# The analyses of efficiency of a power serve in jump depending on the accuracy of its performance in the competitive activity of volleyball players

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***Purpose:*** *to study dependence of indicators of efficiency and quality of a power serve in jump from the increase in accuracy of its performance.*

***Material & Methods:*** *pedagogical observations, mathematical methods of processing of results.*

***Results:*** *the comparative analysis of these indicators of the group of volleyball players of series of plays of the superiority of teams of the highest league, which took place before and after the corresponding experiments, connected with use of the offered by the author technique of increase in accuracy of a serve, is carried out. The assessment of statistical reliability of distinctions between results of the comparative analysis of the corresponding indicators of efficiency is executed by means of the criterion of Student.*

***Conclusions:*** *the reliable changes in values of the corresponding indicators of efficiency of a serve testify to the effectiveness of the offered technique, and consequently, about the correctness of its use during the training process.*

***Keywords:*** *accuracy, criterion, statistical reliability, quality, experiment, technique.*

## Introduction

In recent years, the pronounced trend in the development of men's volleyball at the highest achievements is the desire for widespread use of a power serve in jump in the game of teams. Number of volleyball players, who manage this serve perfectly, is growing all the time. Brilliant performers of this technique appeared in many teams. Analysis of the results of games of the most important international competitions showed that this method of serve plays an important role in achieving success in the competitive activity of volleyball teams, because it allows you to win the point immediately after its implementation. However, it should also be noted many mistakes during its performance, which in turn can lead to loss of points, and even defeat of the team [3; 6; 8].

Therefore, one of the decisive factors in raising the level of the game of the team and the success in competitions of various ranks is technical and tactical improvement of a power serve in jump, the purpose of which is associated with the increase in its efficiency and quality. The increase of the accuracy of its performance in a certain area of the playing court plays the important role in addressing of this issue. This can be achieved by paying serious attention to the appropriate correction of technique of performing of a serve during the training process.

We offered the technique to improve the accuracy of the performance of a serve, according to which the relevant experiments were carried out, for the practical realization of this task [3; 6; 9]. We developed practical recommendations to improve the accuracy of a serve in the works [3; 6] on the basis of the results of the analysis of statistical data of the mentioned experiments and findings of pedagogical observations in the course of their implementation. In accordance with the

practice of sports studies, the repeated experiment was carried out, after the selected group of volleyball players within a certain time used our recommendations during the relevant training.

The comparative analysis of the relevant results was carried out, which were obtained in the processing of statistical data of both experiments, to determine the positive effect of the introduction of the proposed method in the practice of the training process [2]. The assessment of statistical significance of differences between the results of this comparative analysis, which was conducted with the help of the criterion of Student, brought the presence of significant positive change at them.

The important task is control from the sight of the positive effect of the impact of the proposed method to the assessment of the effectiveness of the performance of a power serve in jump in the competitive activity of the qualified volleyball players.

### Communication of the research with scientific programs, plans, subjects

The study was performed according to the plan of the research work of the chair of Olympic and professional sports, the chair of sports and outdoor games of Kharkiv state academy of physical culture. The direction of the research is executed on the subject of the Consolidating plan of research works in the field of physical culture and sports in 2011–2015 on the direction: "Improvement of the training process in sports" (number of state registration is No 0111U003126), on 2016–2018, on the subject "Psycho-sensory regulation of motor activity of sportsmen of situational kinds of sports."

### The purpose of the research:

to learn the dependence of efficiency and quality of a power serve in jump by improving the accuracy of its performance through introduction of the proposed method in practice of the training process.

## Material and Methods of the research

The great importance is given to control of the effectiveness of such innovations at improving the training process through the introduction of new programs, methods, new organization of the training mode, and so on. The competitive activity provides the effective control in the ultimate total as the sports result, which is shown in the course of the competition, is one of the main characteristics of the work of the sportsmen. At the same time, as a rule, it is necessary to compare the initial and final group of indicators of the competitive activity. The comparison can be done by assessing the statistical significance of differences in the indicators, which are investigated. The basis of this comparative analysis can include any indicators and characteristics of the competitive activity. Innovation contributes to positive changes in the values of the relevant parameters of the competitive activity in the presence of these significant changes.

Indicators of effectiveness of a power serve in jump of the group of volleyball players, who participated in the experiments, are included in this work, in the basis comparative analysis [3]. These indicators were identified during the analysis of relevant statistical data series of the Ukrainian championship games among teams of the highest league. The corresponding results of the analysis of performance of a serve by volleyball players in five games on the national championship were used as an output for indicators of effectiveness, during preparation of which the proposed method, is not used in the training process (the initial set of indicators). The certain indicators were also identified in the following five games of the Championship (the finite set) after the cycle of training sessions with the use of the noticed method and the experiment repeated.

Calculations of indicators of effectiveness and quality power serves in jump are performed in this work within the framework of the developed by us approach on the basis on the method of V. K. Lisyanskyi, which is based on mathematical processing of statistical data of pedagogical observations of the game [1].

## Results of the research and their discussion

Restraining the corresponding results of the work [1; 5], we introduced the indicator of effectiveness of a serve (IES) of a certain player in a separate game, using the following correlation:

$$IES = S / N$$

$$S = \sum_i n_i K_i ,$$

Where $n_i$– number of serves that meet the assessment to a specific index $i$ and $K_i$ – the value of specificity factors, $N = \sum_i n_i$ – the total number of serves.

That is, IES determines the combined probability of winning a point in the separate game after the submission of the relevant player and game action of the opposing team.

The values of the introduced by us factors for assessing the quality of a serve $\alpha_i$, which is made by a certain player in a separate game, were calculated using the following formula:

$$\alpha_i = n_i K_i / S$$

They determine the relative contributions to the appropriate indicator of effectiveness of a serve of each game action with the specific end result, the probability of which is equal to $K_i$ [1].

The analysis of statistical data on the implementation of serves by the group of volleyball players, which is conducted with the help of the developed by us computer program "ServeStat" [5], showed: that the initial set of data includes the total number of serves, which is 273, from which 55 were lost and 5 were won directly after performance of a serve (ace); and the final set – 312, 50 and 15 serves, respectively.

The detailed information on indicator of effectiveness and quality of serves in a concrete match was also provided by means of this program. The example of its report to the relevant request of the individual statistics of individual players in one of the games is presented on pic. 1. The following meanings were used in the report: Quan, Quant mis and IES that meet the number of serves, errors, when it is executed and the values of indicator of effectiveness of a serve for different players, respectively. Values α-factors $\alpha_2$, $\alpha_3$, $\alpha_4$, and amounts $\alpha_5$ and $\alpha_6$, ($K_5=K_6=1$), are marked as *α2, α3, α4, α56*, respectively.

**Individual player statistics**

| Team | Player Number | Count | Tot. count | PEP | *a2* | *a3* | *a4* | *a56* |
|---|---|---|---|---|---|---|---|---|
| **Loco Express** | 5 | 16 | 3 | 0,33 | 0,45 | 0,22 | 0,14 | 0,19 |
| **Loco Express** | 8 | 20 | 3 | 0,34 | 0,42 | 0,33 | 0,11 | 0,15 |
| **Loco Express** | 11 | 16 | 1 | 0,37 | 0,45 | 0,38 | 0 | 0,17 |
| **Loco Express** | 13 | 14 | 2 | 0,32 | 0,46 | 0,37 | 0,16 | 0 |

**Pic. 1. Report on the individual statistics of power serves in jump**

The following results were obtained during carrying out the average analysis of values of IES: for the initial set of indicators in the sample size n=20, the arithmetic mean of IES $\overline{X}$=0,25, the standard deviation σ=0,042; for the finite set (sample size n=20) the arithmetic mean of IES $\overline{y}$ =0,35, the standard deviation σ=0,019.

The comparison of IES indicator values was carried out using the statistical significance of the criterion of Student. In the practice of sports studies, this test is used to compare the mean values of parameters [7]. For the value of the *t*-test with errors representativeness *m*, which are equal to 0,0096 and 0,0044 for the initial and final samples, respectively, we get t≈9,47. When the reliability P=0,95, which is typically used in sports studies in accordance with the table of Student (see, E.g. [7]) we limit this criterion $t_{lim}$=2,02 volumes for samples, which are indicated higher.

As from the comparison of both criteria it comes up, that $t > t_{lim}$, the difference between the indicators, which were considered statistically significant. This means that the significant paradigm shift is in the initial and final set of indicators. Thus, we can conclude that the proposed method of the improvement of accuracy of performance of a serve proven itself as an ef-

fective innovation.

The average values α-factors that give contribution to the corresponding value of IES of the initial (finite) set of these indicators are showed in pic. 2 and 3.
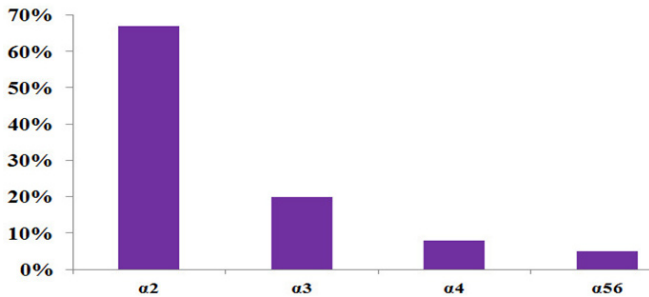


**Pic. 2. Diagram of the quality of a power serve in jump to the original set of statistics**

With regard to the assessment of the quality of performance of a serve, the factors $\alpha_5$ i $\alpha_6$, which are connected with the winning of a point immediately after the implementation of a serve, mainly determined its quality. The greater the total contribution of these factors in the value of IES, the better a serve is. We believe the quality of the effective serve should be estimated by the sum of the three factors $\alpha_4$, $\alpha_5$ i $\alpha_6$, which are proportional to the values of the highest probability to win the point [1].
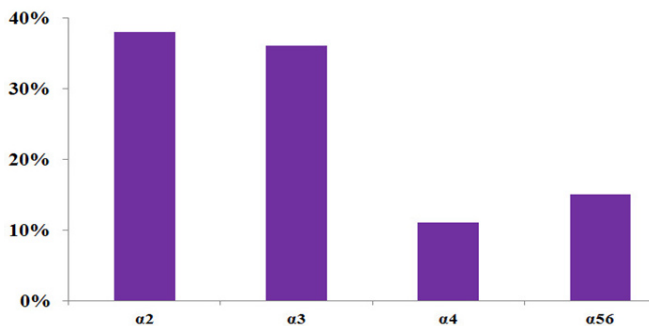


**Pic. 3. Diagram of the quality of performance of a serve in jump for the final set of statistics**

Comparing the results for α-factors that are shown in these pictures, it can be concluded that the serve, which corresponds to the diagram in pic. 3, is much better, as the total contribution of its effectiveness α-factors, $\alpha_4$, $\alpha_5$ i $\alpha_6$ is much higher. While as, $\alpha_2$-factor makes the main contribution to the efficiency of a serve, which corresponds to the diagram in pic. 2, that is connected with the lowest probability to win the point.

## Conclusions

The influence of the proposed methods of the improvement of the accuracy of performance of a serve in jump on one of the main indicators of competitive activity is studied by the author – the indicator of the effectiveness of its implementation. For this purpose, the comparative analysis of these indicators is conducted, which were defined in the experimental group of volleyball players in a series of games of the national championship league teams, which were held for the initial experiment [6] and after the repeated experiments [3], in preparation for which this technique was used. The effect of the test innovations is assessed by the criterion of statistical significance of Student. The observed significant changes in the respective indicators of effectiveness of a serve testify to the effectiveness of the proposed technique, and thus the correctness of its use during the training process. The analysis of statistical data on the implementation of serves also showed that the average indicators of efficiency of a serve increased by 10%, reduced the number of errors when performing multiple serves, and the number of points which are won directly rose noticeably after performance of a serve.

A comparative analysis of the quality of performance of a serve by volleyball players on games before and after the corresponding experiments showed that it is more qualitative in the latter case, because the relative contribution α-factors which are proportional to the highest values of the probability to win the point, and the indicator of effectiveness of a serve is substantially higher. While in the first case, α-factor makes the main contribution to this indicator, which is connected with the lowest probability to win the point.

**Prospects for further research.** The conducted by us researches of opportunities of the offered technique of increase in accuracy of a power serve in jump from the point of view of positive influence on indicators of efficiency and quality of its performance proved that its use is correct in the course of training of volleyball players for competitions. Interest of use of this technique in the training process in beach volleyball, considering its specific features is interesting of the practical point of view.

## References

1. Gradusov, V. O., Lisyanskiy, V. K. & Melnik, A. Yu. (2011), "Research of efficiency and quality of feed volleyball skill in competitive activities", *Pedagogika, psikhologiya ta mediko-biologichni problemi fiz. vikh. i sportu*, No 6, pp. 26-30. (in Ukr.)
2. Melnik, A. Yu. (2015), "An analysis of the laws of motion of the ball when the power supply in the jump", *Slobozans`kij naukovo-sportivnij visnik*, No 1 (45), pp. 81-84. (in Russ.)
3. Melnik, A. (2016), "The efficiency analysis techniques to improve the accuracy of the power supply in the jump qualified volleyball", *Slobozans`kij naukovo-sportivnij visnik*, No 3 (53), pp. 84-88. (in Ukr.)
4. Melnik, A. Yu. (2015), "Study of kinematic characteristics of the ball on the accuracy of the power supply in a jump in volleyball", *Problemy i perspektivy razvitiya sportivnykh igr i edinoborstv v vysshikh uchebnykh zavedeniyakh: Sb. X mezhdun. nauchn. konf., 6 fevralya 2015 goda* [Problems and prospects of development of sports and martial arts in higher education: Coll. X Internat. Scien. Conf.], Kharkiv, February 6, 2015, pp. 112-114. (in Ukr.)

5. Melnik, A. Yu. (2013), " Research of efficiency of feeding in volleyball based on database technology Microsoft Access", *Slobozans`kij naukovo-sportivnij visnik*, No 3, pp. 185-189. (in Russ.)

6. Melnik, A. Yu. & Gradusov, V. O. (2015), " Development of methods for increasing the precision of the power supply in a jump in volleyball", *Naukoviy chasopis "Naukovo-pedagogichni problemi fizichnoi kulturi*, No 8(63)15, pp. 54-57. (in Ukr.)

7. Nachinskaya, S. V. (1987), *Osnovy sportivnoy statistiki* [Fundamentals of sports statistics], Vishcha shkola, Kyiv, 189 p. (in Russ.)

8. Asai, T. et al. (2010), Fundamental aerodynamics of a new volleyball, *Sports Technology*, Vol. 3, No 4. pp. 235-239.

9. Melnik, A. (2015), "Studying the physical laws of moving ball at the power serve in jump", *Slobozhanskyi herald of science and sport*, No 1(45), pp. 76-81, available at: http://journals.uran.ua/sport_herald/article/view/59295/55200

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