

**NATIONAL SPORTS ACADEMY “Vasil Levski”**

---

**DEPARTMENT OF WRESTLING AND JUDO**

**KALINA GEORGIEVA STEFANOVA**

**Optimization of the Training Methodology  
for Sambo and Judo Competitors**

**ABSTRACT**

of a dissertation for the award of the educational and scientific degree  
“Doctor” in the professional field 7.6. Sport, doctoral program “Theory  
and Methodology of Sport Science”

**Supervisor:**

**Assoc. Prof. Todor Marinov, PhD**

---

Sofia, 2026.

**KALINA GEORGIEVA STEFANOVA**

# **Optimization of the Training Methodology for Sambo and Judo Competitors**

## **ABSTRACT**

of a dissertation for the award of the educational and scientific degree  
“Doctor” in the professional field 7.6. Sport, doctoral program “Theory  
and Methodology of Sport Science”

### **Official Reviewers:**

Assoc. Prof. Rasho Makaveev, PhD

Prof. Dimitar Kaikov, DSc

### **Supervisor:**

**Assoc. Prof. Todor Marinov, PhD**

---

**SOFIA , 2022**

The dissertation comprises 146 standard pages of text. It is illustrated with 18 tables and 16 figures. The bibliographic references include a total of 137 sources, of which 27 are in Cyrillic, 81 in Latin script, and 7 are Internet sources. Two appendices are included in the dissertation.

The dissertation was discussed and approved for public defense before a scientific jury at an extended meeting of the Department of Wrestling and Judo at the National Sports Academy “Vasil Levski,” held on 16 December 2025.

The public defense of the dissertation for the award of the educational and scientific degree “Doctor” will take place on 04 March 2026 at 14:00 in Lecture Hall A3 of the National Sports Academy “Vasil Levski,” Studentski Grad, Sofia.

# Introduction

In contemporary sports science, the study of combat sports holds a significant place due to their complexity, specific training methodologies, and the high importance of the various forms of athletic preparation for competitors—physical, technical, tactical, and psychological. Among the most prominent and globally recognized combat disciplines are judo and sambo, which not only possess rich historical and cultural traditions but also demonstrate substantial similarities in their technical arsenal, training processes, and application in sports practice.

Judo is a Japanese martial art and Olympic sport founded on the principles of efficiency, mutual aid, and respect; its practice encompasses a wide range of technical actions—throws, grappling, and submission techniques. It serves not only as a competitive outlet but also as a pedagogical system for physical and moral education, emphasizing discipline, self-control, and personal development.

Sambo is a martial art and sport that emerged from the synthesis of technical elements from judo and various forms of national wrestling.

Both judo and sambo are characterized by high dynamism, intensity, a complex technical structure, and intricate motor actions. Taken together, these factors place high demands on the physical fitness of athletes striving for peak performance and the execution of effective technical-tactical maneuvers.

In this context, the present study aims to develop and test a methodology for refining the technical preparation of adolescent judo and sambo competitors through the targeted development of their motor abilities. To achieve these objectives, a strength training complex was developed, aimed at maximizing the athletes' motor potential. Within this framework, particular emphasis was placed on the development of 'strength' as a key factor in increasing the effectiveness of technical actions.

Parallel to the implementation of the strength complex, targeted work was conducted to perfect technical execution. During this process, attention was focused on the fundamental elements of throws, resulting in the establishment of objective criteria for evaluating the technical proficiency of the competitors.

## STATEMENT OF THE PROBLEM

Martial arts, in their essence, represent a complex system of philosophical views, motor actions, and cultural-historical practices, the primary goal of which was the formation of self-defense skills and the development of motor qualities. They emerged in response to the necessity of conducting warfare, as well as the need for organized, disciplined training within various societies since antiquity.

In the martial art of Judo:

In 1882, the Japanese educator and martial arts reformer Jigoro Kano created a new system for physical and spiritual development—Judo. In the process of constructing his system, Kano formulated two leading philosophical directives that remains fundamental to this day: 1) Maximum efficiency in the use of physical and mental energy; 2) Mutual benefit and welfare for all.

At the core of Judo training, Kano formulated two primary teaching methods - 'Kata' and 'Randori' - aimed at perfecting the physical body and mastering new techniques for attack and defense. (Kano, 1994)

Sambo (an abbreviation of '*samooborona bez oruzhiya*' – 'self-defense without weapons') originated in the 1920s and 1930s in the former USSR. Anatoly Kharlampiev is recognized as the official founder of the sport (Graham, 2010). In 1938, Sambo was granted official status as a sport in the USSR, which marked the beginning of an accelerated process of establishing training schools, expanding its practice beyond the military and police, and organizing national competitions

### 1.1.1. Sportological Aspects of Preparation in Judo

Judo is a complex Olympic sport where scientific research is focused on optimizing the training and competitive process. Key areas of study include the individualization of preparation based on anthropometric and physiological characteristics, the influence of the environment, and the role of genetic markers associated with strength and endurance (Franchini, 2024). A significant portion of research is dedicated to aerobic and anaerobic capacity, including high-altitude training (Purnamasari et al., 2024). Specific performance capacity in judo is most frequently evaluated using the Special Judo Fitness Test (SJFT), developed by Sterkowicz (1995) and further refined by Franchini et al. (2009), with modifications proposed for various weight categories (Isik et al., 2017).

### **I.2.2. Content of Sport Preparation in Sambo and Judo**

Within the framework of the sport preparation system, specialists distinguish four types of preparation: physical, technical, tactical, and psychological, each of which plays a key role in efficiency and performance. In sports such as judo and sambo, these types of preparation are closely interconnected and cannot be considered in isolation, as the effectiveness of technical and tactical actions is directly conditioned by the competitor's level of physical and psychological readiness. The specificity of wrestling in the standing position and on the ground requires the synchronized development of strength, speed, coordination, and resilience, realized through adequate technique and tactics. Consequently, sport preparation in judo and sambo should be planned and implemented as a unified, functionally integrated system.

### **I.2.2 Analysis of the Existing Sport Preparation Program and Competitive Calendar**

Judo and sambo are developed within independent federations with similar organizations of their competitive calendars and a single-cycle nature of annual preparation, oriented toward successful performance at national championships as the primary selection mechanism. Sport preparation proceeds through preparatory, competitive, and transition periods, gradually shifting from dominant physical preparation with high volume and moderate intensity to a priority on technical-tactical work and peak performance management (peaking). Through initial screening, control competitions, and an individualized approach, effective planning, recovery, and preparation for participation in national and international championships are ensured.

### **I.3 Age-Specific Developmental Characteristics of Athletes and Adaptations under the Influence of Sport Preparation**

Adolescence (12–18 years) is a pivotal period for judo and sambo competitors, during which systematic sport preparation triggers significant adaptations in the nervous, cardiovascular, respiratory, and musculoskeletal systems. The training process supports the development of coordination, strength, endurance, explosive power (speed-strength abilities), and functional economy, while

simultaneously improving mental resilience and decision-making capacity under dynamic conditions.

The specificity of judo and sambo, characterized by combined aerobic-anaerobic loads, leads to favorable structural and functional adaptations, including increases in  $\text{VO}_{2\text{max}}$ , bone mineral density, and neuromuscular efficiency. Of particular importance are the sensitive periods during adolescence, which dictate the need for targeted and progressive development of motor qualities to maximize long-term athletic potential.

### **I.3 Opportunities for optimizing the Structure of Fundamental Throws in Judo:**

Judo is characterized by exceptionally rich technical content, including throws, groundwork techniques, and control actions, structured into clearly defined categories and execution phases. Competitors build an individual technical arsenal based on their morphological and functional characteristics. Throughout the historical development of the sport, various national schools (Japanese, Russian, Georgian, French) have emerged, distinguished by specific technical styles, tactical approaches, and training models.

Contemporary research in judo and sambo is focused on optimizing technical instruction through biomechanical and tactical analysis, the development of motor behavior in adolescence, and the integration of strength, conditioning, and psychological preparation. Scientific data emphasizes the necessity of an interdisciplinary and functionally integrated approach, where physical, technical, tactical, and psychological preparation are developed in unity to achieve highly competitive effectiveness.

#### **Research Hypotheses:**

A thorough theoretical analysis and synthesis of existing literature, combined with practical experience gained in the training and competitive process, have provided the basis for the following assumptions:

- ✓ The implementation of targeted physical and technical preparation within the judo training process will lead to an improvement in the physical and technical proficiency of the competitors, thereby resulting in significantly more effective performance in sports-competitive activities.

✓ The application of our experimental training methodology will refine the structure of the athletes' physical and technical readiness and will lead to increased determinacy (correlation) between key performance indicators and the effectiveness of competitive actions.

## **AIM, TASKS, METHODOLOGY, AND ORGANIZATION OF THE STUDY**

### **II.1. Aim and Tasks of the Study**

The aim of our study is to refine the preparation methodology for sambo and judo competitors. To achieve this, the following primary tasks have been defined:

1. To develop the theoretical foundations of the problem under investigation.
2. To develop and pilot an enhanced methodology within the training process aimed at improving the physical and technical proficiency of the athletes.
3. To analyze the changes in the physical and technical readiness of judo and sambo competitors.
4. To identify the structural changes in the physical and technical proficiency of the athletes.

### **II.2. Subject, Object, and Participants of the Study**

❖ **Subject of the study:** The reliability of our refined methodology for improving the physical and technical proficiency of the athletes.

❖ **Object of the study:** The indicators of the athletes' physical and technical readiness.

❖ **Participants:** A total of 24 judo and sambo competitors from SC "Sports Academy CSKA" and SC "Lokomotiv Sofia," aged 15–17 years, were studied. The sample was divided into an experimental group and a control group. The experimental group consisted of 12 athletes from SC "Sports Academy CSKA," while the control group included 12 athletes from SC "Lokomotiv Sofia."

### **II.3. Research Methodology**

To achieve the aim and validate the research hypothesis, a comprehensive methodology was applied, incorporating the following reliable scientific research methods:

- Review of literary and documentary sources.
- Interviews/Professional dialogue.
- Pedagogical observation.



- Pedagogical-constative experiment (diagnostic/baseline experiment).
- Pedagogical-transformative experiment (intervention/interventionist experiment).

The experimental methodology was conducted within the training process of the athletes from SC "Sports Academy CSKA" between September 2022 and May 2023. The experimental group followed the methodology developed by us, while the control group followed the standard preparation methodology. Depending on the stage of athletic preparation, the relative proportion of training sessions dedicated to aerobic capacity, motor qualities, and technique was varied purposefully.

### *Preparatory Period*

During the first stage (September–December 2022), initial testing of the competitors from both groups was conducted. The training process emphasized the development of aerobic potential and fundamental motor qualities—endurance, strength, and flexibility. Resistance training was implemented over a 10-week period and structured into two cycles: the first aimed at developing maximum strength (6 weeks, 3 sessions per week), and the second focused on explosive power and speed-strength qualities (2 sessions per week). The transition between cycles was carried out gradually through exercise substitution. Loads were prescribed individually based on regular submaximal testing and the calculation of one-repetition maximum (1RM) using the Brzycki formula. A strength and conditioning coach actively participated in the training process to optimize technique and load management.

Aerobic preparation included 2 sessions per week, while technical sessions were held 3–4 times weekly, depending on the strength cycle. These technical sessions focused on mastering standard judo techniques through specific drills (Tai-sabaki, Uchikomi, Butsukari, Nage Komi, and Tandoku-renshu), primarily utilizing the repetition method.

The second stage of the preparatory period (January–February 2023) facilitated the transition to the competitive period. Technical training sessions took a predominant share (6 per week), oriented toward modeled and combined technical execution, grip fighting (kumi-kata), and drilling competitive situations, including randori. In parallel, aerobic capacity and physical attributes were maintained through up to 2 sessions per week.

### *Competitive Period*

The competitive period (February–May 2023) focused on achieving and managing optimal athletic form (peaking). The training process was dominated by technical sessions (7 per week), which included tactical and competitive sparring with specific objectives and the refinement of modeled/mastery-level technical execution. One session per week was dedicated to maintaining aerobic capacity and motor qualities through circuit training involving specific and special preparatory exercises. Prior to Sambo competitions, shock microcycles were implemented, focusing on Sambo-specific stances, techniques, and maneuvers.

#### *Transition Period*

The transition period (May–June 2023) commenced following the national championships and included a second round of testing for both the experimental and control groups. Training consisted of 4 technical sessions per week, emphasizing error correction and standardization of execution, as well as 4 sessions with an aerobic focus for maintenance. These included games and circuit training to stabilize functional status and target underdeveloped muscle groups.

#### **❖ Sport-Pedagogical Testing**

To determine the physical and technical proficiency of the athletes at the beginning and end of the experiment, the following tests were conducted:

1. *30m Dash*
2. *Standing Long Jump*
3. *Medicine Ball Throw*
4. *30-Second Sit-Ups*
5. *T-Test*
6. *Bend, Twist, and Touch*
7. *Handgrip Dynamometry*
8. *Throwing an Opponent*

#### **❖ Expert Assessment of Technical Skills**

During the course of the study, the competitors demonstrated standard execution of throwing techniques from the syllabi for 5th, 4th, and 3rd kyu. Specialists evaluated the performance using a 10-point scale based on our defined criteria for technical proficiency, as follows:

Initial Breaking of Balance (Kuzushi):

- Body positioning – establishing the stance.
- Establishing the grip (Kumi-kata).
- Off balancing the opponent.

Entry and Positioning for the Throw (Tsukuri):

- Stability.
- Body posture during the execution of the technique.

Control during Execution and Completion of the Throw (Kake):

- Speed and precision of execution.
- Final finishing movement.

As a result of this analysis, the experts developed a comprehensive profile of the athletes' technical competence, which served as the basis for the subsequent interpretation of the effectiveness of the applied training methods

#### ❖ **Mathematical and Statistical Processing**

The data obtained from the testing was processed using IBM SPSS Statistics 22. The following mathematical and statistical methods were applied:

1. Variational Analysis
2. Hypothesis Testing
3. Correlation Analysis.
4. Graphical Analysis

#### **II.4. Organization of the Study**

The study was conducted between November 2021 and August 2025 and comprised the following three primary stages:

- First Stage (November 2021 – August 2022): The conceptual framework of the research was formulated, and the dissertation topic and structure were defined. An extensive review of literature pertinent to the problem was conducted, and the training methodology for judo and sambo competitors was designed.

- Second Stage (September 2022 – June 2023): The practical research was implemented with judo and sambo athletes from SC 'Sports Academy CSKA' and SC 'Lokomotiv Sofia' in Sofia. The reliability of the developed pre-preparatory methodology was tested. The resulting data were processed and analyzed, leading to further refinement of the methodology.

- Third Stage (September 2023 – August 2025): This stage focused on the systematization, synthesis, and in-depth analysis of the collected research data. A comparison was made between the initial objectives and the results achieved, along with an evaluation of the effectiveness of the applied training methodology. Furthermore, key conclusions were drawn, and recommendations for practical

application and future scientific research into the refinement of judo and sambo training were established.

## ANALYSIS OF THE RESEARCH RESULTS

III.1. Variational Analysis of the Research Results Variational analysis was employed to characterize the distribution of quantitative indicators derived from the motor tests. The analysis focused on the meaning ( $\bar{X}$ ), the primary measures of dispersion—standard deviation (S) and coefficient of variation (V%)—as well as the indicators for determining the shape of the distribution: skewness (As) and kurtosis (Ex).

Tables 2 and 3 present the initial and final results of the motor tests for the two studied groups.

**Table 2**

*Results of the variational analysis of physical proficiency indicators for the athletes studied at the beginning of the experiment*

Indicators test	Experimental						Control				
	$\bar{X}$	S	V%	As	Ex		$\bar{X}$	S	V%	As	Ex
30m Dash	5,5	0,58	10,6	,02	,10		6,3	0,49	7,7	1,86	4,14
Standing long jump	197, 9	34,0 3	17,2	-,58	1,29		189, 6	33,9	17,9	-1,54	1,95
Medical ball throw	577, 0	129, 6	22,5	1,10	,33		674, 0	173, 1	25,7	0,65	-1,17
30s sit-ups	25,1	3,35	13,3	-,92	2,76		25,4	6,44	25,4	0,10	-1,25
T-test	15,0	1,56	10,4	1,53	3,04		14,5	1,46	10,1	0,40	-1,23
Dynamic Flexibility	8,8	1,88	21,4	-,23	-,36		10,1	3,51	34,7	1,10	0,66
Left hand grip	22,3	7,43	33,3	0,74	-,68		25,2	9,57	38,0	0,93	0,15
Right hand grip	26,9	7,42	33,3	-1,09	3,69		26,8	8,77	32,7	0,09	-1,17
Opponent throwing	16,1	2,47	15,3	-,472	1,76		16,9	0,78	4,6	0,49	-0,99

At the initial stage of the study, the control group was characterized by homogeneity in the '30m Dash,' 'T-test,' and 'Opponent Throwing' indicators, as well as relative homogeneity in the 'Standing Long Jump,' 'Medicine Ball Throw,' and 'Sit-ups.' Heterogeneity of results was established in the tests for 'Dynamic Flexibility' and 'Handgrip Dynamometry,' which can be attributed to individual differences in the development of flexibility and grip strength.

For the experimental group, a distinct homogeneity of results was recorded at the beginning of the study in the '30m Dash and 'T-test,' indicating a roughly equal level of speed and agility. Relative homogeneity was also observed in the indicators for 'Standing Long Jump,' 'Medicine Ball Throw,' 'Sit-ups,' 'Dynamic Flexibility,' and 'Opponent Throwing,' testifying to the balanced development of fundamental motor qualities and providing a prerequisite for effective technical execution. At the same time, the 'Handgrip Dynamometry' test showed marked heterogeneity, indicating a significant dispersion in grip strength among the individual competitors

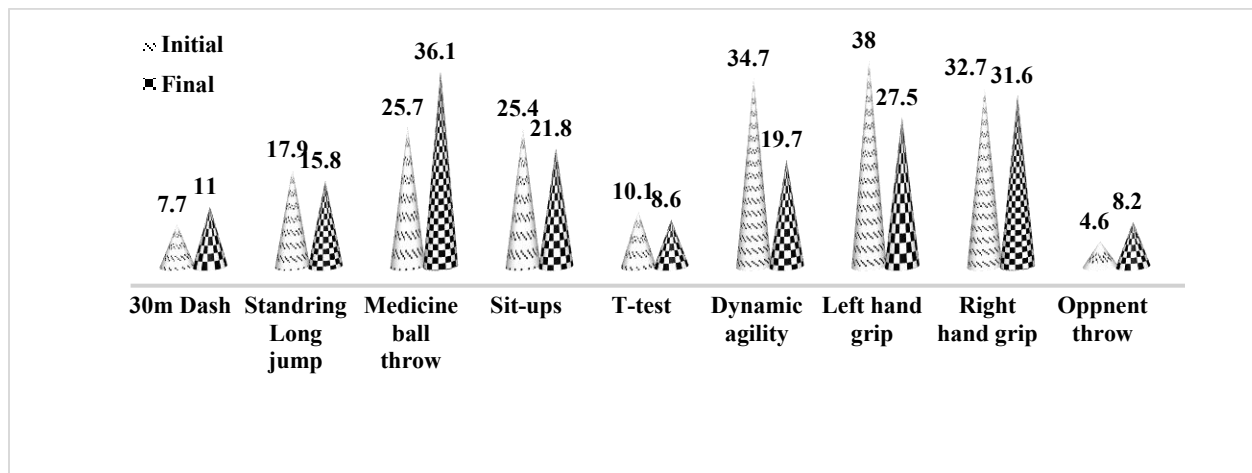
**Table 3**

*Results of the variational analysis of physical proficiency indicators for the athletes studied at the end of the experiment*

Indicators test	Experimental						Control				
	$\bar{X}$	S	V%	As	Ex		$\bar{X}$	S	V%	As	Ex
30m Dash	5,3	0,55	10,4	-,02	,53		5,8	0,64	11,0	1,00	-,17
Standing long jump	229,0	27,50	12,0	-,20	-1,05		198,8	31,49	15,8	-,65	-1,01
Medicine ball throw	750,0	165,3	22,0	,49	-1,48		621,5	224,3	36,1	-1,31	2,80
30s sit-ups	28,8	4,92	17,1	-1,03	,20		26,4	5,76	21,8	-,03	-1,82
T-test	13,0	1,21	9,3	,82	-,42		14,5	1,25	8,6	1,80	3,92
Dynamic Flexibility	9,3	1,71	18,4	,04	-,35		7,9	1,56	19,7	-,88	,91
Left hand grip	25,5	7,43	33,0	,38	-1,49		28,3	7,77	27,5	,41	1,04
Right hand grip	30,7	8,32	27,1	-,77	-,85		30,2	9,54	31,6	-,70	-,83
Opponent throwing	17,6	0,84	4,8	,19	-,14		16,5	1,35	8,2	,07	-1,65

In the final stage of the experiment, the control group maintained homogeneous indicators in the '30m Dash' (V=11.0%), the 'T-test' (V=8.6%), and 'Opponent Throwing' (V=8.2%) (Table 3). The group remained approximately homogeneous in the 'Standing Long Jump' (V=15.8%), 'Sit-ups' (V=21.8%), and 'Dynamic Flexibility' (V=19.7%), as well as in 'Handgrip Dynamometry' for the left hand (V=27.5%) and the right hand (V=31.6%). Simultaneously, an increase in variability was observed in the 'Medicine Ball Throw' (V=31.6%), resulting in the group being characterized as heterogeneous for this indicator. Meanwhile, upon completion of the experiment, the indicators for the experimental group demonstrated group homogeneity in the '30m Dash' (V=10.4%), 'T-test' (V=9.3%), and 'Opponent Throwing' (V=4.8%). The group remained relatively homogeneous in the 'Standing Long Jump' (V=12.0%), 'Medicine Ball Throw' (V=22.0%), 'Sit-ups' (V=17.1%), and 'Handgrip Dynamometry' for the left hand (V=27.1%). High variability was observed in the values for 'Handgrip Dynamometry' of the right hand (V=33.0%).

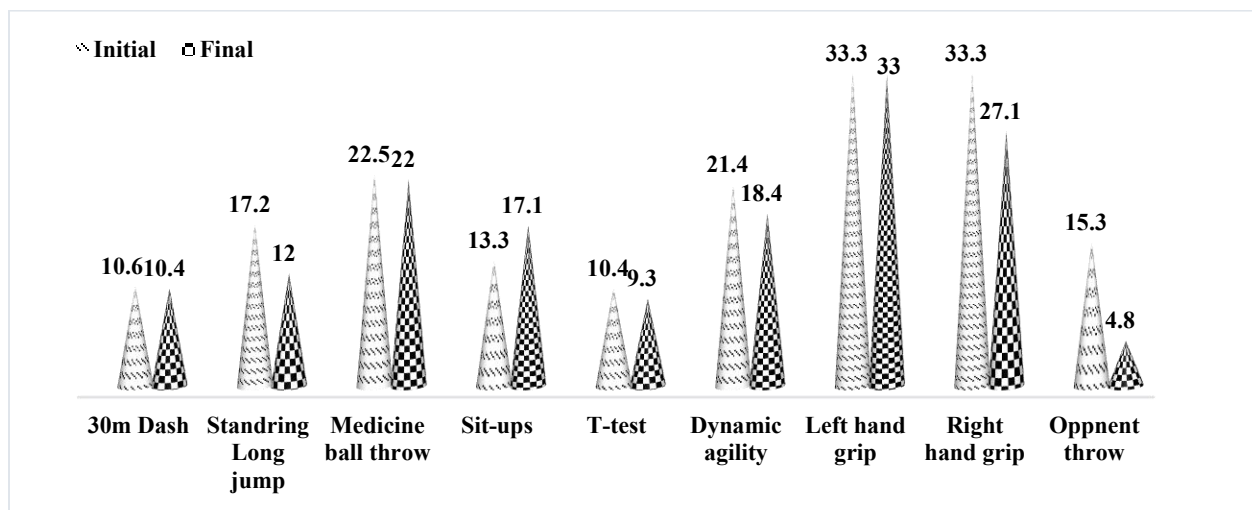
Figure 1 illustrates the coefficients of variation (V%) for the experimental group across the two testing sessions.



**Fig. 1.** Variability of motor test indicators for the control group at the baseline and final stages of the study (%).

Comparing the variability of the control group indicators between the beginning and the end of the experiment, it is established that variability decreased by the final stage in the following tests: 'Standing Long Jump' (initial=17.9% vs. (Vfinal=15.8%), 'Sit-ups' (Vinitial=25.4% vs. Vfinal=21.8%), 'T-test'

( $V_{\text{initial}}=10.1\%$  vs.  $V_{\text{final}}=8.6\%$ ), 'Dynamic Flexibility' ( $V_{\text{initial}}=34.7\%$  vs.  $V_{\text{final}}=19.1\%$ ), and 'Handgrip Dynamometry' for the left hand ( $V_{\text{initial}}=38$  vs.  $V=27.5\%$ ) and the right hand ( $V_{\text{initial}}=32.7\%$  vs.  $V_{\text{final}}=31.6\%$ ). This suggests that the applied standard methodology had an equally favorable influence on the motor qualities of speed, explosive power of the lower extremities, abdominal musculature, dynamic flexibility, and grip strength in both hands for the control group athletes. Simultaneously, an opposite trend is observed—an increase in variability values for the following tests: '30m Sprint' ( $V_{\text{initial}}=7.7\%$  vs.  $V_{\text{final}}=11.0\%$ ), 'Medicine Ball Throw' ( $V_{\text{initial}}=25.7\%$  vs.  $V_{\text{final}}=36.1\%$ ), and 'Opponent Throwing' ( $V_{\text{initial}}=4.6\%$  vs.  $V_{\text{final}}=8.2\%$ ). In this case, the results indicate that the standard methodology did not have a uniform favorable impact on the development of speed, explosive power of the upper extremities, and the technical proficiency of the control group athletes. The coefficients of variation for the experimental group following both testing sessions are presented in Figure 2.



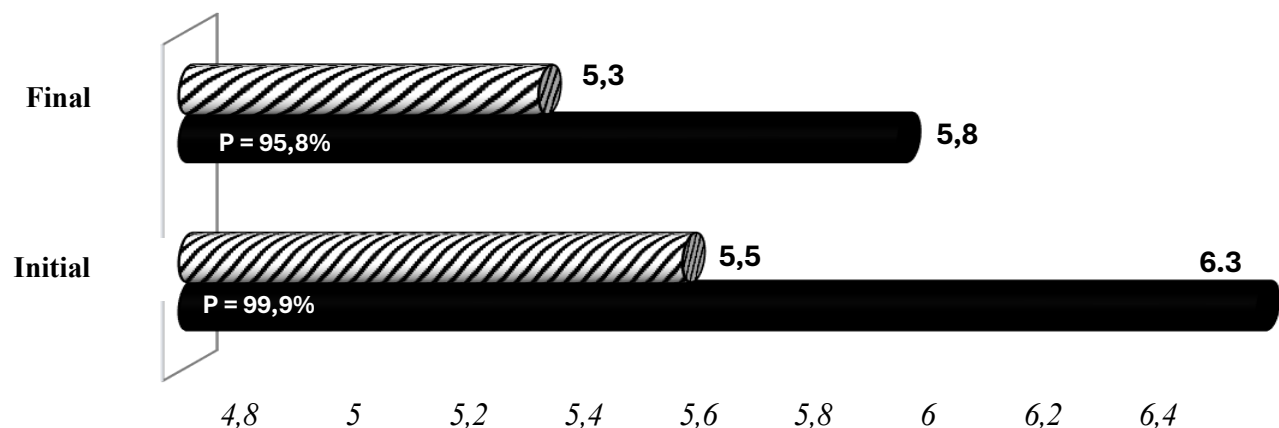
**Fig. 2.** Variability of motor test indicators for the experimental group (%).

Analyzing the mean values of the experimental group tests at the end of the study, a decrease in variability is observed across nearly all assessments: '30m Sprint' ( $V_{\text{initial}}=10.6\%$  vs.  $V_{\text{final}}=10.4\%$ ), 'Standing Long Jump' ( $V_{\text{initial}}=17.2\%$  vs.  $V_{\text{final}}=12.0\%$ ), 'Medicine Ball Throw' ( $V_{\text{initial}}=25.5\%$  vs.  $V_{\text{final}}=22.0\%$ ), 'T-test' ( $V_{\text{initial}}=10.4\%$  vs.  $V_{\text{final}}=9.3\%$ ), 'Dynamic Flexibility' ( $V_{\text{initial}}=21.4\%$  vs.

V=18.4%), 'Handgrip Dynamometry' for the right hand ( $V_{\text{initial}}=33.3\%$  vs.  $V_{\text{final}}=27.1\%$ ), and 'Opponent Throwing' ( $V_{\text{initial}}=15.3\%$  vs.  $V_{\text{final}}=4.8\%$ ).

### III.2. Hypothesis Testing of the Results from the Pedagogical Experiment

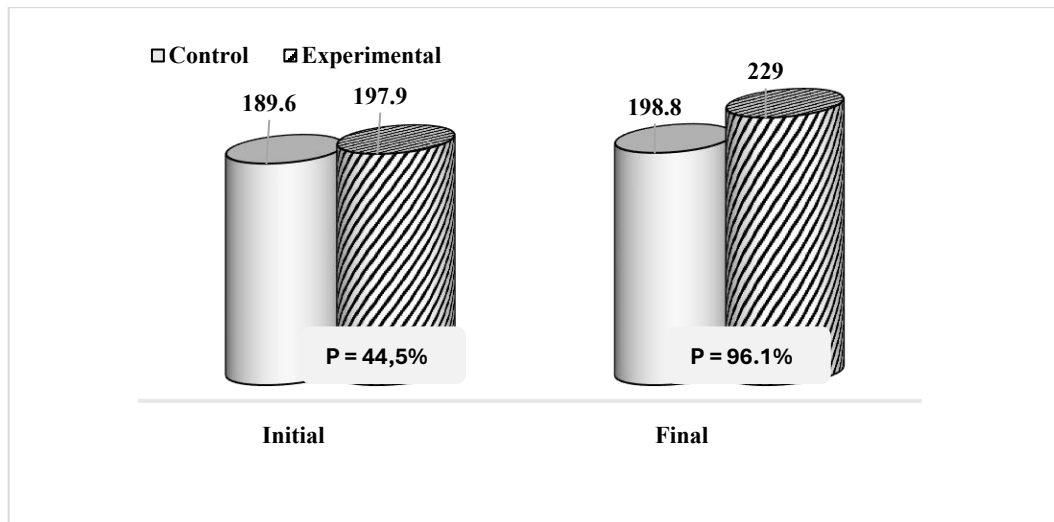
Judo is a sport that requires the execution of precise and explosive technical actions, movement and positioning, timely reactions to the opponent's maneuvers, and rapid transitions from attack to defense and/or from standing (tachi-waza) to groundwork (ne-waza). Consequently, the motor quality of speed is a key element, significantly impacting the effectiveness of the athletes' actions and the achievement of high sports results. Using the '30-Meter Dash' test, we established the speed levels of the competitors from both groups at the beginning and end of the experiment. Figure 3 presents the results of the two speed tests for both the control and experimental groups. At the initial stage, the control group showed an average result of 6.3 s ( $S = 0.49$ ), while the experimental group achieved 5.5 s with a standard deviation of ( $S = 0.58$ ). The initial difference between the two groups was ( $d = 0.8$ ) s. The experimental group is significantly faster, a statement supported by a high confidence level ( $P=99.9\%$ ). This indicates that the initial disparity prevents us from attributing the development of this specific motor quality solely to the application of our methodology."



**Fig. 3.** Comparison of mean performance in the "30-Meter Dash" speed test for the control and experimental groups at the baseline and final stages of the experiment (s).



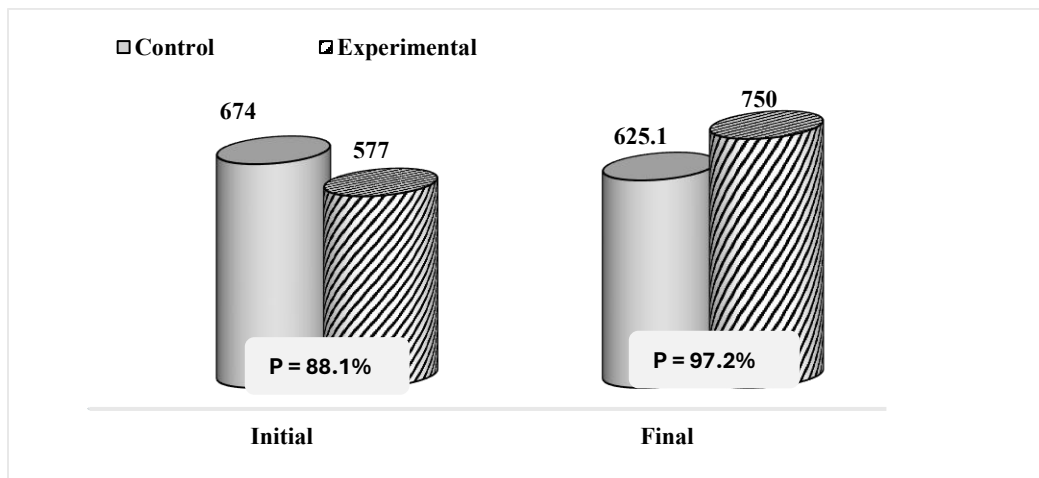
At the end of the experiment, both groups improved their results. The control group showed a statistically significant improvement—from 6.3 s ( $S = 0.49$ ) at the baseline to 5.8 s ( $S = 0.64$ ) at the final stage, with a mean difference of ( $d = 0.5$ ) s and a confidence level of ( $P = 98.5\%$ ). The experimental group also improved from 5.5 s ( $S = 0.58$ ) to 5.3 s ( $S = 0.55$ )—but the recorded growth was statistically insignificant ( $P=91.1\%$ ). Nevertheless, the experimental group maintained a substantial advantage over the control group at the end of the experiment, with a group difference of ( $d = 0.5$ ) s supported by a confidence level of ( $P=95.8\%$ ). This indicates a higher final level of speed among the athletes who trained according to the experimental methodology. The strength of the lower extremities, and specifically their explosive power, plays a vital role in the effectiveness of judo techniques. It contributes to the rapid and powerful execution of movements for positioning, maneuvering, and the performance of technical actions aimed at gaining an advantage over the opponent. To evaluate this motor quality, we conducted the 'Standing Long Jump' test. Figure 4 presents the mean performance values from the 'Standing Long Jump' for the athletes at the beginning and the end of the experiment.



**Fig. 4.** Comparison of mean performance in the "Standing Long Jump" test for lower extremity explosive power between the control and experimental groups at the baseline and final stages of the experiment (cm).

It is evident that when comparing the initial performance of the two groups, there is no significant difference -  $d = 8.3$  cm ( $P=44.5\%$ ), which provides a

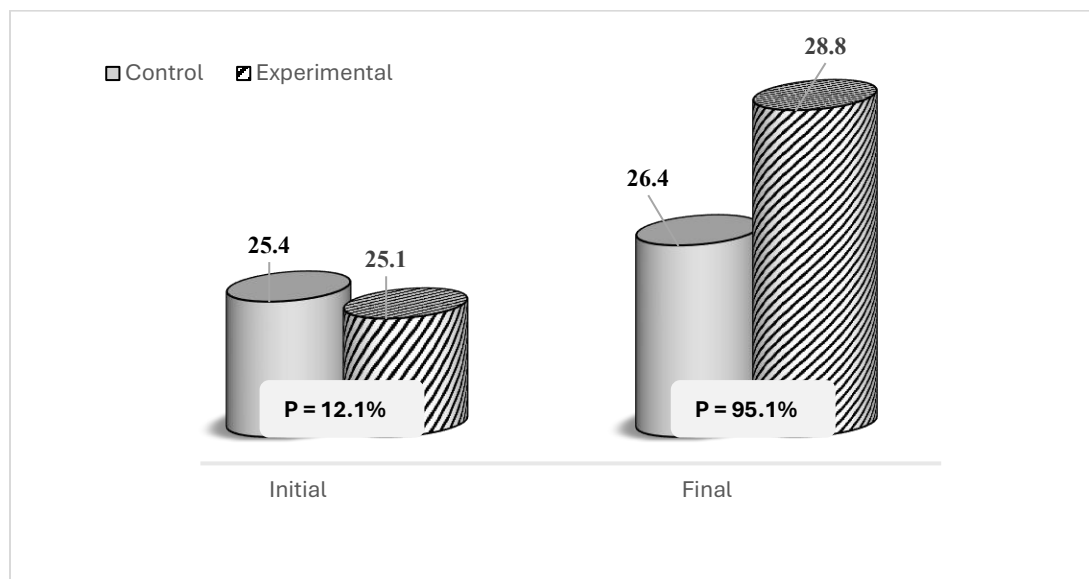
convincing basis to demonstrate the effectiveness of our methodology. At the end of the experiment, favorable changes were observed in the explosive power of the lower extremities of the athletes in the experimental group. The exercises implemented during the experiment significantly increased the strength of the subjects, with a difference of ( $d = 31.1$ ) cm ( $P = 99.9\%$ )—from 197.9 cm ( $S = 34.03$ ) at the baseline to 229.0 cm ( $S = 27.50$ ). Meanwhile, the control group athletes did not significantly improve their lower extremity explosive power during the experiment. Their initial performance of 189.6 cm ( $S=33.90$ ) improved by a minimal difference of  $d = 9.2$  cm ( $P=55.3\%$ ) to a final result of 198.8 cm ( $S=31.49$ ). The strength of the upper extremities is of essential importance in judo and sambo, as they are actively involved in all phases of technical actions—establishing and breaking the grip, off-balancing, and executing throws or controlling techniques on the ground. Therefore, within this experiment, we applied the 'Medicine Ball Throw' test to determine the level of upper extremity explosive power. Figure 5 presents the results of the 'Medicine Ball Throw' test.



**Fig. 5.** Comparison of mean performance in the "Medicine Ball Throw" test for explosive power of the upper extremities and trunk between the control and experimental groups at the baseline and final stages of the experiment (cm)

At the beginning of the experiment, no significant difference was observed between the mean results of the two groups. The control group achieved an average result of 674.0 cm ( $S = 173.1$ ), while the experimental group reached 577.0 cm

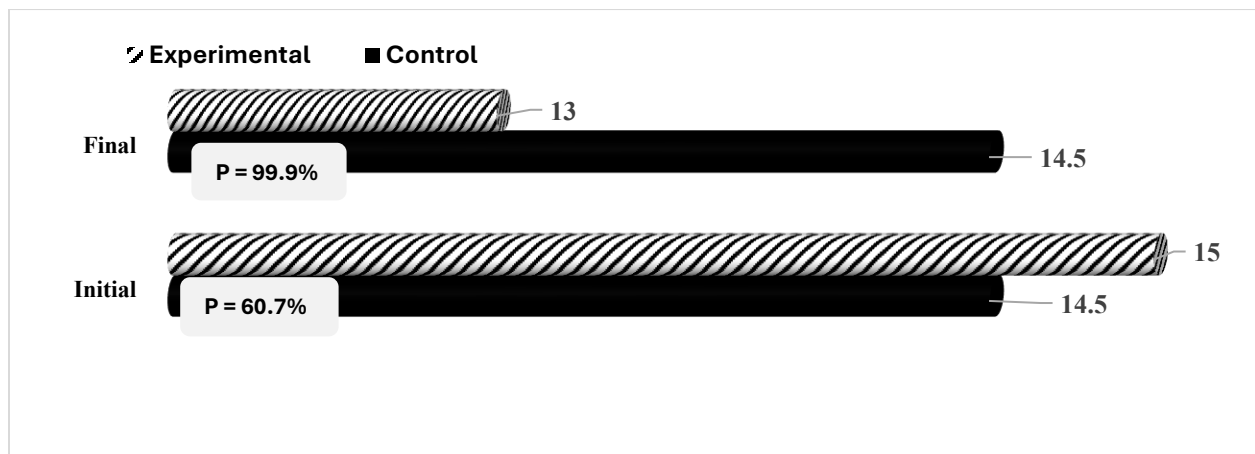
( $S=129.6$ ), with a minimal and statistically insignificant difference of  $d = 97.0$  cm ( $P = 88.1\%$ ). Toward the end of the experiment, the analysis revealed substantial differences in the dynamics of this indicator between the two groups. The experimental group showed a significant improvement—from  $577.0$  cm ( $S = 129.6$ ) at the baseline to  $750.0$  cm ( $S = 165.3$ ) at the final stage, with a mean difference of  $d = 173.0$  cm and a very high confidence level ( $P = 99.9\%$ ). In contrast, the control group not only failed to improve its results but showed a regression—from  $674.0$  cm ( $S=173.1$ ) to  $621.5$  cm ( $S=224.3$ ), though this difference was statistically insignificant ( $P = 51.7\%$ ). A comparison of the final results between the groups shows a clear advantage for the experimental group, with a difference of  $d = 128.5$  cm and a confidence level of ( $P = 97.2\%$ ). The abdominal muscles play a key role in achieving high efficiency and performance in judo, as they contribute to optimal biomechanics, stability, and movement power. The strength of the abdominal musculature was measured using the '30-second Sit-up' test. Figure 6 presents the results of the test conducted at the baseline and the final stage of the experiment.



**Fig. 6.** Comparison of mean performance in the "30-second Sit-up" test for abdominal muscle strength-endurance between the control and experimental groups at the baseline and final stages of the experiment (number of repetitions).

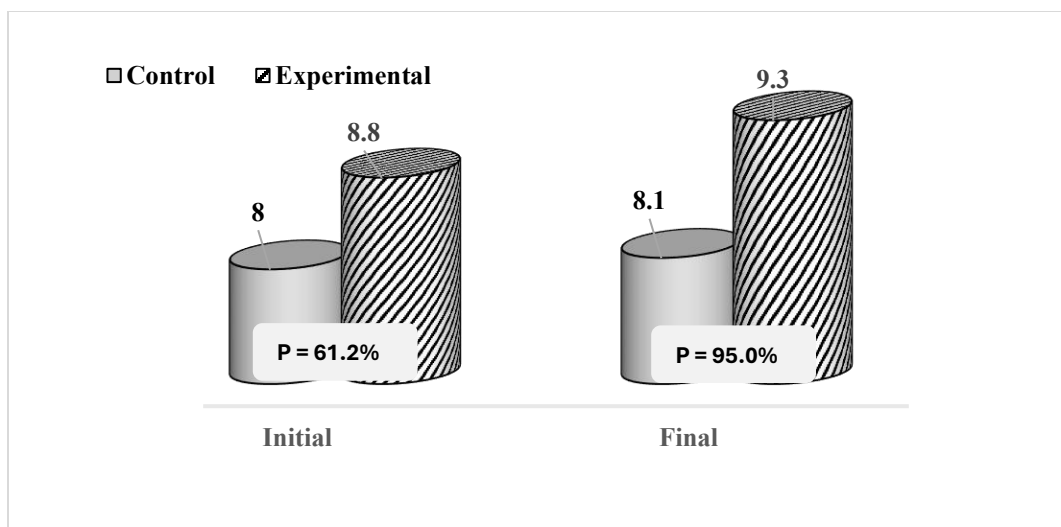
Following the implementation of the experimental methodology, a statistically significant improvement was established in the experimental group - increasing from

25.1 repetitions ( $S=3.35$ ) to 28.8 repetitions ( $S = 4.92$ ), with a mean difference of  $d = 3.7$  repetitions and a confidence level of ( $P = 99.0\%$ ). For the control group, the improvement was minimal and statistically insignificant—from 25.4 repetitions ( $S = 6.44$ ) to 26.4 repetitions ( $S = 5.76$ ), with a mean difference of  $d = 1.0$  repetition ( $P=46.9\%$ ). At the end of the experiment, the experimental group outperformed the control group by  $d = 2.4$  repetitions, with the recorded difference being statistically significant ( $P=95.1\%$ ). The 'T-test' provided the opportunity to evaluate the athletes' ability to coordinate their movements in space, time, and degree of effort in the most effective manner possible. Figure 7 illustrates the results recorded at the baseline and the end of the study.



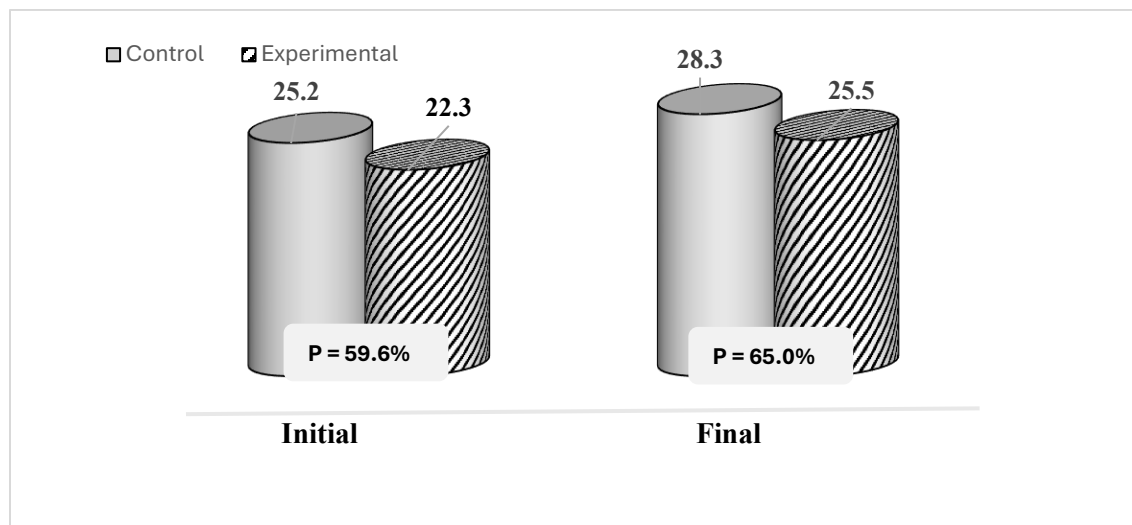
**Fig. 7.** Comparison of mean performance in the "T-test" for agility between the control and experimental groups (s).

Agility assessed via the 'T-test'. The results from the T-test demonstrate a distinct positive impact of the experimental methodology on the development of agility. The experimental group showed significant improvement—from 15.0 s ( $S = 1.56$ ) at the baseline to 13.0 s ( $S=1.21$ ) at the end of the experiment, with a mean difference of  $d = 2.0$  s and a confidence level of ( $P = 99.9\%$ ). The control group did not demonstrate any substantial change, with the result remaining practically unchanged at 14.5 s at both the beginning and the end ( $P=14.0\%$ ). A comparison between the groups at the conclusion of the experiment shows a clear and statistically significant advantage for the experimental group  $d=1.5$  s ( $P=99.9\%$ ).

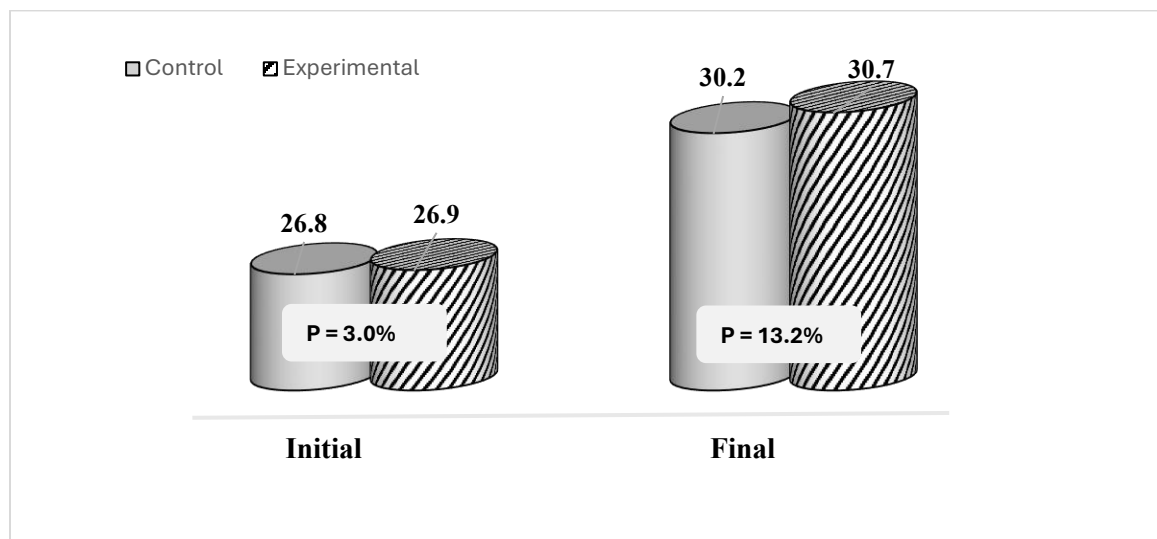


**Fig. 8.** Comparison of mean performance in the "Bend, Twist, and Touch" dynamic flexibility test between the control and experimental groups at the baseline and final stages of the experiment (repetitions)

Dynamic flexibility occupies an important place in the structure of motor preparation and significantly influences the effectiveness of technical actions in judo. To determine the dynamic flexibility levels of the competitors in both research groups, the "Bend, Twist, and Touch" test was applied at the baseline and the end of the experimental period. Analysis of the dynamic flexibility test results reveals a trend toward improvement in the experimental group, although the intra-group growth did not reach the level of statistical significance  $d = 0.5$  ( $P=66.5\%$ ). The control group also recorded a minimal improvement  $d=0.1$  ( $P=11.1\%$ ). Nevertheless, a comparison of the final results shows a significant advantage for the experimental group - 9.3 compared to 8.1 repetitions, with a difference of  $d = 1.2$  and a confidence level of ( $P=95.0\%$ ). Grip strength is considered an exceptionally vital element in judo, as it directly influences the effectiveness of all technical actions a competitor may undertake during a match. Recognizing the importance of this quality, we conducted the "Handgrip Dynamometry" test to assess its status in the competitors of both groups. Figures 9 and 10 present the results for left and right-hand grip strength, conducted using a handheld dynamometer.



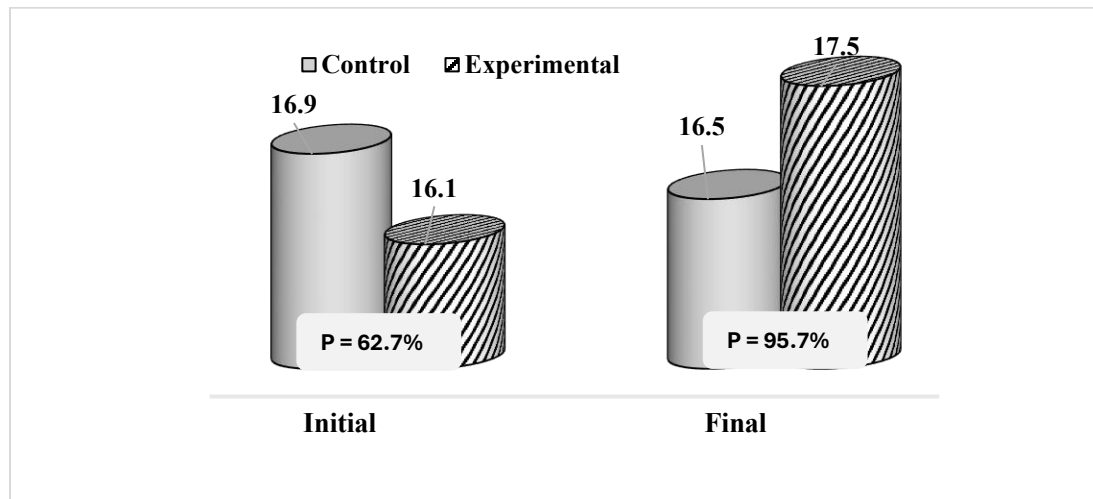
**Fig. 9.** Comparison of mean performance in the "Handgrip Dynamometry" test for left-hand grip strength between the control and experimental groups at the baseline and final stages of the experiment (kg)



**Fig. 10.** Comparison of mean performance in the "Handgrip Dynamometry" test for right-hand grip strength between the control and experimental groups at the baseline and final stages of the experiment (kg)

The results of the grip strength tests demonstrate more moderate dynamics. Regarding left-hand grip strength, both groups improved their results; by the end of the experiment, the control group maintained an advantage (28.3 kg compared to 25.5 kg), but the difference between the groups was statistically insignificant ( $P = 65.0\%$ ). For right-hand grip strength, both groups achieved statistically significant

intra-group improvements, yet the inter-group difference at the conclusion was minimal and insignificant  $d = 0.5$  kg; ( $P=13.2\%$ ). The data indicates that the development of grip strength requires additional targeted methodological intervention.



**Fig. 11.** Comparison of mean performance in the "Opponent Throws" test between the control and experimental groups at the baseline and final stages of the experiment (number of repetitions)

The correct and effective execution of techniques is a fundamental factor for achieving high performance in judo. It creates the necessary prerequisites for competing with minimal energy expenditure, establishing tactical advantages, and building stable, timely defenses against opponent attacks. To determine the level of technical efficiency in conjunction with the manifestation of the athletes' motor qualities, the 'Opponent Throwing' test was applied. The analysis of technical indicators reveals a clear advantage for the experimental methodology. The experimental group demonstrated a statistically significant improvement—from 16.1 to 17.6 throws  $d = 1.5$  ( $P = 97.1\%$ ), whereas the control group showed a lack of progress and a minimal regression. At the end of the experiment, the experimental group outperformed the control group by  $d = 1.1$  throws, a difference that is statistically significant ( $P = 95.7\%$ ). This confirms the positive effect of the integrated approach to developing motor qualities and technical preparation. In summary, the results of the variational analysis indicate that the applied experimental methodology leads to more pronounced and sustainable improvements in key motor qualities with direct relevance to competitive activity, as well as an increase in the athletes' technical efficiency. Concurrently, specific components emerged where the

effect was more limited, highlighting the need for more targeted intervention in future training practices.

### III.3. Identifying the Interrelationships between Physical and Technical Proficiency Indicators resulting from the implementation of the Experimental Training Methodology

Correlation analysis was employed to establish the strength of the interrelationships and the degree of determinacy between the various indicators of physical and technical readiness for the competitors in both research groups. Specific attention was directed toward the correlations within the experimental group that had the most direct relevance to the efficiency of their motor actions.

Table 15 presents the correlation matrix of the motor test indicators for the experimental group at the baseline of the study.

**Table 15**

*Correlation matrix of the interrelationships between individual motor qualities of the experimental group at the baseline of the study*

Tests	30m Dash	Long jump	Medicine ball	Sit-ups	T-test	Dyn. agility	Left hand grip	Right hand grip	Opponent throw
30m Dash	1								
Long jump	-0,72*	1							
Medicine ball	-0,11	0,08	1						
Sit-ups	-0,69*	0,51	0,26	1					
T-test	0,52	-0,38	-0,30	-,78**	1				
Dynamic agility	-0,49	0,39	-0,16	0,59	-0,49	1			
Left hand grip	0,39	-0,56	0,02	-0,32	0,44	-0,34	1		
Right hand grip	-0,03	0,06	-0,02	-0,23	0,32	-0,27	0,41	1	
Opponent throw	-0,36	0,48	-0,52	0,47	-0,55	0,50	-0,48	-0,20	1

\*\*significance level alpha = 0.01 \* – significance level alpha = 0.05;

The initial correlation analysis reveals a predominance of weak correlations ( $r < 0.30$ ), indicating insufficient functional connectivity between fundamental motor qualities. Practically insignificant and unexpected are the negative correlations between speed and upper extremity explosive power ( $r = -0.11$ ), speed and right-



hand grip strength ( $r = -0.03$ ), lower extremity explosive power and upper extremity strength ( $r = -0.08$ ), and between lower extremity strength and right-hand grip strength ( $r = -0.06$ ). Low correlations were also established between upper extremity strength and both right-hand ( $r = -0.02$ ) and left-hand grip strength ( $r = 0.02$ ), as well as between 'Opponent Throwing' and right-hand grip strength ( $r = -0.20$ ). A weak positive relationship was recorded between upper extremity strength and abdominal musculature ( $r = 0.26$ ). Concurrently, moderate correlations were identified between speed and left-hand grip strength ( $r = 0.39$ ), speed and dynamic flexibility ( $r = -0.49$ ), lower extremity strength and dynamic flexibility ( $r = 0.39$ ), lower extremity strength and agility ( $r = -0.38$ ), and between lower extremity strength and technical proficiency ( $r = 0.48$ ). Significant correlations were established between speed and agility ( $r = 0.52$ ) and between lower extremity strength and abdominal musculature ( $r = -0.51$ ). Furthermore, strong negative dependencies were found between speed and abdominal muscle strength ( $r = -0.69$ ) and between speed and lower extremity strength ( $r = -0.72$ ). A strong positive correlation was recorded between abdominal muscle strength-endurance and agility ( $r = 0.78$ ).

The correlation dependencies between the motor qualities of the experimental group at the conclusion of the study are presented in Table 16.

**Table 16**

*Correlation matrix of the interrelationships between individual motor qualities of the experimental group at the conclusion of the study*

Tests	30m Dash	Long jump	Medicine ball	Sit-ups	T-test	Dyn. agility	Left hand grip	Right hand grip	Opponent throw
30m Dash	1								
Long jump	-,84**	1							
Medicine ball	-0,45	0,57	1						
Sit-ups	-,669*	,779**	0,46	1					
T-test	,762*	-,746*	-0,07	-,84**	1				
Dynamic agility	-,744*	,670*	0,45	,669*	-,646*	1			
Left hand grip	0,21	-0,39	-0,02	-0,45	,644*	0,03	1		
Right hand grip	-0,44	0,24	0,46	-0,02	-0,02	0,29	0,53	1	
Opponent throw	-0,46	0,43	-0,12	0,39	-0,39	,710*	-0,15	-0,27	1

**\*\*significance level  $\alpha = 0.01$  \* – significance level  $\alpha = 0.05$ ;**

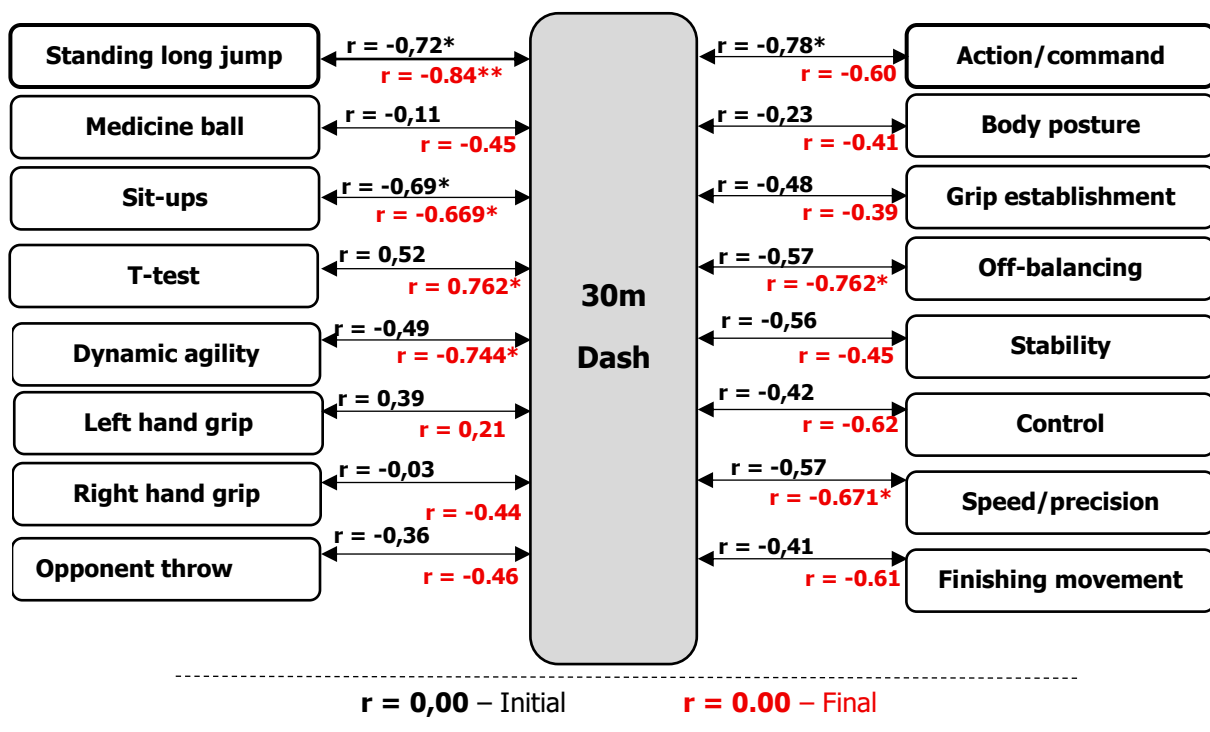
In addition, significant correlation links were established, with 'Establishing the grip' correlating with 'Body posture' ( $r = 0.672$ ;  $\alpha = 0.05$ ), 'Speed and precision' ( $r = 0.650$ ;  $\alpha = 0.05$ ), and 'Finishing movement' ( $r = 0.657$ ;  $\alpha = 0.05$ ). The 'Speed and precision' criterion occupies a central place in the structure of the technique, showing significant dependencies with 'Action upon command' ( $r = 0.667$ ;  $\alpha = 0.05$ ), 'Off-balancing' ( $r = 0.650$ ;  $\alpha = 0.05$ ), 'Stability' ( $r = 0.684$ ;  $\alpha = 0.05$ ), and 'Finishing movement' ( $r = 0.685$ ;  $\alpha = 0.05$ ).

Table 18 presents the correlation dependencies between the technical indicators of the experimental group at the end of the experiment. At the conclusion of the experiment, a distinct strengthening of the correlation links between the leading technical criteria was established, indicating a high degree of functional integration of the technique. The correlation between 'Action upon command' and 'Body posture' increased from moderate ( $r = 0.693$ ;  $\alpha = 0.05$ ) to strong ( $r = 0.895$ ;  $\alpha = 0.01$ ), and with 'Stability' - from moderate ( $r = 0.44$ ) to strong ( $r = 0.830$ ;  $\alpha = 0.01$ ), with the determinacy increasing from 19.4% to 68.9%. Similarly, the relationships with 'Control' from ( $r = 0.51$ ) to ( $r = 0.70$ ;  $\alpha = 0.05$ ) and 'Finishing movement' from ( $r = 0.61$ ) to ( $r = 0.806$ ;  $\alpha = 0.01$ ) strengthened to strong levels, while the dependency with 'Establishing the grip' maintained its strong character ( $r = 0.859 \rightarrow r = 0.824$ ;  $\alpha = 0.01$ ).

Strong correlations were also recorded between 'Body posture' and 'Establishing the grip' ( $r = 0.71 \rightarrow r = 0.78$ ;  $\alpha = 0.01$ ), 'Control' ( $r = 0.28 \rightarrow r = 0.73$ ;  $\alpha = 0.05$ ), and 'Finishing movement' ( $r = 0.40 \rightarrow r = 0.79$ ;  $\alpha = 0.01$ ). The relationship between 'Establishing the grip' and 'Stability' strengthened from moderate ( $r = 0.60$ ) to strong ( $r = 0.880$ ;  $\alpha = 0.01$ ), with a determinacy of (77.4%). The 'Off-balancing' criterion showed strong dependencies with 'Stability' ( $r = 0.880$ ;  $\alpha = 0.01$ ), 'Control' ( $r = 0.861$ ;  $\alpha = 0.01$ ), and 'Finishing movement' ( $r = 0.826$ ;  $\alpha = 0.01$ ). Following the experiment, the links between 'Stability' and 'Control' ( $r = 0.60 \rightarrow r = 0.791$ ;  $\alpha = 0.01$ ), 'Speed and precision' ( $r = 0.684 \rightarrow r = 0.781$ ;  $\alpha = 0.01$ ), and 'Finishing movement' ( $r = 0.726$ ;  $\alpha = 0.01$ ) also intensified. The strong dependency between 'Speed and precision' and 'Control' was further reinforced ( $r = 0.845 \rightarrow r = 0.889$ ;  $\alpha = 0.01$ ), as was the relationship with 'Finishing action' ( $r = 0.685 \rightarrow r = 0.784$ ;  $\alpha = 0.01$ ). Following the implementation of our experiment and the subsequent correlation analysis, we

established that the most informative indicators are the '30-Meter Dash' and the 'Standing Long Jump'. This is due to the fact that these specific tests reveal the highest number and strongest correlation dependencies with both physical and technical proficiency indicators.

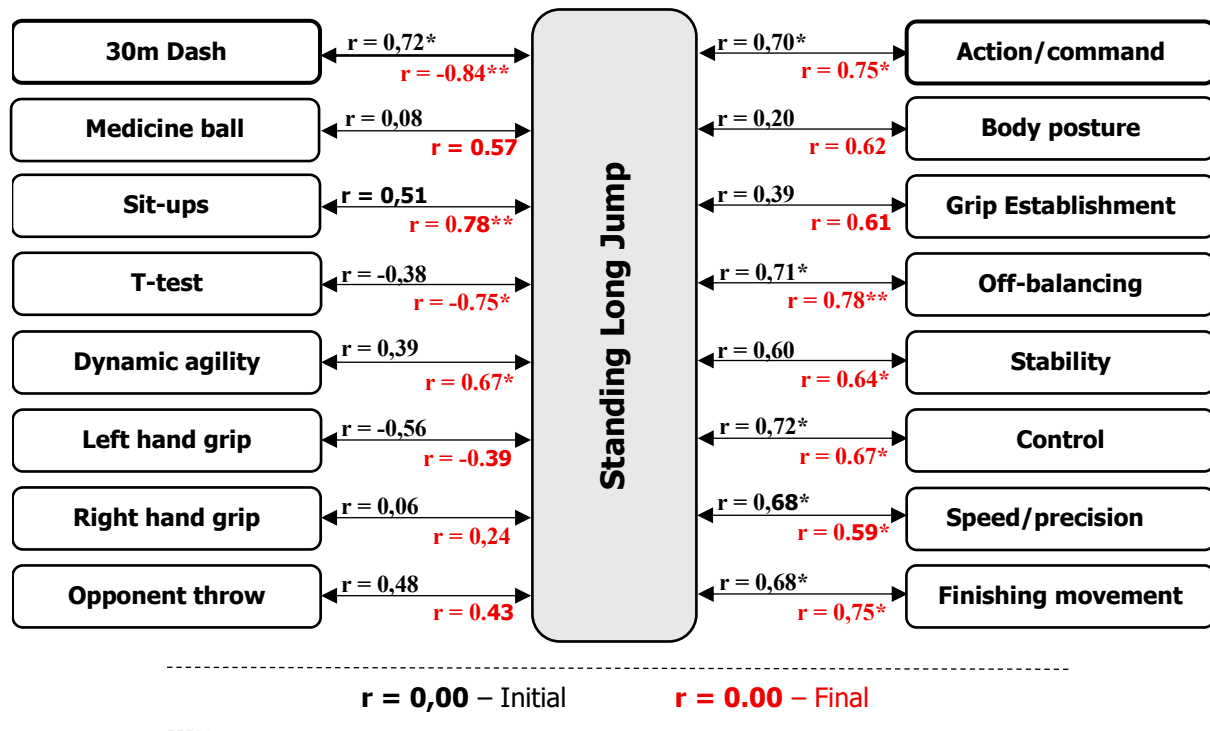
In Figures 14 and 15, we present the correlation model illustrating the interrelationships between the indicators within the designated '30-Meter Dash' and 'Standing Long Jump' group at the baseline and the conclusion of the experiment. An analysis of the figures reveals a distinct strengthening of interrelationships following the implementation of the experimental methodology. The strongest dependencies are established with the 'Standing Long Jump' ( $r = -0.72$ ;  $\alpha = 0.05$ ) before vs.  $r = -0.84$ ;  $\alpha = 0.01$  after), the 'T-test' ( $r = -0.52$  before vs.  $r = -0.762$ ;  $\alpha = 0.05$  after), and 'Dynamic Flexibility' ( $r = -0.49$  before vs.  $r = -0.744$ ;  $\alpha = 0.0$  after), highlighting the leading role of explosive power, coordination, and flexibility in sprint velocity. Although relatively weaker, the correlations with right-hand grip strength ( $r = -0.03$  before vs.  $r = -0.44$  after) and 'Opponent Throwing' ( $r = -0.36$  before vs.  $r = -0.46$  after) also intensified."



**Figure 14** presents a correlation model illustrating the relationships among studied indicators for the 30-Meter Dash' group at both the beginning and end of an experiment.

For some indicators, a weakening of correlations was observed following the experiment, such as with abdominal muscle strength ( $r = -0.69$ ,  $\alpha = 0.05$  before, to  $r = -0.669$ ,  $\alpha = 0.01$  after) and left-hand grip strength ( $r = -0.68$ ,  $\alpha = 0.05$  before, to  $r = -0.55$  after). This suggests a diminishing role for isolated muscle groups in favor of integrated motor qualities. It indicates that, following the experiment, sprint velocity manifests as a result of a more complex interaction between explosive power, coordination, and flexibility. Among technical indicators, the strongest dependency was recorded with 'Off-balancing' ( $r = -0.57$  before;  $r = -0.762$ ,  $\alpha = 0.05$  after), as well as with 'Control' ( $r = -0.42$  before;  $r = -0.62$  after), 'Speed and Precision' ( $r = -0.57$  before;  $r = -0.671$ ,  $\alpha = 0.05$  after), and 'Finishing Action' ( $r = -0.41$  before;  $r = -0.61$ ,  $\alpha = 0.05$  after), all of which showed an increase in correlation strength post-experiment. Dependencies also intensified with 'Body Posture' ( $r = -0.23$  before;  $r = -0.41$  after) and 'Establishing the Grip' ( $r = -0.48$  before;  $r = -0.669$ ,  $\alpha = 0.05$  after), with the determinacy for the latter reaching (44.8%).

In contrast, for 'Action upon Command' ( $r = -0.78$ ,  $\alpha = 0.01$  before;  $r = -0.60$ ,  $\alpha = 0.05$  after), 'Establishing the Grip' ( $r = -0.48$  before;  $r = -0.39$  after), and 'Stability' ( $r = -0.56$  before;  $r = -0.45$  after), a weakening of correlations was observed. This can be interpreted as an expression of increasing technical autonomy and the automation of movements. In summary, the 30-Meter Dash' proves to be an informative indicator of the developmental level of key motor qualities and their integration with technical mastery. The strengthening of correlations following the experiment confirms the effectiveness of the targeted training program and the closer interrelationship between the athletes' physical and technical proficiency.



**Fig. 15.** Correlation model of the interrelationships between the indicators studied within the designated "Standing Long Jump" group at the baseline and the conclusion of the experiment.

The results show that the 'Standing Broad Jump' has strong correlation links with the '30m Dash' ( $r = 0.72$ ;  $\alpha = 0.05$  before and  $r = 0.84$ ;  $\alpha = 0.01$  after), with abdominal muscle strength ( $r = 0.51$  before  $r = 0.78$ ;  $\alpha = 0.0$  after), and with agility ( $r = -0.38$ ) before  $r = 0.75$ ;  $\alpha = 0.05$  after). This confirms the close dependency between the explosive power of the lower extremities and the speed-strength and coordination abilities in judo. A significant increase is also observed in the relationship with dynamic flexibility ( $r = 0.39$  before;  $r = 0.67$ ;  $\alpha = 0.05$  after), while the dependency with right-hand grip strength remains weak ( $r = 0.06$  before;  $r = 0.24$  after). Conversely, the links with left-hand grip strength ( $r = -0.56$  before;  $r = -0.39$  after) and 'Opponent Throwing' ( $r = 0.48$  before;  $r = 0.43$  after) weakened, which can be interpreted as a reduction in the role of pure explosive power in favor of technical refinement.

Strong correlations were also established with specific technical indicators, such as 'Off-balancing' ( $r = 0.71$ ,  $\alpha = 0.05$  before;  $r = 0.78$ ,  $\alpha = 0.01$  after) and 'Finishing Action' ( $r = 0.68$ ,  $\alpha = 0.05$  before;  $r = 0.75$ ,  $\alpha = 0.05$  after), alongside a significant relationship with 'Stability' ( $r = 0.60$  before;  $r = 0.64$ ,  $\alpha = 0.05$  after). Following the experiment, the dependencies with 'Establishing the Grip' ( $r = 0.39$  before;  $r = 0.61$  after) and 'Body Posture' ( $r = 0.20$  before;  $r = 0.62$  after) also became significant. Meanwhile, the correlations with 'Control' ( $r = 0.72$ ) before; ( $r = 0.67$ ) after) and 'Speed and Precision' ( $r = 0.68$  before;  $r = 0.59$  after) slightly weakened, suggesting an increasing technical autonomy among the athletes.

## **CONCLUSIONS AND RECOMMENDATIONS**

The extensive research and applied activity conducted to refine our methodology for the preparation of sambo and judo competitors provides the opportunity to formulate the following key conclusions:

1. Theoretical analysis of literary sources indicates that, in most cases, the preparation of sambo and judo athletes prioritizes either physical or technical training in isolation, rather than addressing them as a unified system. Furthermore, we established that reliable criteria for evaluating the technical proficiency of athletes have not been sufficiently defined.

2. The physical preparation methodology piloted in this study leads to a reduction in the variability of individual motor test indicators among the experimental group participants. The least stable indicators, consequently exhibiting the highest coefficients of variation, are those associated with left and right-hand grip strength.

3. As a result of the implemented methodology, significant improvements were observed in explosive power of the lower and upper extremities, strength-endurance of the abdominal muscles, agility, dynamic flexibility, and the capacity to execute the maximum number of throws within a minimum timeframe. Furthermore, the strength of correlation dependencies and the degree of determinacy between individual components within the structure of the athletes' physical proficiency have increased.

4. A favorable influence of the implemented methodology on the improvement of the subjects' technical proficiency was established. These significant improvements resulted from expanded theoretical knowledge, increased readiness and confidence in executing given commands, and the effective execution

of integrated technical actions. Furthermore, the structure of technical proficiency among the experimental group competitors was refined.

5. The most informative indicators regarding the unified structure of physical and technical proficiency in the experimental group are those for speed (sprint) and explosive power of the lower extremities. This clarifies that speed-strength abilities are decisive factors for the effective application of specific techniques during competition.

6. The significant improvement in the state of motor qualities, the marked refinement of technical skills and habits, and the increased determinacy between individual indicators within the structure of physical and technical proficiency demonstrate that our methodology is effective and suitable for implementation in practical training.

## **RECOMMENDATIONS:**

- ✓ To continue experimenting with new means and methods for improving the physical and technical proficiency of sambo and judo competitors. In future experiments, it is advisable to focus on enhancing grip strength and its correlation with the manifestation of other motor abilities.

- ✓ To conduct larger-scale studies involving a greater number of participants to identify the fundamental factors determining athletic performance in sambo and judo.

- ✓ To develop methodological manuals and handbooks for coaches to facilitate the effective implementation of athletic preparation for competitors.

## **PUBLICATIONS RELATED TO THE DISSERTATION**

Stefanova, K. (2023). Pilot Testing of Evaluation Criteria for Technical Proficiency in Adolescent Judokas. Annual of the National Sports Academy – Annual of the NSA 2023, Issue 2.

Stefanova, K. (2024). Influence of a Specialized Strength Complex on the Physical Proficiency of Adolescent Judokas. Annual of the National Sports Academy – Annual of the NSA 2024, Issue 2.