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# THE SIGNIFICANCE AND RELEVANCE OF USING THE SPSS STATISTICAL PROGRAM IN SPORTS ACTIVITIES

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## ABOUT ARTICLE

**Key words:** Sports statistics, SPSS Statistics package, sports activity, training load, results, scientific analysis.

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**Abstract:** Mathematical statistics provides the foundation for developing approaches that help identify the most effective solutions when dealing with random and unpredictable factors affecting a system. In sports research, processing the collected data using statistical methods is an essential step.

Among the tools for conducting analysis in the humanities, the IBM SPSS (Statistical Package for the Social Sciences) system is one of the leading options. The SPSS Statistics package is a powerful platform for performing complex analyses and includes a wide range of methods, such as non-parametric tests, as well as univariate and multivariate procedures. This program can be used to calculate various descriptive statistics, such as the median, mode, mean, and standard deviation, and to utilize a number of specialized functions. Furthermore, the system has functionality for grouping data according to specified criteria, creating

hierarchical data structures, and analyzing correlations using various measurement methods.

One of the significant advantages of SPSS is its support for a multitude of distribution laws. The base version provides a module for analyzing linear and nonlinear dependencies. The availability of a large number of built-in and add-on modules makes the user's work considerably more convenient and efficient.

**Introduction.** The SPSS program is an important management tool for coaches and specialists, enabling the prompt and reliable processing of data in the sports field [2;3;7;11]. The program helps determine the relationships between athletes' physical fitness indicators, training load effectiveness, technical precision, and athletic performance. Statistical analysis allows for the early identification of problems that arise during an athlete's training, as well as the adjustment and individualization of training programs [2; 3; 7; 11].

The role of statistical analysis is invaluable in modernizing the national sports system, improving the educational and training process in sports institutions, and developing the Olympic reserve [1;2;8;11].

Statistical analysis plays an important role in improving the training process, selecting athletes, assessing the dynamics of their preparedness, and providing scientific support for sports activities. The use of modern statistical software makes it possible to make more informed decisions regarding the planning of training loads, monitoring of functional state, and evaluation of athlete training effectiveness [1; 2; 8; 11].

The SPSS software package has a rich set of features, from entering and modifying research data to performing statistical processing, ranging from the elementary calculation of mean values to the application of complex multivariate methods [3;4;5;6;7;10]. From the perspective of visualizing the obtained data and creating various diagrams, the research problem is a very important and necessary phenomenon. This problem has not yet been sufficiently studied and requires scientific investigation as a pressing issue. Educational and scientific institutions worldwide are conducting research on the pedagogical foundations for improving data processing using the SPSS program.

**Relevance.** Achieving high results in modern sports requires a training process based not only on practical experience but also on a scientific and statistical approach [1;2;8;11]. Athlete training is a complex, multifaceted system, which necessitates a detailed analysis of the interdependencies between training sessions, recovery processes, technical-tactical

characteristics, and athletic achievements. In this context, the use of modern statistical tools in sports activities becomes particularly relevant. Given the increasing volume and diversity of data in sports, their structured analysis and processing are of paramount importance.

SPSS software enables in-depth analysis of athletes' physical, technical, and functional fitness parameters, assessment of the effectiveness of training processes, and monitoring of changes in their dynamics [3;4;7;8;11]. Such research makes it possible to objectively evaluate athletes' readiness levels, develop tailored training plans, and forecast future athletic achievements.

**Research Problem.** Despite the widespread adoption of digital technologies in sports science and practice, the application of the IBM SPSS program for the statistical processing, interpretation, and visualization of data in sports has not been adequately addressed [3-7;10]. This necessitates a more detailed analysis of its practical capabilities within the framework of athlete training, pedagogical monitoring, and scientific support for the training process.

**The Aim of the Study** is to substantiate the significance and relevance of using the IBM SPSS statistical program in sports activities, as well as to demonstrate its practical capabilities for processing and analyzing sports research data.

**Research Objectives.**To explain the significance of statistical analysis in sports; to describe the main capabilities of the IBM SPSS program; to demonstrate the stages of data preparation and entry into the program; to demonstrate the application of descriptive statistics and Student's t-test using a sports study as an example; and to determine the practical significance of SPSS for coaches, instructors, and researchers.

**Materials and Methods.**This paper presents the results of a statistical analysis of data obtained while monitoring training sessions at sports facilities. The study was conducted among 12–13-year-old boys and girls and aimed to examine the comparative dynamics of physical fitness indicators in male and female athletes. A total of 32 individuals participated in the study (n=32). The analysis of the results revealed the characteristics and differences in the level and dynamics of the subjects' physical fitness based on gender.

Before entering data into SPSS, it is necessary to create a variable layout (structure) (based on, for example, a questionnaire) [3, 4, 6, 7, 10]. Data can be imported from MS Excel or MS Access. For example, importing is done through the "Open Data" dialog box by selecting and confirming the desired file. 7; 10]. Data can be imported from MS Excel or MS Access.

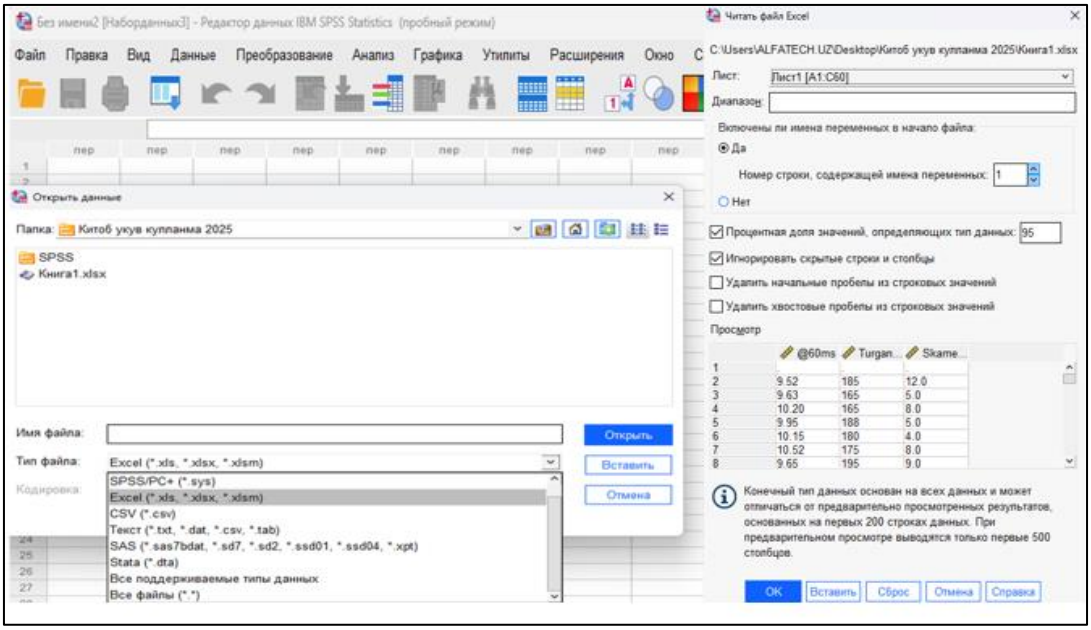


**Figure 1.**Starting the program and entering data into SPSS

In this case, the questions form the basis for the variables. Each variable has its own settings (e.g., name, permissible values, scale type). The database structure should ideally be defined during the research planning and tool development stage (e.g., creating a questionnaire) in accordance with the research hypothesis and objectives.

**Step 1**. Assigning variable names

**Step 2.** Defining their parameters

**Step 3.** Entering data

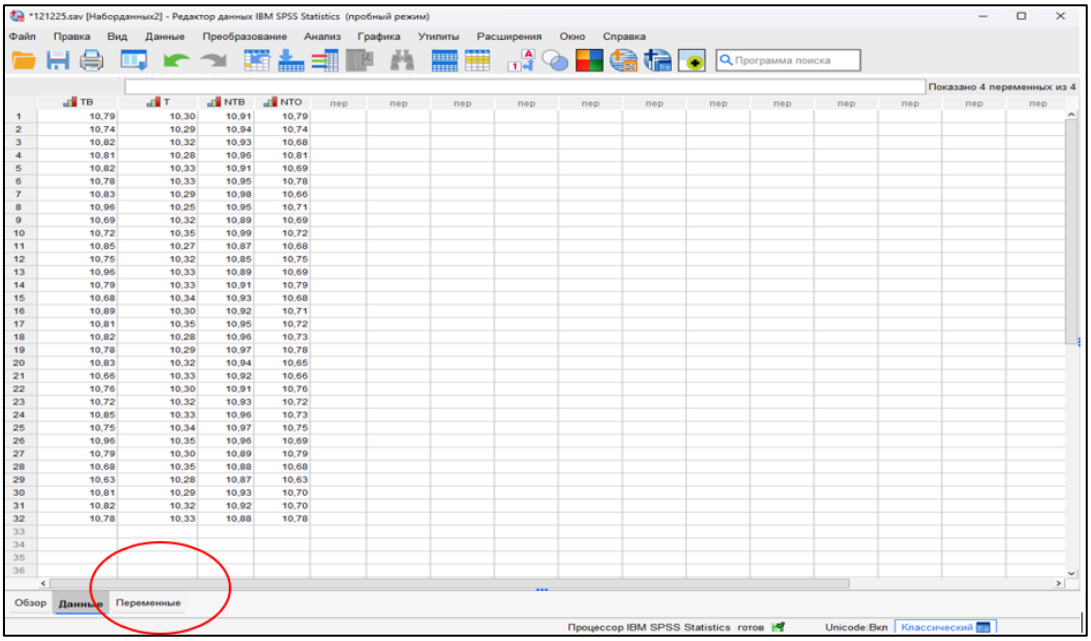


**Figure 2** – Entering data and defining variable parameters in SPSS.

The Variables tab (Variable View) contains information about the parameters of the variables into which the collected data is then entered.

**Variable name (Name):** the first character must be a letter; it must be unique and not exceed 64 characters; spaces are not allowed.

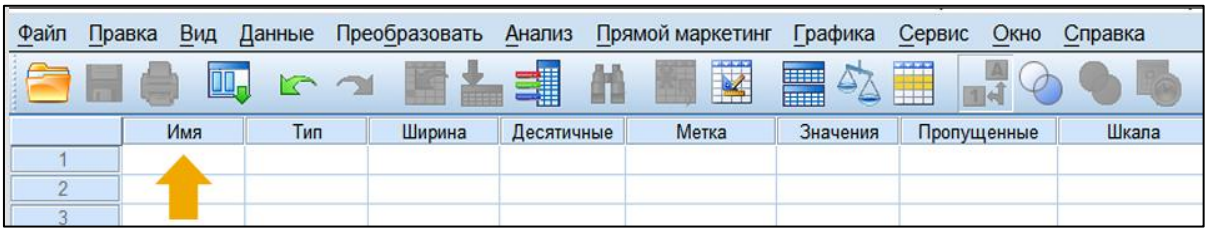


**Figure 3** – Variable types and configuring their parameters in SPSS.

**Variable Type (Type). The two most commonly used variable types are:**

1) Numeric – for all questions whose answers are assigned

numerical values (codes or numbers);

2) String – for open-ended questions without answer codes (for text entry);

3) The **"Width"** parameter allows you to set the number of characters that can be entered for the variable's value;

4) The **"Decimals"** parameter allows you to set the number of digits after the decimal point (up to 16) for the entered variable value.

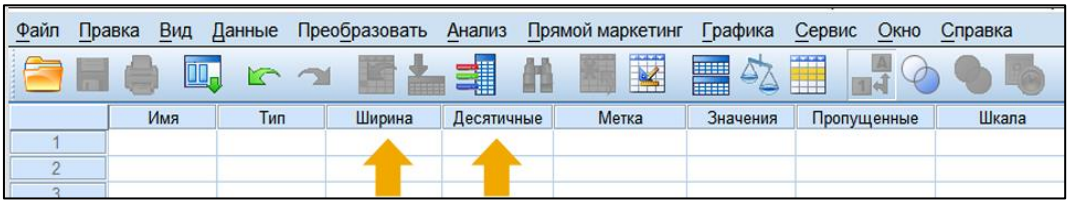


**Figure 4** – Main variable parameters in the SPSS Variable View window.

5. The **"Label"** parameter is used when the meaning of a variable is not clearly reflected in its name. This field is for entering the full name of the variable (usually the question number and wording). The maximum length is 256 characters. Here you can specify the full name of the variable, for example, "Result of the 60-meter hurdles."

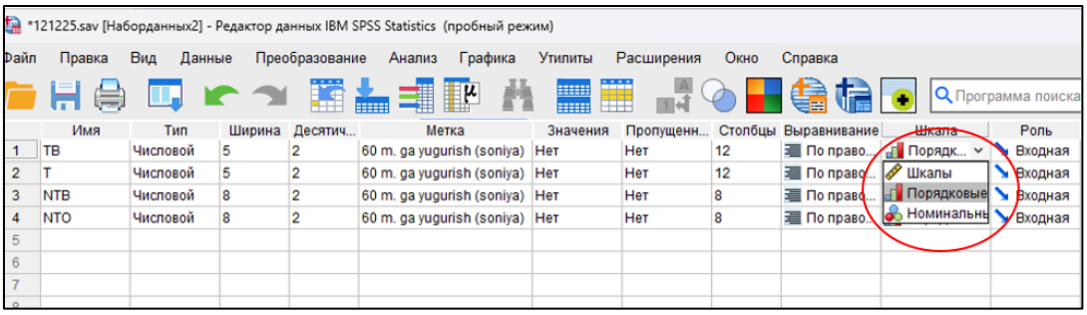


**Figure 5** – Setting variable labels and naming rules in SPSS.

Variable naming rules: The name cannot start with a number and must not contain spaces (e.g., Natija_1 or Yugurish_60m).

Type: If sports results are measured in seconds or centimeters, select the "Numeric" type.

Performing these steps correctly will help you accurately interpret the results of statistical calculations (t-test, correlation) later on.

After setting up the variables, entering the data, and working with the dataset, you must save the working file that contains the data. The dataset (database) can be saved in the standard SPSS format (*.sav) or in other formats, including Excel.

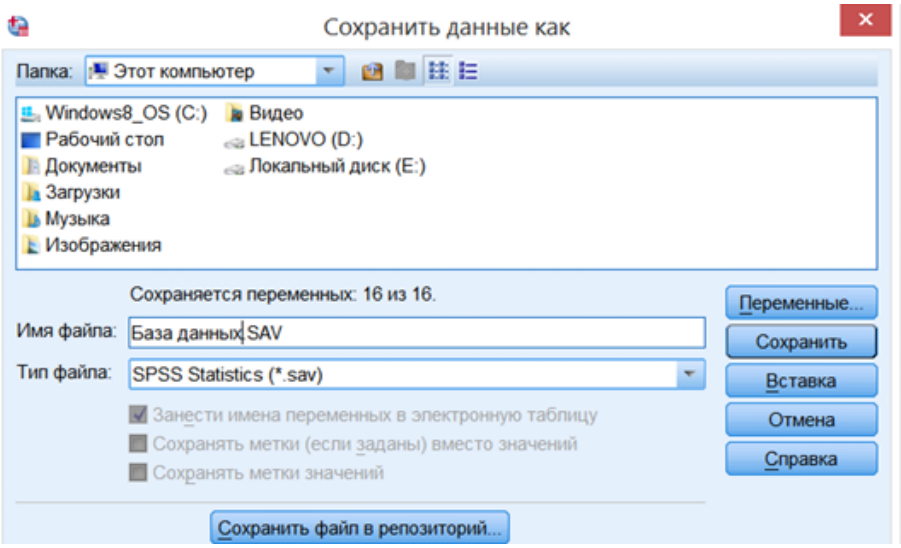


**Figure 6** – Saving the database in the SPSS program's native format.

"Descriptive statistics" are basic statistical parameters that can be used to describe the distribution of the available data, provided it is close to a normal distribution.

To calculate descriptive statistics using the SPSS statistical package, perform the following steps:

1. Enter the values of the variable for which you need to calculate descriptive statistics.

2. Follow this sequence of actions: "Analyze" → "Descriptive Statistics" → "Frequencies."

3. In the "Frequencies" window that appears, move the required variables from the left pane to the right, as shown in the next window.

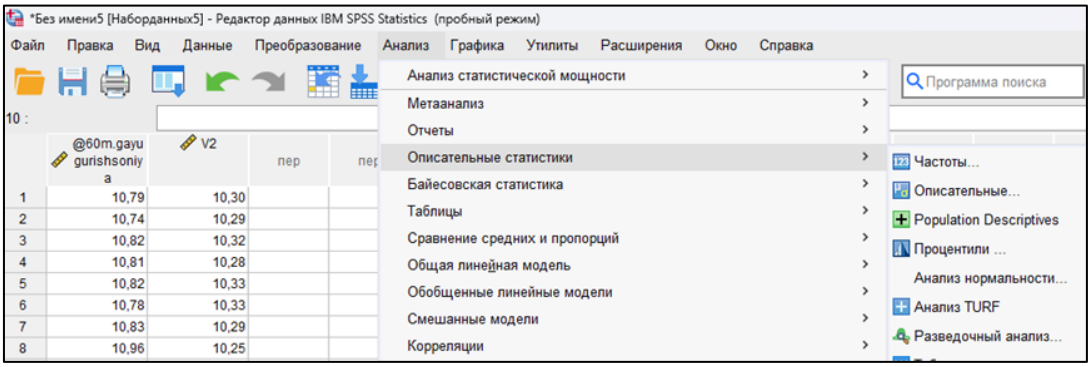

**Figure 7** – Selecting the "Descriptive Statistics" section in SPSS.

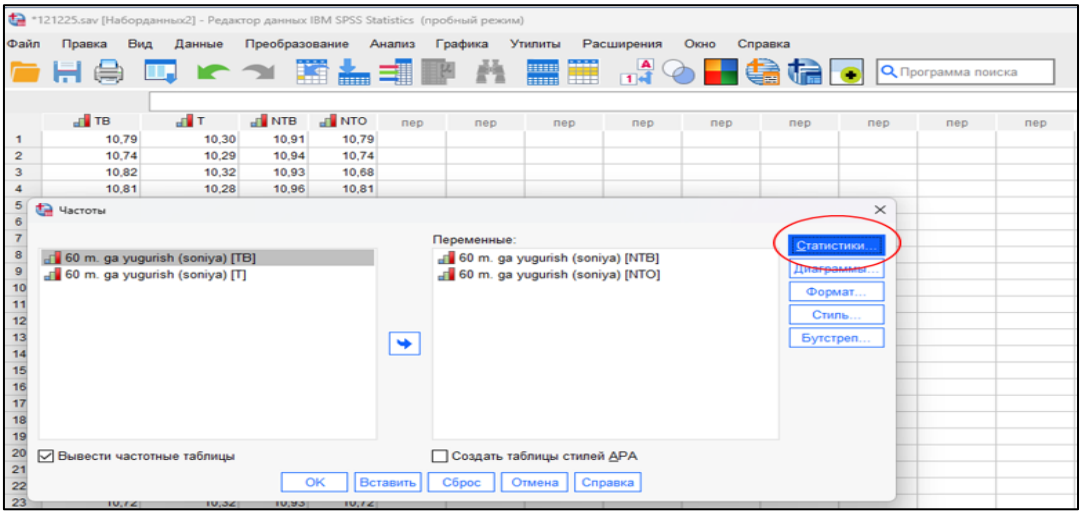


**Figure 8** – The "Frequencies" window for selecting variables when calculating descriptive statistics.

Click the "Statistics" button, and in the window that appears, select (check) the required statistics: mean, median, mode, variance, and standard deviation.

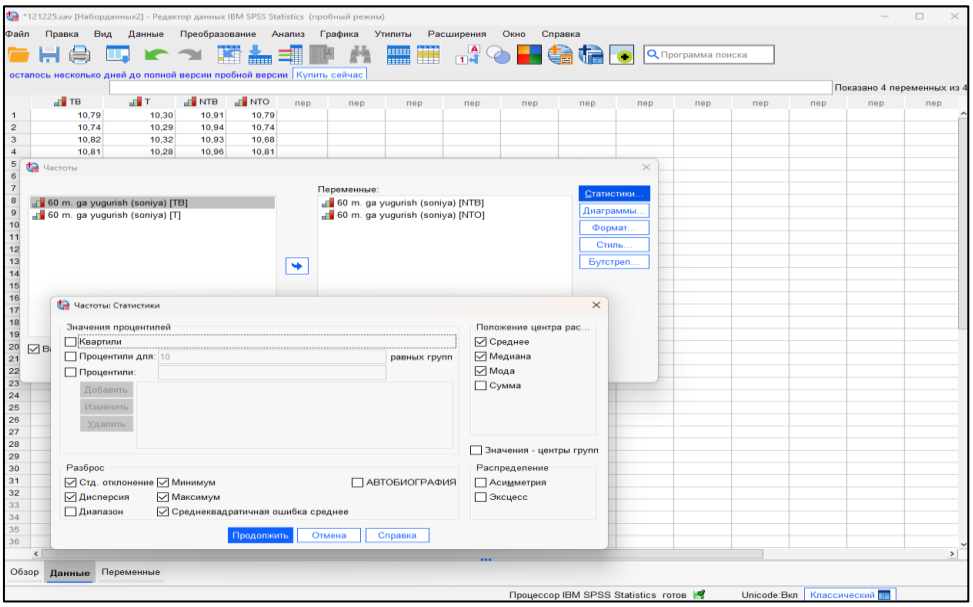


**Figure 9** – Selecting statistical measures in the "Statistics" window in SPSS.

The arithmetic means at the beginning and end of the study were 10.9 and 10.7, respectively; the medians were 10.9 and 10.7; and the modes were 10.91 and 10.68. This indicates that these results are more recurrent. The standard deviations were 0.35 and 0.047. Thus, in this example, there is no difference between the mean and the median; the mean is almost identical to the median. This suggests that the values are evenly distributed.

Student's t-test is used to determine the statistical significance of the differences between mean values in the presented data. Comparing the means of different samples is a frequently used method in statistical analysis. However, the existing difference between the means is related to statistical formulas. In the latter case, the difference is statistically significant. When comparing sample means, both samples must follow a normal distribution. Otherwise, the medians are calculated, and a non-parametric test is used to compare the samples. In our example, this test can be used to compare the changes in the mean differences under two different conditions: the beginning of the experiment (BE) and the end of the experiment (EE). To do this, perform the following sequence of actions using the command "Analyze" → "Compare Means" → "Paired-Samples T Test."

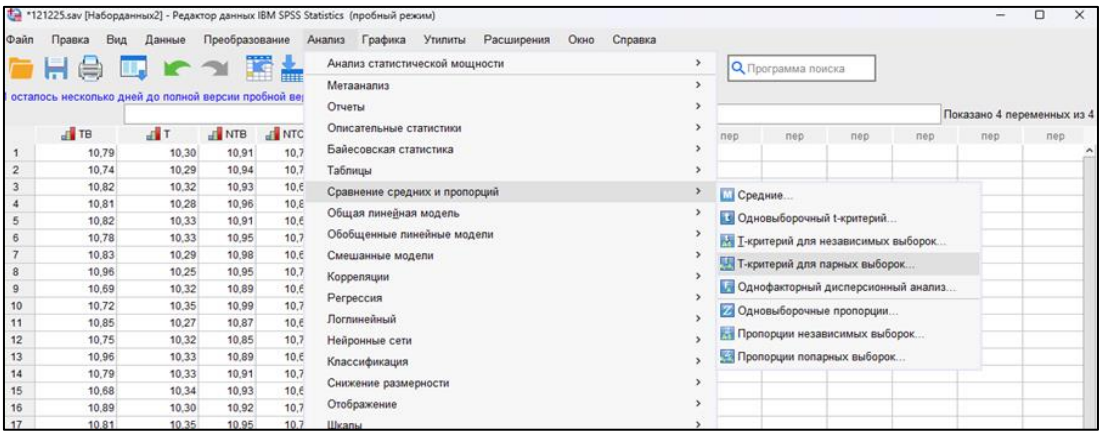


**Figure 10.** Selecting the Paired-Samples T-Test command in SPSS.

The specified variables must be moved to the right side of the dialog box, and the "OK" button must be clicked.

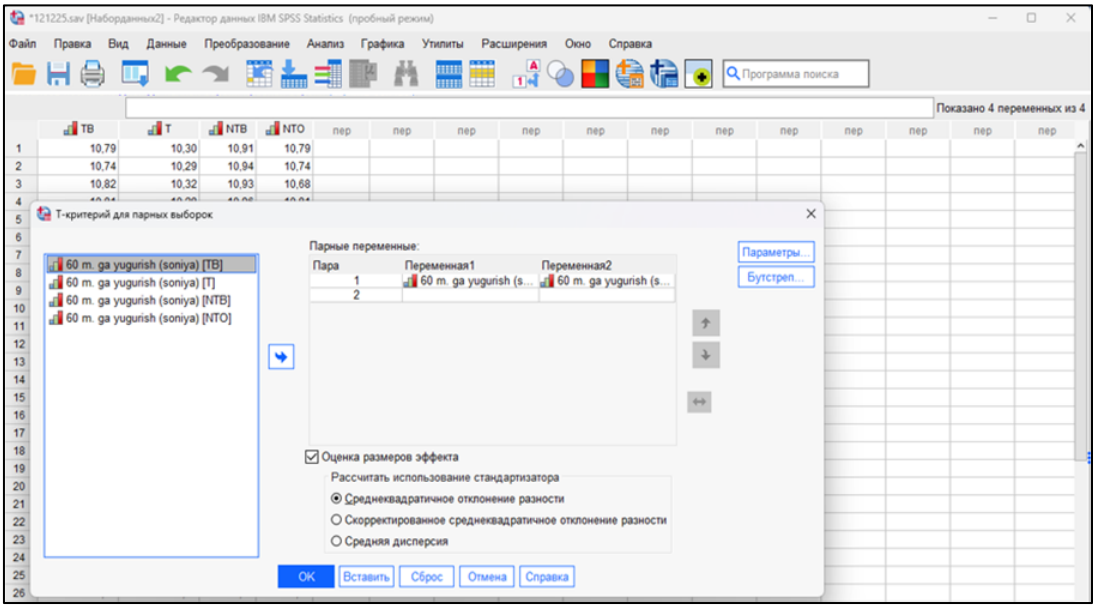


**Figure 11.** – Forming Variable Pairs in the Dialog Box

t-test for paired samples.

**Results.** During the statistical processing of the data obtained from the study, the main descriptive statistics were calculated. It was established that the arithmetic mean values were 10.9 at the beginning of the study and 10.7 at the end. The median values were also 10.9 and 10.7, respectively. The mode values were 10.91 and 10.68, while the standard deviations were 0.35 and 0.047. The data obtained indicate a closeness between the mean and median values, which suggests a relatively uniform distribution of the studied indicators.

To assess the statistical significance of the differences between the indicators at the beginning and end of the experiment, the paired-samples Student's t-test was used. Applying this test allowed for a comparison of measurement results under two interrelated conditions and a determination of the nature of the changes in the studied parameters. The final results of the statistical analysis are presented in Figures 12 and 13.

**Т-критерий**

**Статистика парных выборок**

| | | Среднее | N | Среднеквадратичное отклонение | Среднеквадратичная ошибка среднего |
|---|---|---|---|---|---|
| Пара 1 | 60 m. ga yugurish (soniya) | 10,7916 | 32 | ,08136 | ,01438 |
| | 60 m. ga yugurish (soniya) | 10,3134 | 32 | ,02610 | ,00461 |

**Корреляции парных выборок**

| | | N | Корреляция | Значимости Односторонний p | Значимости Двухсторонний p |
|---|---|---|---|---|---|
| Пара 1 | 60 m. ga yugurish (soniya) & 60 m. ga yugurish (soniya) | 32 | -,200 | ,136 | ,272 |

**Figure 12.** – Results of Paired Samples Analysis in SPSS

**Критерий парных выборок**

| | | Парные разности Среднее | Среднеквадратичное отклонение | Среднеквадратичная ошибка среднего | 95% доверительный интервал для разности Нижняя | Верхняя | т | ст.св. | Значимости Односторонний p | Значимости Двухсторонний p |
|---|---|---|---|---|---|---|---|---|---|---|
| Пара 1 | 60 m. ga yugurish (soniya) - 60 m. ga yugurish (soniya) | ,47812 | ,09028 | ,01596 | ,44557 | ,51068 | 29,957 | 31 | <,001 | <,001 |

Тест парных выборок: Односторонний p

Средняя разница не является значимой для парной(ых) переменной(ых):: *(Нет)*

Средняя разница значима для парной(ых) переменной(ых): *(60 m. ga yugurish (soniya) - 60 m. ga yugurish (soniya))*

Тест парных выборок: Двухсторонний p

Средняя разница не является значимой для парной(ых) переменной(ых):: *(Нет)*

Средняя разница значима для парной(ых) переменной(ых): *(60 m. ga yugurish (soniya) - 60 m. ga yugurish (soniya))*

*Примечание: Справка рассчитывается на основе фактических значений ячеек, а не отформатированных значений.*

**Размеры эффектов парных выборок**

| | | | Стандартизатор[a] | Точечная оценка | 95% доверительный интервал Нижняя | Верхняя |
|---|---|---|---|---|---|---|
| Пара 1 | 60 m. ga yugurish (soniya) - 60 m. ga yugurish (soniya) | d Коэна | ,09028 | 5,296 | 3,935 | 6,648 |
| | | Коррекция Хеджеса | ,09254 | 5,166 | 3,839 | 6,486 |

a. Этот знаменатель используется при оценке размеров эффектов.
d Коэна использует среднеквадратичное отклонение выборки для разности средних.
Коррекция Хеджеса использует среднеквадратичное отклонение выборки для разности средних плюс фактор коррекции.

**Figure 13.** – Final Results of the Paired-Samples Student's t-test in SPSS

**Discussion.** The data obtained demonstrate that using the SPSS program allows for an objective assessment of changes in athletes' physical fitness indicators at various stages of the study. The proximity of the mean and median values indicates a relatively normal data distribution, which enhances the reliability of the statistical interpretation. The use of Student's t-test for paired samples made it possible to compare the indicators at the beginning and end of the experiment and to determine the nature of the changes in the parameters under investigation. This confirms that SPSS can be effectively applied in sports to analyze the training process, monitor performance dynamics, and provide a scientific basis for management decisions. From a practical standpoint, the program is valuable for coaches, instructors, researchers, and specialists in the sports field, as it helps increase the accuracy of analysis and improve the quality of athlete training plans.

**Conclusion.** In conclusion, the analysis shows that the IBM SPSS statistical program holds an important place in modern scientific support for sports activities. Its use allows not only for the processing of empirical data but also for ensuring the scientific validity of decisions made in the training process, pedagogical control, and monitoring of athletes' physical fitness. The study established that the capabilities of SPSS cover all main stages of statistical work: from creating a database structure, defining variables, and entering information, to calculating descriptive statistics, testing statistical hypotheses, and interpreting the results. It is particularly important that the program enables the rapid identification of relationships between the studied indicators, the determination of the significance of differences, and the presentation of results in a visual and easy-to-analyze format. Using the example of data processing from monitoring sessions with 12–13-year-old boys and girls, it is demonstrated that the application of SPSS contributes to an objective assessment of physical fitness levels, the identification of the dynamics of changes in the indicators under study, and the comparison of results at various stages of the experiment. The use of descriptive statistics and Student's t-test made it possible not only to quantitatively characterize the sample but also to determine the statistical significance of the differences between measurements, which is of great practical importance for sports science and coaching.

Therefore, the use of SPSS software in sports should be regarded as an effective tool for the digitalization of scientific and methodological support in the field. Its implementation enhances the quality of research, facilitates more precise planning of training loads, allows for the individualization of athlete preparation, and increases the reliability of conclusions drawn from pedagogical and sports-related studies.

Thus, the significance of the SPSS program is defined by its versatility, accessibility, a wide range of statistical procedures, and high practical value for specialists in physical education and sports. In the long term, the expanded use of this program in sports science and educational practices will contribute to the further improvement of the athlete training system, the modernization of the educational and training process, and the increased competitiveness of domestic sports in the international arena.

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