

## SHOOTING PERFORMANCE DID NOT CHANGE IN ELITE WOMEN'S NATIONAL BASKETBALL TEAMS FROM 1995 TO 2011

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### ABSTRACT

*Performance indices, i.e. model characteristics, quantitative and qualitative indices of a shot made at the basketball match, are a part of the system of criteria that allow one to objectively determine and evaluate the readiness of basketball teams and the quality of their performance. The aim of this research was to identify and evaluate changes in the key quantitative and qualitative indicators of shooting for the best European women's basketball national teams between 1995 and 2011. The data from official statistical documents for the 1995, 1997, 1999, 2001, 2003, 2005, 2007, 2009 and 2013 European women's basketball championships were collected and statistical analyses (mean, standard deviation) of 608 cases were used. It was ascertained that the number of scores in one match of the European championship of the eight best women's basketball teams decreased from 69 to 65 points. The number of shots from close and middle distances dropped sharply – from 51 to 43 points in a match, however, their accuracy remained similar – between 42 and 43 %. The number of long-distance shots increased dramatically, from 9 to 16 points in a match, their accuracy had a tendency to increase from 29 to 33 %. The number of free throws decreased significantly – from 26 to 17 points in a match, but their accuracy remained similar – between 71 and 72 %.*

**Keywords:** basketball, competitive activities, model characteristics, shooting performance.

## USPEŠNOST META NA KOŠ SE MED LETOMA 1995 IN 2011 PRI NAJBOLJŠIH ŽENSKIH KOŠARKARSKIH EKIPAH NI SPREMENILA

### IZVLEČEK

*Del sistema meril, s katerimi lahko objektivno ugotovimo in ovrednotimo pripravljenost košarkarskih ekip in kakovost njihove igre, je kazalec uspešnosti, tj. vzorčnih značilnosti kvantitativnih in kvalitativnih kazalcev meta na koš. Cilj te raziskave je bil ugotoviti in ovrednotiti spremembe v ključnih kvantitativnih in kvalitativnih kazalcih meta na koš pri najboljših evropskih ženskih košarkarskih reprezentancah med letoma 1995 in 2011. Upoštevali smo podatke iz uradnih statističnih dokumentov evropskih ženskih prvenstev v košarki iz let 1995, 1997, 1999, 2001, 2003, 2005, 2007, 2009 in 2013 ter uporabili statistične analize (pričakovana vrednost, standardni odklon) na 608-ih primerih. Ugotovili smo, da se je število doseženih točk v eni tekmi evropskega prvenstva pri osmih najboljših ženskih košarkarskih ekipah zmanjšalo z 69 na 65 točk. Število metov od blizu in s srednje razdalje je močno padlo, in sicer z 51 na 43 točk na tekmo, vendar je natančnost metov ostala približno enaka kot prej, kar je med 42 in 43 %. Število metov z dolge razdalje se je dramatično povečalo, in sicer z 9 na 16 točk na tekmo, tudi njihova natančnost je naraščala, z 29 na 33 %. Število prostih metov se je bistveno zmanjšalo, s 26 na 17 točk na tekmo, njihova natančnost pa je ostala podobna, kar je med 71 in 72 %.*

**Ključne besede:** košarka, tekmovalne aktivnosti, vzorčne značilnosti, uspešnost meta na koš

## INTRODUCTION

Contest performance indicators analysis of the best European basketball teams provides a lot of objective information about the game of basketball, its development and the achieved results. A number of authors (Hughes & Bartlett, 2002; O'Donoghue, 2010) consider the studies in the indicators of contest activities (games) and the changes in the features of key competitions to be one of the most important areas of sports science research. An integral criterion of the effectiveness of team game is the optimal performance achieved in key competitions (Choi et al., 2006). Fitness of players and the team, the quality of the game, which allows achieving good integral development and targeted management of physical training processes, can only be identified and evaluated through the system of objective criteria (Kreivytė & Čižauskas, 2007). A part of the criteria system consists of the indicators of contest activities (games) of highly skilled basketball teams – the model characteristics that condition the victory in the matches and contests between equal opponents (Dezman et al., 2002; Trninić et al.,

2002; Reano et al., 2006), moreover, the knowledge of the contest activities determinants allows the coaches to prepare more accurate schemes for matches and devise the best tactics to win the game (Csataljay et al., 2009).

The team game and its changes can be evaluated by analysing quantitative (shooting from different distances, free throws, rebounds, etc.) and qualitative (shooting efficiency, diversity, etc.) indicators. One of the most important technical actions of players is shooting. These are complex attack closing actions that depend on many factors: the angle and the distance of shooting, the place on the court for a shot, defensive actions, and the structure of an attack (Čižauskas & Kreivytė, 2004). The number of shots from close and medium distance is decreasing due to the increasing variety of offensive tactics and better opportunities to shoot accurately into the basket from long distances (Mendes & Janeira, 2001). Oliver (2004) identifies four key factors in pursuing victory. Two of them are related to shooting, i.e. the accuracy of shooting and the number of free throws (the other two factors are offensive rebounds and the number of turnovers).

There is much research concerning issues about men's basketball teams (Dezman et al., 2002; Tsamourtzis et al., 2002; Trninić et al., 2002; Ibáñez et al., 2003; Choi et al., 2006; Sampaio et al., 2010). Studies about women's teams (Čižauskas & Kreivytė, 2004; Kreivytė & Čižauskas, 2007), their contest performance indicators in comparison with the indicators for men's teams (Sampaio et al., 2004; Reano et al., 2006) are not numerous. Other important research on competitive activities analyses the characteristics of players playing in different positions (Sampaio et al., 2006a, 2008), differences in the actions of starters and non-starters (Sampaio et al., 2006b; Gómez et al., 2009), or differences in the indicators of winning and losing teams in close game situations and play-offs (Jukić et al., 2000; Csataljay et al., 2009, 2012; Kreivytė & Čižauskas, 2010). There is lack of research on the best European women's basketball teams, comparative analysis of the key long-term quantitative and qualitative indicators in competitions that would allow preparing model characteristics for the team games. Therefore, we raised the following research question: what are the main trends of changes in the key components of the game – quantitative, qualitative and model indicators of shooting the ball for a team?

The primary aim of this research was to determine the changes in the key quantitative and qualitative indicators of shooting for the best European women's basketball national teams in the period between 1995 and 2011, while the secondary aim was to compare the best team on the championship (positioned on 1<sup>st</sup> place) with the rest of the teams.

## METHODS

Archival statistics of nine European women's basketball championships (from 1995 to 2011,  $n = 9$  championships, [www.fiba-europe.com](http://www.fiba-europe.com)) were processed. Eight best teams (1<sup>st</sup> to 8<sup>th</sup> place winners) were studied. The winner of the European championship was compared to the other eight teams ranked from second to ninth place. All in all, statisti-

cal protocols of 608 matches in the European championships which were held in 1995, 2007, 2009, 2011 (72 protocols of each match) and in 1997, 1999, 2001, 2003, 2005 (64 protocols of each match) were analysed. The analysis included the recorded number of shots scored in the game, numbers of throws (two-pointers, three-pointers and free throws) and their accuracy (%). The throws were defined according to distance, as follows: a short distance throw was a free throw; a middle distance throw was a two-pointer; and a long distance throw was a three-pointer.

### Statistical analyses

The Statistical Package for Social Sciences SPSS (v18.0, SPSS Inc., Chicago, IL) was used for the statistical analysis. Descriptive statistics were calculated for all experimental data. Kolmogorov-Smirnov test was used to test if data were normally distributed. Differences between the European champion team and the eight best teams were calculated using a three-way analysis of variance-ANOVA (time x throws x team). The statistical significance was set at  $p < 0.05$ .

## RESULTS

Figure 1 shows average indices, as well as the changes in the scored points of the European champions and the eight best teams in European championships. No significant difference was observed ( $p > 0.05$ ) between the European champions and the eight best teams in the number of points scored in the game in the European Championship from 1995 to 2001. Statistically significant difference in the scored points was established between the European champions and the eight best teams in the 2001 European Championship: the champions scored  $78.3 \pm 8.1$  points on average per game, and the average team score was  $69.9 \pm 5.6$  points ( $p < 0.05$ ) (Figure 1). In the European Championships of 2003 and 2009, women's teams scored more points on average than the team that won in the Championship, but the difference of this index between the teams was not statistically significant ( $p > 0.05$ ).

European best women's basketball teams won the maximum points in a match in 2003 Championship, averaging  $73.9 \pm 4.6$  points, and the European champions won most points during 2001 Championship match, i.e.  $78.3 \pm 8.1$  points. The fewest points were scored by the teams in the 2009 Championship, averaging  $64.6 \pm 8.8$  points. This index was also the worst for the champion team as they scored only  $63.1 \pm 8.9$  points.

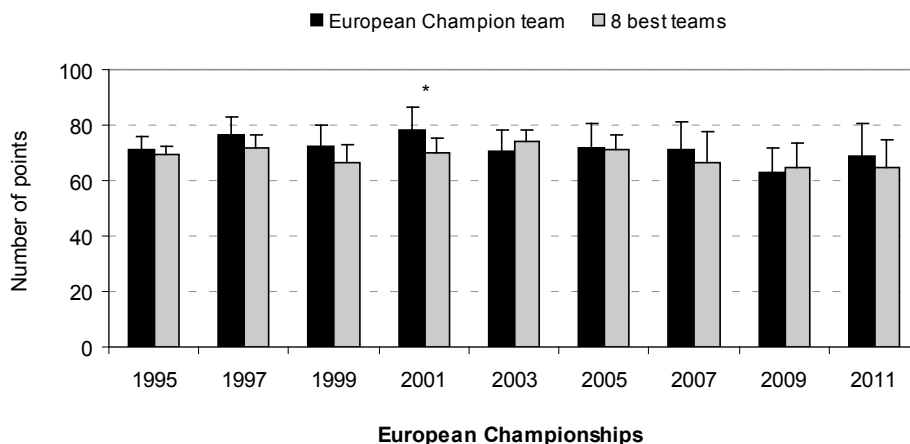


Figure 1: The number of scores for women's basketball teams in the European Championship matches (average per one game).

Note: \* -  $p < 0.05$ , comparing the average indices of the champion team and the best 8 teams.

Figure 2 shows changes in the average indices (number and accuracy of throws) for women's basketball teams. Most of the close-range and mid-range shots were performed by the teams in 1995 European Championship matches, an average of  $50.8 \pm 4.1$  shots. European champion team usually made close-range shots in 2005 Championship matches, an average of  $52.9 \pm 6.5$  shots. The team performed the fewest two-pointers in the 2009 European Championship matches, an average of  $41.7 \pm 7.6$  shots. European champion team performed the fewest close-range and mid-range shots in the 2003 and 2009 Championship matches, respectively,  $41.4 \pm 6.9$  and  $41.3 \pm 3.6$  shots. Comparing the differences of the average performance indices of eight best teams and the champions we see that only in the 1997, 2001, 2005, 2007 and 2011 Championships the champion team made more close and mid-range shots than the other teams, but statistically significant differences were established only in the 2007 Championship ( $p < 0.05$ ).

The accuracy of two-pointers was the best in the 1997 Championship matches, the average accuracy of team throws was  $48.9 \pm 2.1$  %, and the champions most accurately attacked in close positions in the championship of 1999, the average accuracy of the throws at that time was  $52.9 \pm 5.5$  %. The accuracy of close and mid-range shots was the worst in the 1995 Championship games, the average rate of team accuracy being  $41.9 \pm 2.3$  %, and the champions worst attacked the basket from a close position in the 2005 Championship games, averaging  $42.9 \pm 6.4$  %. In all championships, with the exception of the one in 2005, the accuracy of champion's close-range shots was better

than the average value of the eight best teams. A significant difference between the teams indices was established only in the Championship of 1999 ( $p < 0.05$ ) (Figure 2).

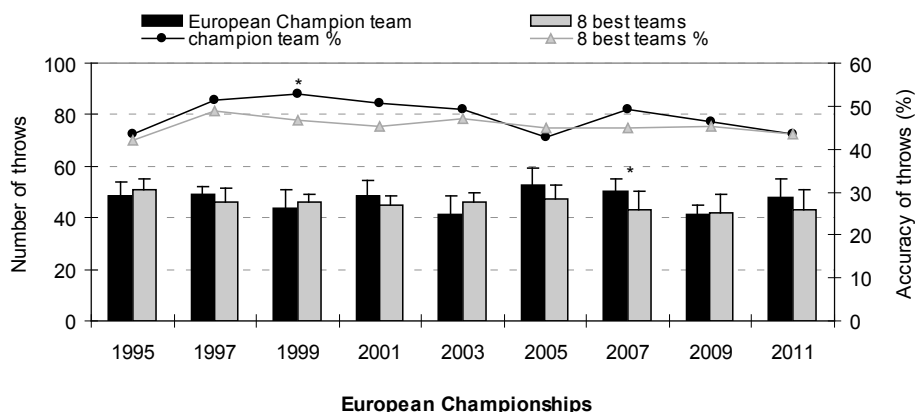


Figure 2: The number and accuracy of close and mid-range shots for women's basketball teams in the European Championship matches (average per one game).

Note: \* -  $p < 0.05$ , comparing the average indices of the champion team and the best 8 teams.

Figure 3 shows the changes in the indicators of long-range and mid-range shots (number of throws and accuracy) for women's basketball teams. Most of the long-range shots were made by teams in the 2009 European Championship matches, an average of  $17.4 \pm 4.6$  shots. The fewest two-pointers were made by teams in the 1999 European Championship matches, an average of  $8.2 \pm 1.1$  shots. The European champion team made the fewest shots from distant range in the 1997 Championship matches, an average of  $8.0 \pm 2.5$  shots. Comparing the differences in the average indices of performance of the best eight teams and the champions, we see that only in two championships (in 1995 and 1999) the champion team made more long-range shots than other teams, but the statistically significant difference in those indices was established only in the 2007 and 2009 Championships ( $p < 0.05$ ).

The accuracy of three-point throws was the best in the 2005 Championship, the average accuracy of team throws was  $34.4 \pm 5.9\%$ , and the champions most accurately attacked from far in the 2011 Championship, the average accuracy of the throws was  $42.7 \pm 12.9\%$ . The accuracy of long distance shots was the worst in the 1995 Championship games, the average rate of team accuracy was  $29.2 \pm 8.7\%$ , and the champions' worst long distance attack was in the 1997 Championship games,  $17.0 \pm 11.9\%$  on average. The accuracy of champions' three-pointers was better than the average index of eight best teams only in the 1995, 2001, 2005 and 2011 Championships. A statistically significant difference between the teams was established only in the 1997 and 2011 Championship ( $p < 0.05$ ) (Figure 3).

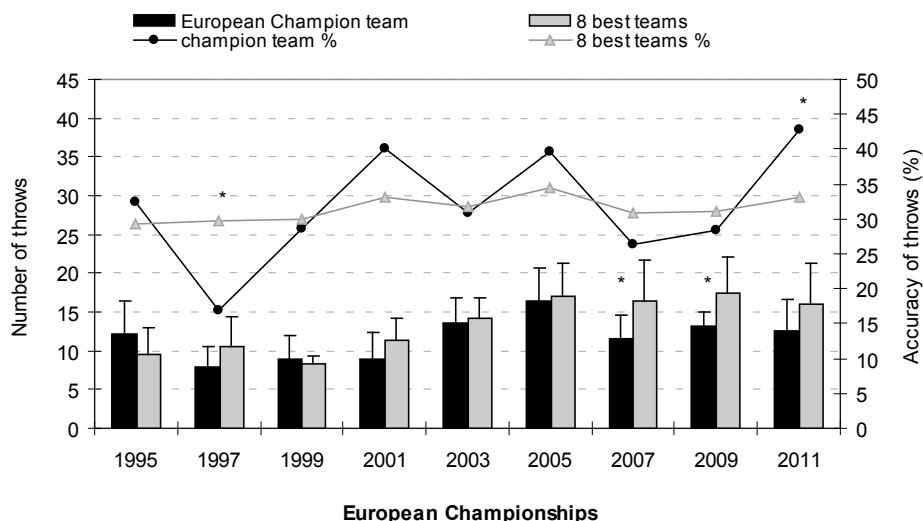


Figure 3: The number and accuracy of long-range shots for women's basketball teams in the European Championship matches (average per one game).

Note: \* -  $p < 0.05$ , comparing the average indices of the champion team and the best 8 teams.

Figure 4 shows the changes in the average indices of free throws for women's basketball teams (number and accuracy of throws). Most free throws were made in the 1995 European Championship matches, an average of  $26.0 \pm 2.8$  throws. European champion team made most free throws in the 1997 Championship, an average of  $28.3 \pm 8.1$  throws. The teams and the champions made the fewest free throws in the 2005 European Championship matches,  $15.7 \pm 3.0$  and  $10.9 \pm 5.2$  throws respectively. Comparing the differences of average performance indices of eight best teams and champions, in all the championships, with the exception of 2005, the champion team made more free throws than the other team. A significant difference between teams was established in the 2005 championship ( $p < 0.05$ ).

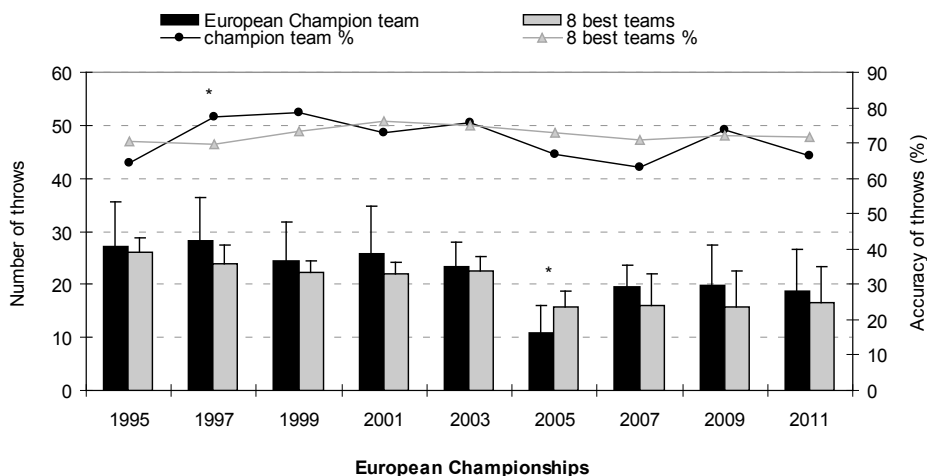


Figure 4: The number and accuracy of free throws for women's basketball teams in the European Championship matches (average per one game).

Note: \* -  $p < 0.05$ , comparing the average indices of the champion team and the best 8 teams.

Free throw accuracy was the best in the 2001 Championship, the average accuracy of team free throws was  $76.2 \pm 6.9\%$ , and the champions performed most accurate free throws in the 1999 Championship, the average accuracy of the throws was  $78.4 \pm 6.2\%$ . Free throw accuracy was the worst in the 1997 Championship, the average accuracy rate of teams was  $69.7 \pm 7.3\%$ , and the champions' worst attack of the basket from the free-throw line was in the 2007 Championship matches,  $63.3 \pm 11.8\%$  on average. The accuracy of free throws in the champion team was better than the average index of eight best teams only in the 1997 and 1999 Championships. Significant differences between teams were established only in the 1997 and 2005 Championships ( $p < 0.05$ ) (Figure 4).

## DISCUSSION

The aim of our research was to investigate the changes in the shooting indices (number and accuracy) of eight best women's basketball teams in the European championships (between 1995 and 2011). The analysis of the long-term performance indicators of the best European women's basketball teams highlights their variability. There was an obvious decline in the scored points since the 2003 European Championship, i. e. the number of points scored in the game dropped from 74 (in 2003) to 65 points (in 2009, 2011). One of the indicators that describe the nature of offence in basketball teams and the effectiveness of a game is the number of points scored. Of course, it depends on



objective factors: the opponents' style of play, the number of very capable players in the team, team tactics in a game, etc. (Reano et al., 2006). The causes of decline in performance could be stabilization of offensive and defensive tactics, more equal capacity of rivals, changes in rules (Tsamourtzis et al., 2002). The decrease in scored points could also be the result of fewer short-distance and medium-distance shots per game, intensified defence and, therefore, the increased number of turnovers per game.

In general, basketball performance depends offensively on shooting field goals (Trinić et al., 2002; Sampaio et al., 2004; 2006a, 2006b, 2010). In the game of elite women's teams, the end of the game is usually determined by the accuracy of shots, especially the shots from close and mid-range distances (which make up the majority of all the shots) (Kreivytė & Čižauskas, 2007, 2010). In the best eight teams, the best average shot from close and mid-range distances in one match was 51 (1995). The decrease in the number of such shots (by 8 to 10 shots) was observed in the latest European championships (2007, 2009, and 2011). The causes of the decrease in the number of shots could be either active defence in the penalty area or an increased number of long-range shots. Most authors claim in their works that the accuracy of two pointers can often determine the finish of the game (Mendes & Janeira, 2001; Dezman et al., 2002; Gómez et al., 2006, 2009). The number and the accuracy of successful shots from close and mid-range distances is the indicator reflecting offensive performance which shows that better teams are tactically disciplined with clear targets. Oliver (2004) argues that the basketball teams with slower game pace demonstrate better accuracy of shots from close and mid-range distances. The author explains the fact that while preparing for the game and competition, the team coaches increasingly focus on the improvement of shots and ball control. Our investigated accuracy of two pointers in the European championships teams changed insignificantly (the best shot accuracy was 48.9 %, and the worst shot accuracy was 42.9 %). The best accuracy of two pointers was reached by the champions of 1999, whose accuracy of throws was 52.9 %.

An increase in the number of long-range shots has been observed since the 2001 European championship. The number of long-range shots of eight best women's basketball teams in the 1995 championship was 9, and in the last European Championship (2011) the teams performed 16 long-range shots in a match. The European champions do not overindulge in these shots; only in two championships (1995 and 1999) they performed more long distance shots than other teams. Kreivytė & Čižauskas (2010) studied the differences of the performance indices between winning and losing teams in the 2009 European Women's Basketball Championship games and found that the losing team often rescues its performance with long distance shots at the end of the game, but when the game is point to point, the winning team makes fewer long distance shots, but their accuracy is better. Similar results were obtained by other authors (Csataljay et al., 2009, 2012) who investigated men's basketball teams. The accuracy of long-range shots from 1995 to 2011 European championships remained similar; it differed by only 4 %.

The number of free throws in the game shows the activity of a team in organizing and completing the attacks when the opponent applies active defence systems (Oliver,

2004). Free throw accuracy is exceptionally affected by the result of the match and the associated mental status of the basketball player performing a throw (Vickers, 2007). In 1995, the best women's basketball championship teams were very active in offence and stood at the free-throw line 26 times per game. High activity while finishing the attacks and the stability of the accuracy of free throws were demonstrated by the European Champion of 1997: in one championship match, the average of 28 free throws was made, and 22 of them were accurate (79 % accuracy), which accounted for 29 % of the total points in the game (Čižauskas & Kreivytė, 2004). Many authors (Trninić et al., 2002; Gómez et al., 2006; Csataljay et al., 2009, 2012) studied men's basketball teams and found that teams winning the matches made significantly more free throws than the losing teams.

Since the 2005 European Championship, a noticeable decrease in the number of free throws was observed. In this championship, the teams made only 16 free throws, and the European champion made even fewer, 11 free throws. A similar result was shown by the teams in the last European Championship in 2011 (fewer than 17 shots in a match). In all championships, European champions made more free throws than other teams except for one championship (in 1995). In closely contested games, free-throws have been reported to be important for the game outcome (Jukić et al., 2000; Gómez et al., 2006). It has been established that the mean accuracy of free throws of the world basketball players (both men and women) per match is 76 %. The 65 % accuracy of throws is considered to be poor, as the accuracy of the best basketball players usually reaches 90 % or more in a game (Vickers, 2007). The accuracy of free throws in our investigated teams matched the average assessment of the world's best teams (76 %) only in the 2001 European Championship. In other championships the accuracy of free throws was similar and altered for about 5 %.

## CONCLUSIONS

Model characteristics of women's basketball teams shooting and their changes: the number of scored points in one match decreased from 69 to 65 points; the number of shots from close and middle distances dropped sharply – from 51 to 43 points in a match; however, their accuracy remained similar – 42 – 43 %; the number of long-distance shots increased dramatically – from 9 to 16 points in a match, their accuracy had a tendency to increase from 29 to 33%; the number of free throws decreased significantly – from 26 to 17 points in a match and their accuracy remained similar – 71 to 72 %.

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