUL TOOLS TO PREDICT FUTURE PERFORMANCE? ANALYSIS OF FORMER INDIVIDUALLY PRIZED YOUNG SELECTED MALE BASKETBALL PLAYERS

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ABSTRACT. Success in team sports foremostly depends on individual performance and the cooperation of the team members. We aimed to investigate the individual performance changes of youth awarded basketball players from youth to senior national team level. For this purpose we examined four game-related basketball statistics: Minutes Played (MP), Points Scored (PS), Rebounds (REB), and Assists (AST) both in youth and senior level with regression analysis. We collected all the individually prized players of former youth European Championships available on the most reliable websites (N=323). We used descriptive statistical methods and also investigated correlation between their prized performance and their senior peak performance on national level ($p<0.01$). Our analysis showed that a larger amount of the previously awarded players became member of their senior national team (58%, n=188). 90.71% of the awarded players (n=293) were the first or second best scoring leader of their own team in their youth prime. We found moderate significant correlation between youth rebounds and senior rebounds, also youth assists and senior assists, but only weak correlation between youth and senior Minutes Played and Points Scored. From this aspect getting awards on youth level can boost an athlete's career, but it doesn't mean to reach the same peak when they are selected to the senior squads as time and age are dominant background variables, an extended analysis is needed in the future.

Keywords: *basketball players, performance, game-related statistics, selection, youth sport*

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Introduction

From basketball to other team sports it became more and more widespread to predict future performance from past and present data (Senderovich et al. 2018). These generated added values can help the coaches and other decision makers to select the best available option during a single game, a tournament or a season. In the case of some individual sports, senior achievement can be predicted from early stages of young athletes' early career. Schumacher et al. (2006) stated that those cyclists who had taken part in the junior world championships were more successful as adults than those who had not had that opportunity. More research confirmed the point of view saying that exceptional individual performance in youth age can increase success in adulthood. Brouwers et al. (2012) and Pereira et al. (2014) ended up with similar results in gymnastics and tennis. From an additional aspect Barreios et al. (2014) investigated 395 athletes at four different sports. Their results showed difficulties of predicting late success based on youth achievements. All of the studies agree on the fact that until peak senior performance leads a long and rocky road.

Analysing youth national competitive experience at basketball, Kalén et al. (2017) came to the conclusion that those teams and players who performed better had a bigger number of former senior championships, showing that a particular competition experience can be a defining element of success both in individual and team performance. Arrieta et al. (2015) analysed FIBA U16, U18, U20 Championships, and concluded that at the U20 category, the oldest players had the best performance, and in all categories the oldest athletes played the most. We can observe that the most researched statistics are the game-related statistics, furthermore the most often used measures for analysing individual performance in scientific context are the game-related statistics (Sampaio et al., 2010). Scientific researches focus on the crucial factors that differentiate between winning and losing teams, and determine the result of a match or a championship (Zhang et al., 2020, Casals & Martinez, 2013, Csataljay et al., 2009, Puente et al., 2015, Zhang et al., 2018, Gomez et al., 2016). Despite the fact that recent studies analyse team performance indicators mostly (Kubatko et al. 2007), our goal was to examine the individual performance change and correlation in youth and senior levels. We believe that performance analysis in basketball can lead to better understanding and decisions.

Materials and methods

However, these game-related statistics give a plenty of opportunity to evaluate basketball performance nowadays, the explosive amount and depth of data can be reached just in recent years. Some research has identified the

field-goal percentage, defensive rebounds (Summers, 2013, Özmen, 2016, Ibanez et al., 2008), assists (Özmen, 2016) as the game-related statistics that highly correlates with success (Summers, 2013). Assists, steals and blocks are also important factors, when taking key winning factors into account (Sampaio, Lago, & Drinkwater, 2010b, Ibanez et al., 2008). Lorenzo et al. (2019) examined average points, assists, field goal percentages and free throws amongst senior basketball players, and concluded that during their career there is a positive trend in assists and free throw percentages. We decided to choose four main variables: Minutes Played (MS), Points Scored (PS), Rebounds (REB), and assists (AST), because these statistics are also well accessible from former youth tournaments and still used in statistical comparisons.

Our research aim was threefold:

(1) to evaluate the value of „youth level" prizing from the viewpoint of senior national team selections by descriptive statistical methods

(2) to examine the importance of scoring in youth age

(3) to examine correlations between youth and senior game-related statistics

Firstly, we collected all of the former youth basketball players who have participated at youth European Championships and were selected to the „All-star team" or „Most Valuable Player" of the tournament. According to FIBA Regulations (2016) these awards are provided by the organisers of the youth tournament and the Organising Committee decides about the list of the awarded players. Five players are selected to the „All-star" team, and one player is named as the MVP (Most Valuable Player). Similar to previous studies (Sampaio et al. 2018, Kalén et al., 2017) we used the FIBA archive pages and FIBA official tournament sites for data retrieval. A total amount of 323 players (mean age: 27.75±4.42) were collected during a three months period. (November 2020 to January 2021). The data was cleaned and clustered with Microsoft Excel 2010, which was then imported to IBM SPSS Statistics. To evaluate prizing we created four groups with roles:

- bench role – a player, who played 0 to 10 minutes at senior level
- additional role – a player who played 10 to 20 minutes at senior level
- key role – a player who played 20 to 30 minutes at senior level
- star role –a player who played 30 to 40 minutes at senior level

We determined senior peak performance as the highest statistical average value that the player reached during a single senior tournament. We considered youth performance values at the tournament where the player was awarded by an individual prize. There were 51 players, who were prized more than once, in that case the higher performing tournament was taken into consideration.

We used the guideline of Cohen (1992) to interpret the correlation coefficient at the significance level of $p<0.01$ with the following intervals: -0.3 to +0.3 Weak; -0.5 to -0.3 or 0.3 to 0.5 Moderate; -0.9 to -0.5 or 0.5 to 0.9 Strong; -1.0 to -0.9 or 0.9 to 1.0 Very strong.

We maintained the following hypothesises:

(1) We hypothesised that players, who were awarded at youth level can reach senior national team rosters. These players can get a defining role at a senior national team level.

(2) Moreover we hypothesised that the awarded players were the best point scorers of their team during their awarded tournaments.

(3) We assumed that performance indicators (PS, MP, REB and AST) at our analysis can correlate at youth and senior age. Talented players like formerly prized athletes can use youth European Championships as a test event which can forecast the potential of their senior peak performance.

(4) We also assumed that a connection between formerly prized U20 players' junior and senior performance can be higher. We thought the correlation is higher in this age group then in the total sample. This presumption is based on the competition system that this is the nearest challenge to adult basketball. From this stage, players can easily reach professional status and join possibly the senior national team.

Results

Evaluation of the roles of youth awarded players at senior level

First of all, we used descriptive statistical methods as we introduce the percentages of former youth selected players participating at senior national teams. 58% of the players were able to attend at their senior team at least once (n=188). We can assume that it can be a significant amount. As a comparison in football it is observed at the Dutch national team that 50% of the youth selected players were deselected after two years (Verbeek et al., 2017). A high fluctuation between age groups and early dropout were also identified within the German youth national football teams (Schroepf and Lames, 2018). From this point of view, we can assume that prizing at young age could boost young players' career. Prizing at youth level can also effect a player's decision at choosing the professional career.

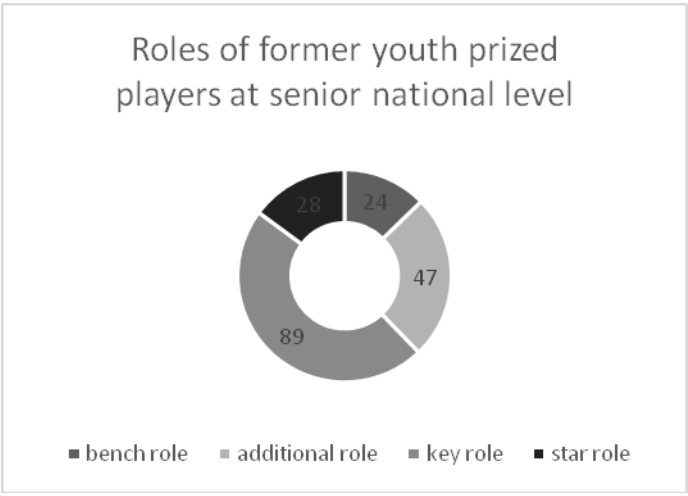

Figure 1. Roles of former youth prized players at senior national level (figure by the author)

From those players who were awarded at youth categories and later joined their senior national team the smallest portion has a bench role. Only 13% of these senior selected players (n=24) get 0 to 10 minutes at their peak. It is also rare that someone from the youth awarded player later becomes the most used player (30 to 40 minutes) at senior level, which means 15% (n=28) of the formerly prized players will be favoured the most by senior national team coaches.

There are athletes who reach senior national team squads with an additional role, these players get 10 to 20 playing minutes at their peak. We can diagnose that most of the youth awarded players take part a huge role at senior national level, almost half of the prized players 47% (n=89) spend 20 to 30 minutes on the court at their senior peak. According to these results it can be noted that the bigger part of the youth awarded players 62% (n=117) have a determinant role at senior tournaments.

Heuristic traps in prizing?

Recent research proves that despite the fact that we can already measure the efficiency of individuals and teams in a complex way, in the case of awards, salaries, or all-star voting, scoring is primarily what even professionals take into account, e.g. with the shooting percentage. Berri, Brook, and Fenn (2011) asked decision makers what statistics are used to select potential players from universities by NBA teams. Based on university player statistics, the point/minute ratio has the greatest impact on selection. In contrast, the throwing percentage

has a relatively low effect on the draft position, rebounds and turnovers have virtually no effect on the position on the player's exchange. However, the age of the players, as well as the fact that the player's team was among the top four in the university league, had outstanding relevance in the draft order. Berri, Brook, and Schmidt (2007) summed up coaches 'votes for the best NBA rookies between 1995 and 2007 and found that points scored were the most important statistical indicators of nominations, while professionals rated throwing percentages, rebounds, and turnovers also to be statistically significant.

Berri, VanGilder and Fenn (2014) made a similar conclusion when analysing the votes, and - as in the best rookie vote - in this statistical context, the points scored determined the outcome of the MVP vote mostly, however the shooting efficiency among sports journalists was not a significant factor in the selection.

According to our research, more than 90% of the award winners were the best or second-best scorers of their teams. We investigated the awarded youth athletes and from the total population 293 (90.71%) player was the leader or the second option of their team in scoring. In our interpretation we can refer this effect as a heuristic trap. We use heuristics when we want to reach a quick yet easily accessible solution. Decision makers simplify their decisions by reducing the effort of making a decision to a satisfactory solution. (Simon, 1956). Before the award-giving ceremony the Organising Committee has to name five extraordinary players to receive the prize. It is assumable that decision makers take points scored into consideration with a huge impact.

Usually prized players have a huge, comprehensive skill set, and in most cases decision-makers recognize talents (the "coach's eye"), however it can be a danger to reduce the attention (even unintentionally) to one statistic dimension. If we make this mistake there is a chance to disregard players with high shooting efficiency or rebounding, passing ability. As the role of prizes becomes more important, the responsibility of decision-makers increases as well.

If higher portion of youth awarded athletes later reach first class teams and the senior national squad, individual recognition does matter. In case individual recognition is significant, from our point of view it is appropriate to give these awards on the basis of more objective criteria especially in youth categories.

Correlations between Minutes Played (MP), Points scored (PS), Rebounds (REB), and Assists (AST) at youth and senior events

As minutes played (MP) is the indicator on basis of which players based on their role can be ranked (Zilinyi et al., 2020) we intended to examine if youth MP can be associated with senior national team level. Our results can be seen at the next table and graph:

Table 1. Correlation matrix of youth and senior MP (table by the authors)

Correlations

		Youth MP	Senior MP
Youth MP	Pearson Correlation	1	.259**
	Sig. (2-tailed)		.000
	N	188	188
Senior MP	Pearson Correlation	.259**	1
	Sig. (2-tailed)	.000	
	N	188	188

**. Correlation is significant at the 0.01 level (2-tailed).

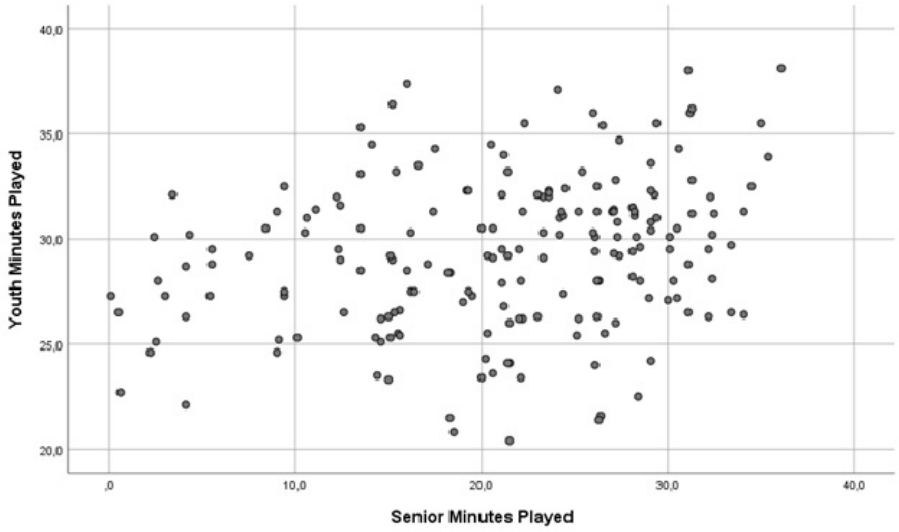

Figure 2. Senior and youth minutes played (figure by the author)

The correlation coefficient is low (r=0.259), which means correlation between youth and senior MP is weak. U20 awarded players' (n=101) minutes have almost the same, low correlation (r=0.232) at senior peak age. From this angle to have the same amount of playing time, athletes have to earn their spot with hard work if they reach the senior squads, as it is not guaranteed, even if they were nominated to a prize at the last youth category. As awarded athletes played an average of 29.3 minutes during their award-winning tournament,

this number decreased when they reached their peak at a single senior tournament. Those who were selected to their senior national squads spent an average of 21 minutes on the court.

The Standard Deviation significantly changed in senior level (±8.6), as some athletes played more minutes, but most of the players had a small decrease in playing time. At senior level players had to deal with a larger amount of competitors, this can be one of the reason why the MP may vary on a larger scale. The Standard Deviation at youth level (±3.62) can be explicable with the fact that these players were the best of their categories and their coaches gave the most opportunity for them as they were considered as young prospects. These players participated at almost full games for most of the time, as it is crucial to win games with the best available players on the court.

We can also differentiate the achievement in youth ages and in the adult era, if we investigate the PS and MP at both level. We can see a strong (r=0.521) correlation at youth level, and a stronger correlation (r=0.823) at adult performance.

Table 2 and 3. Correlation matrixes of youth and senior MP, youth and senior PS

Correlations

		MP Senior	PS Senior
MP Senior	Pearson Correlation	1	.823**
	Sig. (2-tailed)		.000
	N	188	188
PS Senior	Pearson Correlation	.823**	1
	Sig. (2-tailed)	.000	
	N	188	188

**. Correlation is significant at the 0.01 level (2-tailed).

		MP youth	PS youth
MP youth	Pearson Correlation	1	.521**
	Sig. (2-tailed)		.000
	N	188	188
PS youth	Pearson Correlation	.521**	1
	Sig. (2-tailed)	.000	
	N	188	188

**. Correlation is significant at the 0.01 level (2-tailed).

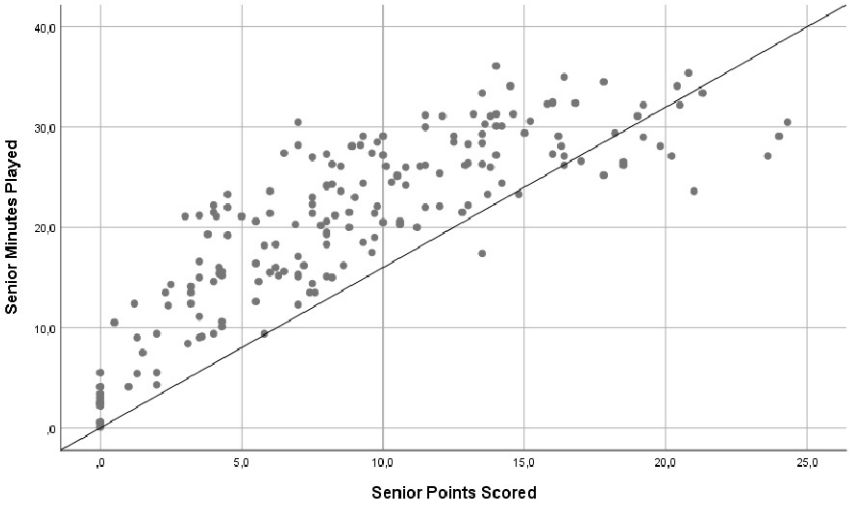

Figure 3. Senior MP and senior PS (figure by the authors)

From this point of view in accordance of points it is presumable that at senior age a mature and reliable performance can be calculated from these players, while at youth categories point scoring is least stable and doesn't depend on playing time that much. We can assume that the bigger linear connection between points and minutes in senior age can related to higher consistency. At younger age player's performance may vary bigger even inside a single tournament. The following graphs show the difference and difficulty of scoring at senior level.

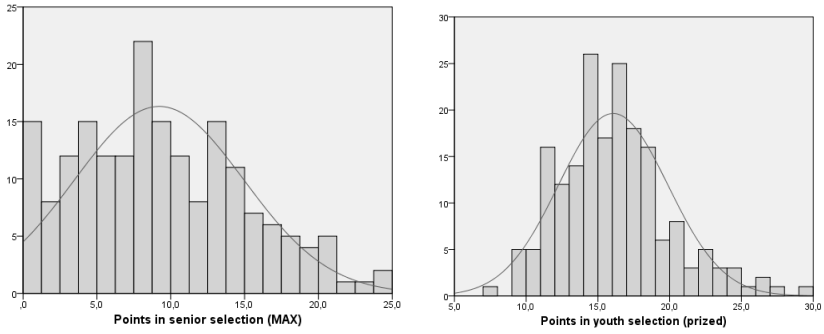

Figure 4. Points at youth and adult age (figure by the author)

It is clear from the results that only a few players can score the same average of points at senior age, most of them has a significant drop at points. Difficulties of scoring at senior age strengthen the transition challenges from junior to adult sport at the highest level. Analysing the correlation between youth and senior PS, we found a weak correlation. (r=0.265).

Table 4. Correlation matrix of points scored (table by the authors)

		PS YOUTH	PS SENIOR
PS YOUTH	Pearson Correlation	1	.265**
	Sig. (2-tailed)		.000
	N	188	188
PS SENIOR	Pearson Correlation	.265**	1
	Sig. (2-tailed)	.000	
	N	188	188

**. Correlation is significant at the 0.01 level (2-tailed).

The correlation coefficient was a little bit higher when we investigated the link between youth and senior points in the case of U20 prized players, a moderate correlation was diagnosed (r=0.305) during the analysis. At this context the outcome can confirm our third assumption, that outstanding performance at U20 categories can be related better with the senior peak performance, than outstanding performance at lower youth categories. This presumption was strengthened during the analysis of REB and AST on both levels. Although in the case of rebounds, the correlation was moderate (r=0.453) between youth and senior level at the whole sample of the players, the coefficient's value increased when we investigated only the U20 awarded athletes. We found a strong correlation between U20 youth REB and senior REB. (r=0.576). The connection between youth AST and senior AST was also strong (r=0.511), however there were no significant difference between the whole sample and the U20 players (r=0.558).

Table 5. and 6. Correlation matrix of rebounds and assists (table by the authors)

Correlations

		REB YOUTH	REB SENIOR
REB YOUTH	Pearson Correlation	1	.453**
	Sig. (2-tailed)		.000
	N	188	188
REB SENIOR	Pearson Correlation	.453**	1
	Sig. (2-tailed)	.000	
	N	188	188

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

		AST YOUTH	AST SENIOR
AST YOUTH	Pearson Correlation	1	.511**
	Sig. (2-tailed)		.000
	N	188	188
AST SENIOR	Pearson Correlation	.511**	1
	Sig. (2-tailed)	.000	
	N	188	188

**. Correlation is significant at the 0.01 level (2-tailed).

Discussion

Roles and minutes are often cleaner at senior selections, because achievement and success is primary. In youth categories individual development is one of the key responsibility for coaches. It is also recognizable that adolescent player's performance is very inconsistent.

We can agree with the statement that most of the awarded players will be selected to their senior national squads (58%), it is a great sign predicting for the future performance to compete, perform well, and being awarded in these youth tournaments.

On the other hand, we have to notice the limitation of this paper. As time and age are dominant background variables, the above graphs and tables, the sample's size can change dynamically due to time. Younger players can get more minutes, and the list of senior selected players can grow. The peak performance of an athlete can vary due to their sport. Bradbury (2009) conducted a research in baseball, and he found that baseball players peak much later than assumed, at age 29 or 30. In Basketball Berri et al. (2006) found that the peak can be as early as 24 or 25. Pelton (2010) had significant results about players' performance and aging at the NBA, a slightly negative linear association between age and performance was observed. As in the current research some players still didn't have the chance to reach their peak, it is reasonable to conduct the same research a few years later.

It can be another interfering factor that clubs and national associations are counter-interested in the athletes' participation at senior national tournaments. However there is a clear federal intention to approach the positions of the stakeholders. Injuries can also effect players' potential improvement and opportunities. If we think about player selection for prizing at the end of a youth tournament, other distorting effects can be detected: the potential lobby of domestic teams, the psychological pressure of team strengths and rankings, the nationality and

composition of the jury. It is foreseeable that everyone can't be rewarded who excels in some statistical indicators, it would be a reasonable step from the international basketball association (FIBA) to determine the exact factors that influence the decisions of the awards.

Conclusion

Although we didn't find significant correlation in points scoring and minutes playing at youth and senior peak performance, these statistics can dominate player evaluation (Berri et al., 2007). Previous researches about salary determination, employment discrimination, and post season awards have all amplified the importance of scoring (Berri et al., 2010). From this purpose it is important for the players to improve their scoring ability. This study confirms that double selection (youth selection and awarding) can promote the transition to the senior national team, as the awarded players' bigger part joined the senior squad later.

Decision makers can often notice and identify talent owing to grandiose statistics like points scored, but the fluctuation of performance of youngsters also has to take into consideration during evaluation. Furthermore, we can agree with that as more and more data is available for national coaches, if the coaching staff does a proficient monitoring, they can choose the most reliable players for their game strategy. Due to the fact that rebounding and assists can be also game-determinative, the link between U20 and senior performance at this segment can help to project the future potential of the awarded youth players in these statistic dimensions. As double selection (youth selection and awarding) can still strengthen a career, and the selected players' significant portion could make it to the NBA, it is an individual aim for players to attempt shots and be a leader to their team. In this situation collective efforts and intents are in contrary with personal goals.

Although determinative factors of team wins due to previous studies are (among others) rebounds and field goal percentage, attacking the rim and taking responsibility for young talented players can increase their chance to be selected for youth awards, and from youth awards senior national team and professional status is not a huge step. However, it cannot be stated that shooting the ball is the only way to be a star player, it is clear that athletes with scoring abilities will be noted by scouts, coaches and tournament organisers.

In the context of transition from youth to senior performance, further analysis is needed. Correlation with shooting accuracy (free throw and field goal percentage) could be a next step to compare in youth and senior level as it is one of the most important factor, which can determinate winning and

losing teams. (Puente et al. 2015, Csataljay et al., 2009). Talent identification and player evaluation is a multilevel task, with the analysis of game- related statistics further development can be reached in this context.

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