Efficiency of students passing the GTO standard "16 kg kettlebell snatch" after the introduction of advanced specialization in kettlebell sport

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Abstract

Objective of the study is to evaluate the effectiveness of students' performance of the GTO standard "16 kg kettlebell snatch" after the introduction of the specialization "Kettlebell lifting".

Methods and structure of the study. The following research methods were used in the work: literature review, mathematical processing of research results, data collection. Using the example of data on passing the GTO standards for snatching a 16 kg kettlebell, an analysis of the dependence of the results on the introduction of the specialization is carried out.

Results and conclusions. The obtained achievements indicate a positive impact of the strategy of introducing the specialization "Kettlebell lifting" on increasing the level of physical quality "strength" of students.

Keywords: *kettlebell lifting, students, strength training, snatch, passing standards, gamma distribution, data extrapolation.*

Introduction. Currently, kettlebell lifting is one of the most actively developing sports disciplines. A distinctive feature of kettlebell lifting is its relative cheapness and convenience of training - it can be done outdoors, in a forest belt, indoors, in a gym or even in a student dormitory room. Research on kettlebell lifting as a specialization of the discipline “Physical Education” in higher education institutions is especially relevant, which is due to the significant role of this discipline as one of the factors in maintaining and supporting the physical, mental and social health of students [1].

Kettlebell lifting can be especially useful and recommended for people suffering from back problems or leading a sedentary lifestyle. This is due to the fact that kettlebell lifting training has a high level of intensity, which allows you to burn a large number of calories in a short time, as a result of which weight loss occurs [2].

Objective of the study is to evaluate the effectiveness of students in fulfilling the GTO standard “kettlebell snatch 16 kg” after the introduction of the specialization “Kettlebell lifting”.

Methods and structure of the study. In this paper, using the example of data on passing the GTO standards for snatching a 16 kg kettlebell for the fall of 2022, 2023 and 2024, an analysis is made of the dependence of the results on the introduction of specialization. It is assumed that with the introduction of the specialization “Kettlebell Sport” in 2023, students will more often and more successfully perform a kettlebell snatch as an exercise to determine strength when passing the GTO standards. Classic statistical methods of data processing taken from probability theory and mathematical statistics are used as research methods.

Results and conclusions. The table presents aggregated data with the total performance of the kettlebell snatch by all students in the fall of a particular year.

It clearly shows that the introduction of specialization has significantly increased students’ interest in fulfilling this standard. For a more detailed presentation of the data, we will divide the results into ranges of 5 units: from 10 to 110. Taking into account all of the above, we will present the data for 2022-2024 in the form of histograms (Fig. 1).

Results of passing the standard for snatching a 16 kg kettlebell

Year	Number of students	Number of lifts
2022	56	2376
2023	122	5414
2024	183	8681

Fig. 1 gives a clear idea of the dynamics of changes in passing the standard. As the total number of students passing this standard increases, the scales along the ordinate axis also change. In the first histogram, corresponding to the period before the introduction of the Kettlebell Lifting specialization, the data are grouped to a greater extent around the snatch values less than the median - 40, but there are also values significantly greater than 40, which indicates an a priori presence of students interested in kettlebell lifting. In the next two histograms, the distribution pattern takes on a more "average" character: the values are grouped around the median (40), while the number of students passing the standard for high values remains approximately the same, but the number of students passing the standard for a value less than the median has significantly decreased, which allows us to judge the averaging of the results. Below are the mathematical expectations and standard deviations of the specified samples: m_{22} = 43,1250, m_{23} = 45,9426, m_{24} = 4 8,9208, σ_{22} = 21,8162, σ_{23} = 16,7685, σ_{24} = 18,5662, где m_{2i} ,σ_{2i} , $i=2...4$, – are the mathematical expectations and standard deviations, respectively, for the autumns of 2022, 2023, and 2024.

Let us agree that now and in the future the level of statistical significance will be equal to 0.05. Let the hypothesis consist in fulfilling condition (1), $M(X_{22}-X_{23})=a_0=0$ (1), where $M(...)$ – is the designation of the mathematical expectation, are $X_{22,}$ X_{23} – random average values from the samples of the 22 nd and 23 rd years, respectively; while H_1 the hypothesis is expressed as follows: $M(X_{22}-X_{23}) <0$.

Substantially, (1) and the competing hypothesis mean checking whether the introduction of specialization in 2023 is statistically significant, i.e. whether it significantly affected the results of passing the standards. To check (1), we find the critical value of the left-hand critical region using the table of critical points of the Student's distribution. The significance level is 0.05, the number of degrees of freedom is $n=20-1=19$. Then $t_{kp=}2,09$ – If $t^*> - t_{kp}$ то H_0 then the hypothesis is accepted, otherwise – rejected. Let's calculate the values, D = – 0,7416, S_d= 2,9639, we get t^*=–2,3604 < – 2,09, H_0 the hypothesis about the statistical insignificance of introducing specialization is rejected – i.e. the hypothesis is accepted.

From the mathematical expectations calculated above, it is easy to see that the dynamics of change in results is positive – i.e. the indicators are increasing, therefore, taking into account the acceptance of this hypothesis, it can be argued that the introduction of specialization in 2023 had a positive effect on students' results in passing the 16 kg kettlebell snatch standard at the GTO. Similarly, we examine the statistical significance of changes in the results of 2024, relative to the results in 2023. Calculated value In this case, the hypothesis about the statistical significance of changes is also accepted. This means that in 2024, the changes relative to the year of introduction of the specialization are also significant and, we note again, positive.

As can be seen, for the gamma distribution, the hypothesis can be accepted with accuracy up to statistical significance for all years.

Fig. 2 shows the graphs of the gamma distributions corresponding to the samples shown in Fig. 1, respectively, and supplemented with a linear forecast for 2025.

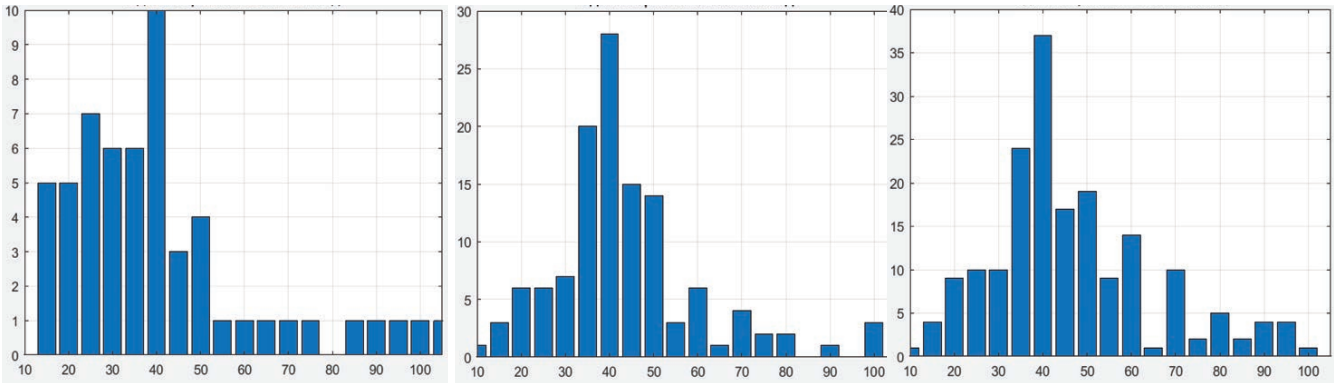

Fig. 1. Histogram of passing standards among students in 2022-2024

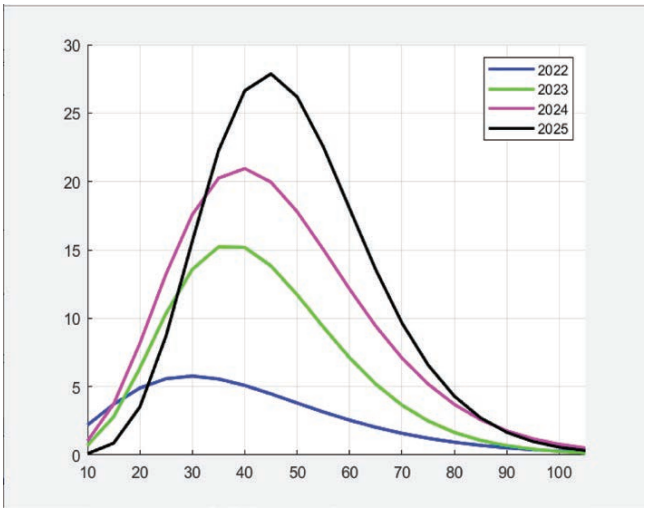

Fig. 2. Gamma distributions that best approximate the results of standard measurements

Each of the distributions differs from the previous ones in the overall sample size, as well as the position of the maximum: over time, it shifts to the right. Over time, the mathematical expectations, variances, and the total number of students participating in passing the standard change. All the conclusions described in Fig. 1 also apply to Fig. 2, which allows us to see the improvements in the quantity and quality of passing the standard in a more visual form. Let us now solve the problem of predicting the results of passing the standard in 2025. For simplicity, we will approximate the following value of the mathematical expectation according to the linear law, characteristic of the first few years of dynamics: m_{25}=51,7919 .

We will calculate the dispersion based on extrapolation by a periodically decaying exponential function: σ_{25} = 15,8698.

To calculate the total number of students in the Kettlebell Lifting specialization participating in the GTO standards, we will use extrapolation using the logistic function: n_{25} = 213 .

The final extrapolation is shown in black in Fig. 2. It is clear that the graph has shifted to the right as before, while the number of students passing the standard with low values has decreased even more, while the overall level of physical fitness has increased even more, so that on average each student in 2025 should be able to perform 51 snatches with a 16 kg kettlebell in peak condition, while the spread of values has become even smaller.

Conclusions. On average, all students pass the standard significantly better, and the number of students passing it has also increased significantly over time, which allows us to judge the positive dynamics of interest in kettlebell lifting. Let us also note the dynamics of the number of students passing the kettlebell snatch test with a gold medal: 33 out of 56 students in 2022, with P(x)=0.5893, 99 out of 122 in 2023, with P(x)=0.8115, 149 out of 183 in 2024, with P(x)=0.8142, the forecast for 2025 is 184 gold out of 213 students, with P(x)=0.8638.

As can be seen, over time, not only the total number of students passing the snatch test increases, but also the number of students passing this test with a gold medal, and even the percentage of such students, which is quite consistent with the dynamics and strategy for introducing the specialization presented above.

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