DIFFERENCES IN EFFICIENCY OF ATTACK IN THE TOP LEVEL VOLLEYBALL COMPETITION

ABSTRACT

The top volleyball national teams are comprised of the best national volleyball players, who very successfully performed the technical and tactical elements, precisely in the most important competitions. Based on this fact, the main problem of this research is successfulness in realiziation of technical and tactical elements in attack: service, setting and spike. The aim of the research was to determine differences in the efficiency of these elements between the three best-placed teams in the final classification at the European Volleyball Championships Rome-Belgrade, 2005.

With an analysis that includes all sets who have been played, it was concluded that the observed three national teams are statistically significantly different in the realization of attack, especially in service, and spike. It was also concluded that the elements in the attack individually contribute to mutual statistically significant difference of the national teams also in the level of sets that have been played in the qualifications. This especially applies to the service. At the level of sets that have been played in the finals of the Championship, are not identified statistically significant differences in attack between the national teams. This is justified by the high level of equality in the realization of technical and tactical elements, especially when it comes to elite-level competitions such as the World and European Championships.

Keywords: efficiency, attack, differences, European Championship, volleyball players.

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With an analysis that includes all sets that are played, it was concluded that the observed three national teams are statistically significantly different in realization of attack, especially in service and spike. It was also concluded that the elements in the attack individually contribute to mutual statistically significant difference of the national teams also in the level of sets that are played in the qualifications. This especially applies to the service. At the level of sets that are played in the finals of the Championship, are not identified statistically significant differences in attack between the national teams. This is justified by the high level of equality in the realization of technical and tactical elements, especially when it comes to elite-level competitions such as the World- and European Championships.

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INTRODUCTION

The specificity of the volleyball game is that in the sports match she can be separated in two phases that contain an attack and defense as basic activities. At the matches there are always those who attack, and the others who defend themselves. In their structure, each of these phases contains the technical and tactical elements as main tools for the conduct of sports fight in volleyball game. The results of some researches in volleyball and also competitive practice shows that is possible to determine a model of efficiency for each of these phases of the game and also to determine the overall efficiency for each team in a same contest, depending on whether the team better or worse was placed.

So, the basic problem of this research paper is the successfullnes of the realization of technical-tactical elements in attack. The aim is with discussion assumption that, under the principle of hierarchy, (most) successful national team will be the team which is (most) effective in the realization of services, setting and spike and in this way explain the final ranking of selected national team at the European Championship in volleyball for men held in Rome and Belgrade in year 2005. Subject of research refers to the analysis of elements in the attack techniques in terms of differences in the realization of these elements between the three best-placed teams in the final ranking of the first A and the other B group at the European Championship Rome-Belgrade 2005. Objectives are: (2) to determine the effectiveness of any individual element of attacks in the set and match, (3) to identify possible differences between the national team of Serbia and Montenegro, Russia and Italy in the efficiency of the attack at all stages of the competition, and (4) to determine which of elements differentiates these national selection of the most successful, more successful and

the least successful in attack.

Following the defined problem and research objectives, hypothesis are: (1) three best placed national team are different in the realization of attack in the level of all played sets, (2) three best placed national team are different in the realization of attack in the level of sets played in qualifications, (3) three best placed national team are different in the realization of attack at the level of sets played in the finals of the Championship.

RESEARCH METHODS

We apply the descriptive method, which aim is to explore the current state. This method is based on the technique of performing element of attack in men's volleyball, and then tactics as an instrument for their realization. Then, it is applied a comparative analysis of these elements for different levels of success of the three top ranked men's volleyball national team at the recently held European Championship in volleyball, Rome - Belgrade 2005. A sample of this research are the players of three best placed national teams and expression their techniques in 69 sets which they have in total played of the European Championship 2005. For research purposes, it is observed of 18 matches (5 matches in the group for each team, 2 in the finals of the tournament - semifinals, match for third place and final matches). The study represented a system of variables related to only one phase of competitive activity in a volleyball game - attack and within the phases the observed variables are: service, setting and spike (Kostić, 1999; Stojanović, Kostić & Nešić, 2005).

For collection of data about the structure of competitive activities in attack was used research techniques *the observation with registration*, and as an instrument was used observational paper. Each element is described on a four degrees scale based on criterion *successful* and *unsuccessful* (Nešić, 2006). For each technical-tactical element of the attack is determined one scale. After collecting the data, is counted coefficient of efficiency (KE) for each variable.

To process the obtained data were used descriptive methods to determine the normality of the distribution of the parameters and also methods of comparative statistics. From the area of comparative statistics was applied discriminant analysis to test differences of means of independent samples at the multivariate level.

INTERPRETATION OF RESEARCH RESULTS WITH DISCUSSION

The differences between the teams in the realization of attack - all sets that are played

In table 1 are presented the square of the coefficient of discrimination (Eigenvalue), canonical correlation coefficients (R Canonicl), values of Bertlet test (Wilks'Lambda), the value of Chi square test (Chi-Sqr.), degrees of freedom (df) and the value of probability of error, on the significance level of p=.05.

As can be noticed from the results, only the first discriminant function is statistically significant. The aforementioned discriminative power of the variables is expressed through the test (Wilks-Lambda), which in this case, the first discriminant function and the mean amounts (**.676**), and the value of Chi square test (**30.39**), which confirms that the differences between the three best teams are significant, because their significance level is above the

threshold probabilities (p-level =.**002** <.05).

Table 1. Significance of isolated discriminant function

DF	Eigenvalue	Canonicl R	Wilks' Lambda	Chi- Sqr.	df	p-level
1	.393	.531	.676	30.39	12	**.002**
2	.062	.242	.941	4.69	5	.454

In table 2 is presented the structure of the first discriminant function and the participation of technical and tactical variables of attack elements in forming of the discriminate function.

Table 2. Structure discriminant function

T.T. Element	DF 1
SERVICE	**.66**
SETTING	.20
SPIKE	**.55**

The most significant contribution to the first discriminative function have variables SERVICE =**.66** and SPIKE =**.55**, while the other variables have no significant correlation, given that the limit of significant correlation coefficients for df = 12 is **r = .532**, at the level of error probability **p= .05.**

Table 3. Centroids of the groups

Team	DF 1
ITALY	.38
RUSSIA	**.45**
SCG[1]	-.91

The centroids of the groups (Table 3) in this case represent the mean results of three national teams. It is clearly evident that in the technical-tactical elements SERVICE and SPIKE best results achieved national team of RUSSIA **(.45)** and ITALY **(.38),** because their centroids are located very close to each other in the quadrant with a positive value. The weakest results were achieved by national team of SCG **(-.91),** because his centroid located at the opposite pole, in the quadrant with negative sign. With an analysis of the mean values of all variables given in Graph 1 it is evident that Russia had the best results in the SERVICE, and Italy in the SPIKE.

Graph 1. *Mean values of variables in the attack*

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[1] SCG – Serbia and Montenegro
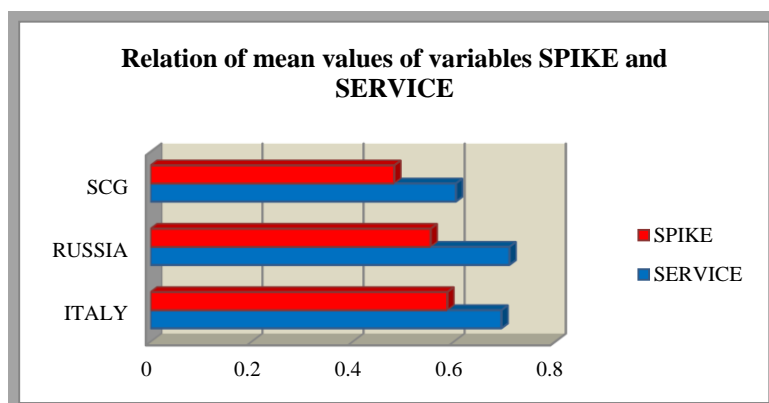
In order to explain between which pairs of national teams were noted the differences in efficiency in SPIKE, was calculated the significant difference for each pair.

Table 4. The significance of differences between teams

Team	ITALY	RUSISIA	SCG
ITALY	*	.581	**.003**
RUSSIA	.581	*	**.001**
SCG	**.003**	**.001**	*

It may be observed that the difference in success of the realization TT element[2] SPIKE noted between national teams of RUSSIA and SCG at the level of significance p =.**001** and of ITALY and SCG at the level of significance p =.**003**, and it can be concluded that the national teams of RUSSIA and ITALY had a statistically significant better results in spike then the SCG national team, in all sets that are played. Other values of the difference between national teams of RUSSIA and ITALY for these variables are not statistically significant (Table 4).

Table 5. Mean values of successfull realization of TT elements of attack of teams in all sets that are played

Team	SERVICE	SETTING	SPIKE	N
ITALY	.694	.335	**.587**	27
RUSSIA	**.710**	**.337**	.554	30
SCG	.604	.303	.482	26

The table 5 shows the mean of the successful realization of TT elements in attack, for the three teams in all played sets. The analysis reveals a best numerical result in SERVICE **(.710)** and SETTING **(.337)** for the national team of RUSSIA, and the best numerical result in the SPIKE **(.587)** for the national team of ITALY. From available data it can be concluded that in the attack phase, on the level of all played sets, the most effective

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[2] TT element - Technical and tactical element

was RUSSIA, then ITALY, and as the third SCG, which is in contrast with the final ranking of the three national teams in the EVC[3] 2005.

To be able to explain this phenomenon, it is necessary specifically in this case to analyze the differences in the successful realization of TT elements of attack in sets that are played by the groups in the qualifications, but also the differences in successful realization of TT elements in sets that are played in the finals of the Championship.

The differences between the teams in the realization of attack - sets that are played in qualifications

As can be noticed from the results (Table 6), only the first discriminant function is statistically significant. The discriminative power of the variables is shown by the test (Wilks-Lambda), which in this case, for the first discriminant function is medium and amounts **(.513)**, the value of Chi square test **(33.07)**, which confirms that the differences between the three best placed teams are significant, because their significance level is above the level of probabilities (p-level =. **001** <.05).

Table 6. Significance of isolated discriminant function

DF	Eigenvalue	Canonicl R	Wilks' Lambda	Chi-Sqr.	df	p-level
1	.781	.662	.513	33.07	12	**.001**
2	.095	.295	.913	4.50	5	.479

The table 7 shows the structure of the first discriminant function and the participation of technical and tactical variables in attack elements in forming of the discriminant function. The obtained values indicate that the variable SERVICE (-.**74**) have significant correlation at the level of sets played in the qualifiers, since the borderline significant correlation coefficients for df = 12 is **r =. 532** at the level of probability of error of .05.

Tabela 7. Structure discriminant function

T.T. Element	DF 1
SERVICE	**-.74**
SETTING	-.40
SPIKE	-.46

The centroids of the groups (Table 8) in this case represent the arithmetic mean of the results of three teams. It is obvious that in the technical and tactical elements SERVICE the best results achieved the national team of RUSSIA **(-.69)**, because its centroid is located in the quadrant with a negative sign (Table 8.), then the national team of ITALY **(-.48)**, and the weakest results were achieved by the national team of SCG (**1.23**), because its centroid is located at the opposite pole, in the quadrant with positive sign, and at very large distances

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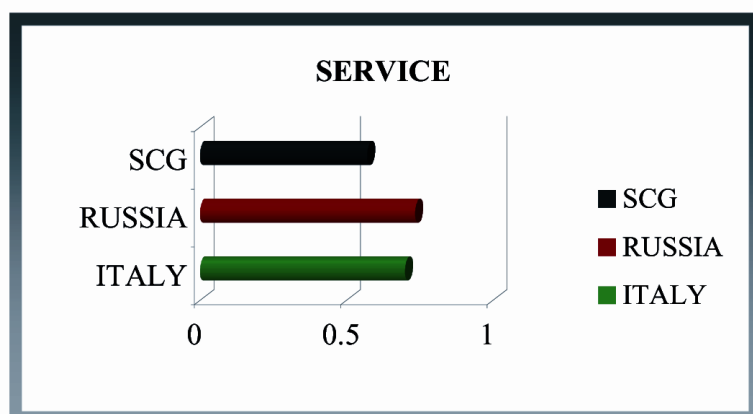[3] EVC - The European Volleyball Championship

from the centroid of teams of RUSSIA and ITALY.

Table 8. Centroids of the groups

Team	DF 1
ITALY	-.48
RUSSIA	**-.69**
SCG	1.23

With an analysis of the mean values presented in the Graph 2 can be noticed that RUSSIA is contained the best result in SERVICE, followed by ITALY and finally by SCG.

Graph 2. Mean values of variable SERVICE

To explain between which pairs national team have noted differences in the efficiency SERVICE, the significance of differences was calculated for each pair (Table 9). It can be noticed that the statistically significant difference in the effectiveness of TT elements SERVICE recorded between the teams of RUSSIA and SCG in the level of significance of p=**.000**, and the difference between the teams of ITALY and SCG in the level of significance of p =**.002,** so it can be concluded that the teams of RUSSIA and ITALY had significantly better service than the team SCG in sets that are played in the qualifications. The values of the differences between teams of RUSSIA and ITALY for this variable are not statistically significant.

Table 9. The significance of differences between teams

Team	ITALY	RUSSIA	SCG
ITALY	*	.576	**.002**
RUSSIA	.576	*	**.000**
SCG	**.002**	**.000**	*

The table 10 shows the mean performance realization TT elements of attack for national team in sets played in the qualifications. It can be noticed that the best numerical results in the SERVICE **(.734)** and SETTING (.**360**) has a team of RUSSIA, and SPIKE (.**590**) team of Italy.

Table 10. *Mean values of the success in realization of the TT elements in attack –*
all sets that are played in the qualifications

Team	SERVICE	SETTING	SPIKE	N
ITALY	.699	.329	**.590**	17
RUSSIA	**.734**	**.360**	.562	20
SCG	.570	.272	.479	18

These results are in accordance with the team standings at the end of the European Championship and they are match with the results of the differences that we found in all played sets, which leads us to the conclusion that the efficiency of teams from qualification had a significant impact on the final efficiency of teams at the end of the Championship. For this reason, we believe that the real value of the difference between successful realization of attacks and their impact on the final placement can be determined solely on the basis of differences in successful realization of attack sets played in the finals of the Championship, that is in the semifinal and final matches, where the three best teams were fighting in the direct duels.

The differences between the teams in the realization of attack - sets that are played in the finals of the Championship

As you can see (Table 11.), there was no even one significant discriminant function. The discriminative power of the variables is shown by the test (Wilks-Lambda), which in this case for both discriminant functions is medium and high (.**550** and .**838**), which confirms that the differences between the three best teams are insignificant, because their level of significance is below the level of probability (p-level =.**336** and .**553**>.05). Of course it is in such a case, where none of the discriminant function was not statistically significant, further interpretation of the manifest area is redundant, but it is very important for us to conclude that the numerical difference between the three teams to be able to compare team ranking with success in the realization of technical-tactical ethe elements in attack.

Table 11. Significance of isolated discriminant function

DF	Eigen-value	Canonicl R	Wilks' Lambda	Chi-Sqr.	df	p-level
1	.525	.587	.550	13.46	12	.336
2	.193	.402	.838	3.97	5	.553

The analysis of table 12, shows the mean of performance in the realization of TT elements in attack for the three teams and sets played in the championship finals it can be noticed that the best numerical results in the SPIKE (**.581**) and SERVICE (.**686**) have a national team of ITALY, while the SCG national team was the best in SETTING (.**373**). These results cannot explain to us the team ranking at the end of the European Championship because the differences in the success of the realization of the TT elements in attack between the three teams were not statistically significant.

Table 12. Mean values of the success in realization of TT elements in attack -
sets that are played in the final

Team	SERVICE	SETTING	SPIKE	N
ITALY	**.686**	.325	**.581**	10
RUSSIA	.663	.292	.539	10
SCG	.680	**.373**	.487	8

In order to explain the relationship between the final team ranking in the championship and the success of the realization of TT elements in attack, we have analyzed sets played in direct duels between the three teams, because it is likely that the team ranking at the Championship was decided in the fifth set in both semi-finals, so in the final match. The success of the realization of the TT elements in attack in the first four sets in these matches was decisive for the outcome, but the success of the realization of TT elements in the fifth and final set. For this reason, in the tables 13 and 14 we will show mean of success in the realization of TT elements of attack in the fifth set semi-final between teams of ITALY and SCG, and the fifth set of the final match between teams of ITALY and RUSSIA and try to use them to explain the final team ranking.

With an overview of table 13, can be noticed that the national team of ITALY had significantly much greater efficiency in the realization of the variables SPIKE (.**727**) and SETTING (.**417**) than the national team SCG, which in the same variables had significantly much lower efficiency (.**333** and .**278**). From the analysis of these differences can be noted that national team of ITALY achieved success in the realization of TT elements of attack, which is equal to the success of previous sets, while the SCG team had an extremely low success rate, especially in the SPIKE and SETTING elements. The result of this fifth set, which was decisive, was realized for the benefit of ITALY (15:8), which enabled her to fight for first place, and SCG for the third.

Table 13. Mean values of success in realization of the TT elements of
attack by the teams in the fifth set semi-final ITALY-SCG

Team	SERVICE	SETTING	Spike
ITALY	.769	**.417**	**.727**
SCG	**.889**	.278	.333

From the analysis results mean value realization of TT elements in attack by the national teams of ITALY and RUSSIA in the fifth set of the final match (Table 14.), it can be concluded that the national team of ITALY, in the elements from which he won the points directly and achieved an advantage in the game (SPIKE and SERVICE), had significantly better results. The national team of RUSSIA has achieved better results in the SETTING (.**412**), but this is an important element of preparation for the attack, and not for its realization. If we know that is extreme important the good realization of the attack to win the points, it is clear that the national team of ITALIY achieved an advantage in this set just with better realization of the attack (ITALY =. **900**; RUSSIA =. **588**).

Table 14. Mean values of the success in realization of TT elements by the teams
in the fifth set of the final match ITALY-RUSSIA

Team	SERVICE	SETTING	SPIKE
ITALY	**.786**	.250	**.900**

RUSSIA	.455	**.412**	.588

From previously presented ascertainments we can conclude that it is not possible to determine the team ranking based on their success in the realization of the TT element in attacks in all sets played in championship matches, as well as in sets played in final of championship. The reason for that can be found in the equal level of technical and tactical knowledge of teams who participate in the final of Championships. In this situation, the winner decided the winner is decided by several elements that often cannot be controlled, such as motivation, psychological condition of the team, elements of environment, etc.

CONCLUSION

Based on the given problem, subject, objectives and hypotheses it can be concluded that a three national teams have mutually statistically significant differences in the realization of attack, especially in the service and in the spike. Therefore, based on this, the first hypothesis which includes all played sets can be fully accepted. With this research is also concluded that elements of attack individually contribute to the mutual statistically significant difference of representation in the level of sets that are played in the qualifications. This especially applies to the service, so according to this, the second hypothesis can be also fully accepted. On the level of sets that are played in Championship finals, are not ascertained statistically significant differences between the national teams. With this, the third hypothesis is completely rejected.

These conclusions come from the fact that the national teams of Italy, Russia and Serbia and Montenegro, which have taken the first three places at the European Championship Rome-Belgrade 2005th, are equal by the technical and tactical knowledge and by success in attack. This is clearly observed with an analysis of their success through direct duels in the finals of the Championship. Reasons for that should be looking through the high level of equality in the realization of the TT elements in attack, especially when it comes to elite-level competitions such as the World- and European Championships.

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