PAISII HILENDARSKI UNIVERSITY OF PLOVDIV
FACULTY OF PEDAGOGY

DEPARTMENT: Theory and Methodology of Physical Education and Sports

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STUDY OF TECHNICAL AND TACTICAL PREPARATION IN TAEKWON-DO TRAINING

ABSTRACT

FOR THE AWARD OF THE EDUCATIONAL AND SCIENTIFIC DEGREE
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This dissertation thesis was discussed and proposed for official defense by the extended departmental council of the Department of Theory and Methodology of Physical Education and Sports at the Pedagogical Faculty of Paisii Hilendarski University of Plovdiv on 20.12.2022.

The volume of the dissertation paper is 145 pages, structured in an introduction, 3 chapters containing text, 39 tables and 97 figures. 11 appendices in the amount of 12 pages are attached to the dissertation work. The literary reference consists of 116 literary sources, of which 101 are in Cyrillic and 15 are in Latin. The list of author's publications includes 3 titles.

The defense of the dissertation will take place on 21.03.2023 at 11.00 a.m. at Paisii Hilendarski University of Plovdiv, 24 Tsar Asen St., Conference Hall.

The materials of the defense are available to those interested in the library of the Faculty of Pedagogy at PU Paisii Hilendarski, Plovdiv, 236 "Bulgaria" Blvd., floor IV.

INTRODUCTION

Shrouded in mysticism, the Eastern martial arts have been entering the ranks of the most popular sports in the modern world. Nowadays, Taekwon-do is one of the most practiced martial arts among adolescents both in our country and abroad. We should emphasise that the training methods involved in Taekwon-do attract students of different age groups and with varying learning goals. Its main purpose is the versatile psychophysical enhancement of the personality. Its practice leads to the improvement of a number of mental, physical, technical and tactical indicators, resulting in self-control of the body. Taekwon-do is closely related to the mental, moral, aesthetic and work education of adolescents. One of the basic goals in Taekwon-do training is to improve the technical and tactical preparation by achieving maximum effect with minimum energy expenditure. Tactical preparation is the basis for building the educational and training process. Based on the good mastery of the technique, we arrive at more adequate decisions and actions in various extreme situations during training and competitions. The afore highlights the thesis that the technical and tactical training of Taekwon-do practitioners is determined by the extent to which its content corresponds to specific theoretical and practical methods reflecting the modern requirements for contemporary sports. Simultaneously, technical and tactical improvement is closely related to psychophysical training and correlates with all its components such as physical qualities and mental preparation. The above stated problems give us grounds to focus our attention to the study of technical and tactical training in Taekwon-do. The hypothesis of the research is that, by analysing and optimising the technical and tactical training and developing and introducing by us a model for improving the technical and tactical training of Taekwon-do athletes, the mental, physical, technical and tactical fitness will be enhanced. All this will result in optimisation of the overall structure of the learning and training process in Taekwon-do preparation. Based on this statement, we aim to research, analyse and optimise the technical and tactical practices in Taekwon-do training. In order to achieve this goal we have concrete tasks, namely: to perform a theoretical and retrospective analysis of the development of Taekwon-do from ancient times to the present day, as well as to carry out an analysis of technical training, tactical training, physical training and mental training; to develop training models in order to increase the technical and tactical fitness of Taekwon-do practitioners; to examine different physical, mental and technical qualities of the experimental and control groups; to perform a correlation analysis of the results obtained.

SUMMARY OF CONTENTS OF THE DISSERTATION
CHAPTER ONE

Following the analysis of the problem, by summarising data from various literary sources, CHAPTER ONE examines 4 main topics:

The first part is dedicated to the history and origin of Taekwon-do. As a system uniting a number of martial arts through a precise selection of appropriate techniques, Taewon-do is a relatively young and modern martial art.

Technically, 1955 marks the beginning of Taekwon-do, being also its official recognition as a martial art in Korea. In the same year, a special committee was summoned, including a group of masters, instructors, historians and prominent public figures. They offered a number of names for a new martial art. On April 11, the committee convened by Choi Hong Hee decided to take the name *Taekwon-do*. The fundaments of the new martial art are formed by various Korean martial arts: Tang Soo Do, Taek Kyon, Hwa Rang Do, etc.

In Bulgaria, the development of Taekwon-do began in 1985. This is associated with the arrival of Master Kim Ung Chol from the DPRK in our country, which Sofka Popova recorded on paper (2013). Although his initial stay was brief, he left behind keen disciples and loyal followers.

The question "**Taekwon-do – sports or martial art?"** is also discussed here**.**

According to Choi Hong Hee (2004), Taekwon-do is a scientific method of using the body for self-defense, a body which has reached its maximum potential through intense physical and mental training.

Metaphorically represented, "Tae" means to jump or lunge forward with a kick or a strike with a leg. "Quon" is the designation of a fist, mainly to hit or destroy with the hand or fist. "Do" means the way of art. Taken together, "Taekwon-do" means a spiritual training and technique for unarmed self-defense, health care, involving the skillful application of strikes, kicks, blocks, and movements with bare hands and feet to quickly strike a moving opponent or opponents.

World organisations promoting Taekwon-do are the World Taekwondo Federation WTF, later WT, and the International Taekwon-do Federation ITF. The basis for the current research is laid by the training system in the International Taekwon-do Federation ITF.

In **the second part**, emphasis is placed on psychophysical preparation, paying attention to mental readiness and examining in detail the various physical qualities, as their development in Taekwon-do is monitored from their manifestation in other sports. The explanation of the psychophysical as the union of the physical and the mental, as mutually dependent (internal and external) determinants is closely advocated in the principles of training and practice in Taekwon-do.

M. Georgiev (1997) remarks that the basic purpose of practice in traditional Taekwon-do is the union of mind and body. There is a special denomination for this union of the inner and outer potential of the person – *Simshin Ilche* – translated as *'union of mind and body'*.

This chapter reveals the sub-structures of mental preparedness, adaptation and anticipation, as processes, and the crucial significance of mental readiness in extreme situations.

The **third part** focuses on technical training, which plays a major role when we talk about high sportsmanship. In this part of the thesis theoretical attention is paid to technique in sports and in particular technical training in Taekwon-do, noting that the most used word in the Encyclopedia of Taekwon-do is "technique". Viewpoints are provided regarding the structure of sports technique, the opposing trends in the development of the sports technique and the conditions for the sustainability of sports results are examined. The different characteristics of the technique, the specifics of the technique in different types of sports and phases of mastering the technical skills are defined.

In **the fourth part**, dedicated to tactical training, special attention is paid to the impact of tactics in various sports disciplines. The concepts of strategy and tactics are differentiated, attention is paid to algorithmic, probabilistic and heuristic tactics, and various data in the field of tactics in combat sports and in particular Taekwon-do are also studied and described. Attacks, defenses, maneuvers and various combinations are examined as tools for realising tactical intentions.

CHAPTER TWO
HYPOTHESIS, PURPOSE, TASKS, METHODOLOGY
AND ORGANISATION OF THE RESEARCH
A MODEL FOR IMPROVING THE TECHNICAL AND TACTICAL
TRAINING OF TAEKWON-DO PRACTITIONERS

1. Hypothesis: through analysis and optimisation of the technical and tactical training, as well as by developing and introducing a model for enhancing the technical and tactical training of Taekwon-do practitioners, the mental, physical, technical and tactical fitness will be improved. This will lead to optimisation of the overall structure of the teaching and training process in Taekwon-do preparation.

2. The purpose of the research is to investigate, analyse and optimise the technical and tactical practices in ITF Taekwon-do training.

3. The tasks to achieve the purpose are:
1. To perform a theoretical and retrospective analysis of the development of ITF Taekwon-do from ancient times to the present day.
2. To carry out an analysis of the technical and tactical training in the teaching and training process in ITF Taekwon-do.
3. To analyse the mental and physical training in ITF Taekwon-do preparation.
4. To draw up training models in order to increase the technical and tactical fitness of ITF Taekwon-do practitioners.
5. To examine and analyse individual mental, physical and technical qualities of the experimental and control groups.
6. To perform a correlation analysis of the obtained results.

Research Methodology

The methodology in the offered study strives, on the one hand, to highlight the positive role of the used models, and on the other hand, to define and determine links and dependencies between the individual mental, physical and technical indicators. The above is achieved through a detailed toolkit for analysing the influence of the applied methodology on all physical qualities and, respectively, on the technical and tactical skills of the tested groups. The research also aims to determine the effect of the method on the psyche of the practitioners beyond the standard Taekwon-do training. The dependencies between the individual physical qualities as the object of this study can be used to summarise various conclusions and recommendations to the training and building of programs for the development of the desired qualities in the practitioners.

The **subject** of the research is the technical and tactical preparation in Taekwon-do training and learning.

The **object** of the study are 40 athletes divided into two groups - an experimental and a control one.

The **tools** applied for the analysis of the sports readiness and performance in the context of the impact of sports methodology includes the following tests, indicated in

Table 1. Those aim to provide full objectivity to the results through a diverse and multi-layered assessment of physical, mental and psychophysical performance. Apart from these tests, the research toolkit uses both tabular and graphical analysis methods and the statistical possibilities of correlation analysis to reveal links and dependencies between physical, mental and psychophysical performance. Moreover, a survey was conducted in the form of questions and answers in order to activate the cognitive activity of the researched group in the study.

***Table 1.** Methodological Toolkit*

№	**Method Denomination (Test)**	**Measuring Units**
1.	Side Splits Test	centimeters
2.	Front Splits Test	centimeters
3.	Spine Flexibility Test	centimeters
4.	Dollyeo Chagi Test (left and right kick)	number of hits
5.	Yeop Chagi Test (left and right kick)	seconds
6.	Standing Long Jump Test	centimeters
7.	Sargent/ Vertical Jump Test	centimeters
8.	Pads Test (left and right kick)	number of hits
9.	Impact Force Test	kilograms
10.	30m Sprint Test	seconds
11.	Cooper Test	meters
12.	Patterns Test	points
13.	Time Perception Test	seconds
14.	Test of Collective and Ego Orientation	points
15.	SJT Situational Judgment Test	points
16.	SAM Self-esteem, Activity, Mood Test	points
17.	Survey	points
18.	Variational analysis	
19.	Correlation analysis	
20.	Graphical and tabular analysis	

To reach the goals of the current thesis and clearly objectify the effect of the sports methodology, we implemented the statistical method of related groups, target and control, in two consecutive periods. By means of the method of related groups, the statistical significance of the change in the experimental and control groups in their means, standard deviation and coefficient of variation between two consecutive periods is derived.

Statistical methods

The analysis of the obtained experimental data is performed by means of statistical methods. They are used to examine the results and detect statistical regularities.

1.1. Variational analysis

Mathematical-statistical data processing was performed with Microsoft Excel 2019 and SPSS22 statistical package. The statistical methods used are:

a) arithmetic mean value:

$$\bar{x} = \frac{\sum x}{n}$$

b) standard deviation:

$$s = \sqrt{\frac{\sum(x_i - \bar{x})^2}{n-1}}$$

c) coefficient of variation V (%)

$$V = \frac{s}{\bar{x}} \cdot 100$$

– 95% confidence limit of the mean for a normally distributed sample ($a = 0{,}05$),

$$\mu = \bar{x} \pm \frac{ts}{\sqrt{n}}$$

– absolute increase $d = \bar{x}_2 - \bar{x}_1$ and relative increase

$$d\% = \frac{\bar{x}_2 - \bar{x}_1}{\bar{x}_1} \cdot 100$$

1.2. Hypothesis testing. For the purpose, Student's Criterion for dependent samples under guaranteed probability was applied P = 0,95 (95%)

$$t_{emp} = \frac{|\bar{d}|}{\sqrt{\dfrac{\sum d^2 - n(\bar{d})^2}{n^2 - n}}}$$

1.3. Correlation analysis. We calculated Pearson's coefficient (r) according to the formula:

$$r = \frac{P}{s_x \cdot s_y}, \text{ where}$$

$$P = \frac{\sum xy}{n-1} - \frac{\sum x \sum y}{n(n-1)}$$

Research Agenda

The research is developed in four stages.

I. Stage initiated in 2018, drawing up of dissertation plan, gathering of literary sources, materials, articles, etc., as well as a development of the theoretical part of the problem.

II. The stage began in 2020, related to shaping the text and preparing the tests.

III. Implementation of the tests in 2020-2021, with the collection and processing of the results, as their analysis falls into this stage, too; basic conclusions and recommendations.

A model for improving the technical and tactical training of Taekwon-do practitioners

The purpose is the development of the fundamental physical qualities relevant to the technical and tactical preparation of Taekwon-do practitioners.

The tasks are:

1. Optimisation of certain technical elements in Taekwon-do training.

2. Improvement of tactical training, through the development of some basic physical qualities.

3. Complex development of technical and tactical training.

There are several **methodological guidelines.** To implement the sample model and evaluate its impact on Taekwon-do practitioners, two groups are formed: experimental and control. Specific methods beyond the standard activities are applied in Taekwon-do training sessions on the experimental group. The main tool for achieving the desired results are physical exercises related to the development of individual physical qualities. The interrelationship between flexibility, speed, strength, stamina and coordination with the technical and tactical training of athletes, respectively, is the purpose of the present study. We also look for a different approach in verbal training sessions and in the analysis of tactical concepts, customised by previous actions of the practitioners.

Development of the physical quality Flexibility in Taekwon-do.

Range of motion, allowing for technically correct strikes, is at the heart of the training of every Taekwon-do athlete. The reason to introduce a method for improvement of the flexibility of the lower limbs is of key importance for the development of not only adequate defence and attack techniques, but also for the deployment of actual tactical actions through technical skills. One of the methods for successful development of the physical quality Flexibility is the implementation of additional exercises in the early hours of the day. After short introductory movements, the practitioner can move on to specific exercises for stretching the musculoskeletal system. Those workouts are detailed in Table 2.

The above detailed workouts are applied to the experimental group. Depending on the existing flexibility in the hip joint, the number of repetitions is increased and individual sets are made. Most exercises include active stretching. Maximal amplitude is pursued until the appearance of slight pain.

<div align="center">*Table 2*</div>

N	Workout Description	Repetitions	End Position Hold
1	Forward lunge – the position of the body is with the front leg, maximally bent, extended forward with support on the floor, the rear leg is positioned maximally backward with support only on the toe pads. Active stretching by pulsing up and then holding in the end stance.	10–30 both directions	From 10 to 20 seconds in both directions
2	Forward lunge – rear leg with flat foot on the floor. The exercise is similar to the previous one, but the foot of the rear leg is completely flat on the floor. Active stretching with lunges followed by a hold in the end phase.	10–30 in both directions	From 10 to 20 seconds in both directions
3	Side lunge. Again, pulsing movements with the foot of the supporting leg in full contact with the floor.	10–30 in both directions	From 10 to 20 seconds in both directions
4	Sitting position, legs forward, the torso leans towards the legs. With a maximally straight spine, bends to maximal endpoint and subsequent hold.	10–30	0t 10 to 20 seconds
5	Wide-legged seat with legs bent and feet closed together. With the hands, we press the knees, then pulse and then hold in the end position.	30–50	From 10 to 20 seconds
6	Seat with legs as wide apart as possible, leaning towards one leg with a straight back, followed by pulsing and subsequent hold in the final stance.	10-30	From 10 to 20 seconds
7	Analogous to the previous exercise with forward bends and hold, if possible, with the chest on the floor.	10–30	From 10 to 20 seconds
8	Side (male) splits.		From 20 seconds to 1 minute
9	Front (female) splits.		From 20 seconds to 1 minute in both directions

In the next block of workouts, an increase in amplitude is pursued by increasing the limit of mobility of the joints, muscles and tendons, which is carried out with the assistance of a partner. This is the so-called passive flexibility. For this purpose, a gymnastic wall and a partner are necessary. In the experimental group, the exercises are performed as a continuation of the main warm-up process.

The specific workouts are laid out in Table 3.

Table 3

N	Workout Description	End Position Hold
1	From an upright position, one leg is raised frontally with the help of a partner until reaching the last possible position, after which the partner, applying force, increases the amplitude a little more until the appearance of slight pain. The supporting leg is turned with the heel pointing forward in the direction of the partner. The spine is as straight as possible, completely flat against the gymnastic wall.	From 30 seconds to 1 minute on each leg
2	In an upright lateral position, the leg is raised with the help of a partner to its extreme position and the amplitude is increased until the appearance of slight pain. It is necessary that the heel is pointing at the direction of the partner and that the head, pelvis and heel of the raised leg are in one line. Hands grip the gymnastic wall.	From 30 seconds to 1 minute on each leg

Improvement of the technical skills in Taekwon-do.

The correlation between the individual physical qualities and the technical abilities of the practitioners is the purpose of this paper. Undoubtedly, improvements in strength, speed, coordination and stamina also affect the technique in Taekwon-do. Apart from enhancing the basic physical qualities, we also aim at the development of technical skills through specific practices embedded in the proposed model.

The purposeful and continual development of the fundamental techniques, called in Taekwon-do "gi bo dojang", accompanies the entire training process, but the inclusion of additional sessions in the discipline variant called "Tul" and correction of the main characteristics – performance technique, balance, strength, breathing and rhythm, are applied at the end of each session and additionally once a week. The specifics of performing the individual techniques are controlled by an instructor, as additional practice in front of a mirror aims at both self-control and correction.

Taekwon-do is a martial art with highly sophisticated lower limbs techniques. Every single detail of the performance is tailored to achieve the maximum effect precisely through a balanced kick with particular requirements regarding

biomechanics of a strong and fast kick. The standard performance of the techniques and the use of the repetition method definitely leads to the acquisition of a good skill of the individual kicks. The model we apply to the experimental group involves performing each technique at the slowest possible pace. Holding and focusing on the final stance of the kick is of particular importance. A gradation of complexity is applied, starting with using some support and medium height techniques, followed by subsequent techniques in the higher parts of the body "napunde" without a support respectively. Every 20 repetitions are followed by rest and stretch of the spine to prevent injuries.

The interaction of various physical qualities in the development of a good technique is of fundamental importance in any sport. The speed of the initial movement or the quick reaction in Taekwon-do is the basis for the subsequent technical and tactical actions. Precisely due to the fact that we have basic techniques, but we also have the preparation scheme for their implementation in the experimental model, we offer a series of rounds aimed at the start of the attack or the start of the defense and the subsequent lunge of attack techniques. We classify this module as technical training despite its strong connection to the development of reaction speed and to the mental preparation of the athletes. The beginning of the specific module is marked by ideomotor workout and ends with such as part of the psychophysical training of the experimental group. The next 5 rounds in front of a mirror include the gradual increase of the initial phases of various techniques. The rounds last for 2 minutes with a 1 minute rest, analogous to the game situation at a competition.

Description of the rounds:

1st round. Mentally, with an image of attack and defense actions. Single imaginary movements with mental representation of instantaneous reactions, accompanied by a sharp exhalation.

2nd round. Only pulse hops from the ankles with slightly bent knees in side guard is performed, as every two hops a slight forward movement and subsequent return at maximum speed is done. The abruptness of the forward movement is dictated by the threatening nature of the technique and is planned during the preceding mental preparation.

3rd round. Simultaneously to the dynamic hops, a backward movement is performed, stepping back, as moving the rear leg first is a necessary condition. At the same time, there is also a change of guard and game position.

4th round. A blend of dynamic guard with threatening moves, back moves, guard change and initiation of attack and defence actions. Example: Hops with a dynamic threatening attack with a leap forward. Hops in place and move backwards with the back leg. Hops again and start of the attack with the front leg, followed by the start of the counterattack with a 180 degree turn.

5th round. Ideomotor workout again, now with a full performance of the specific round. Mental initiation of attacks, defenses and follow-up lunges, false moves before attacking actions, etc. Replaying the entire round tactically, performing mandatory techniques and mentally ordering the activity during the different stages of the match.

CHAPTER THREE
Results and Analysis

Analysis of the survey results

The survey results laid out in the actual study were obtained by examining representatives from the target (experimental) group and the control group in two periods (1st and 2nd survey). The aim is to investigate the influence of sports methodology on the performance of the athletes. In this case, we examined the change on the basis of their self-assessment regarding physical, mental and psychophysical aspects, which are covered in 18 questions. The results are presented in percentages and visualised graphically.

How do you rate your speed, strength, stamina, flexibility, coordination?

This question attempts to assess physical performance and fitness based on five indicators: speed, strength, stamina, flexibility and coordination. Using a scale from 1 to 5, respondents have the opportunity to evaluate their physical fitness. The role of the research is based on personal self-assessment to detect the presence of a positive change as a result of the conducted methodology. The results are displayed in Figures 1 and 2, with the experimental group showing the following change between the first and the second study: an increase of 1 point in speed (from 3 to 4); 2 points in strength increase (from 3 to 5); stamina increase – 1 p. (from 2 to 3); flexibility increase – 2 ps. (from 2 to 4); 1 p. increase in coordination (from 4 to 5). With the control group, we obtained the following results between the first and the second study: no change in speed (from 3 to 3); strength drop of 1 point (from 4 to 3); stamina increase – 1p. (from 3 to 4); 1 point in flexibility increase (from 2 to 3); no change in coordination (from 2 to 2).
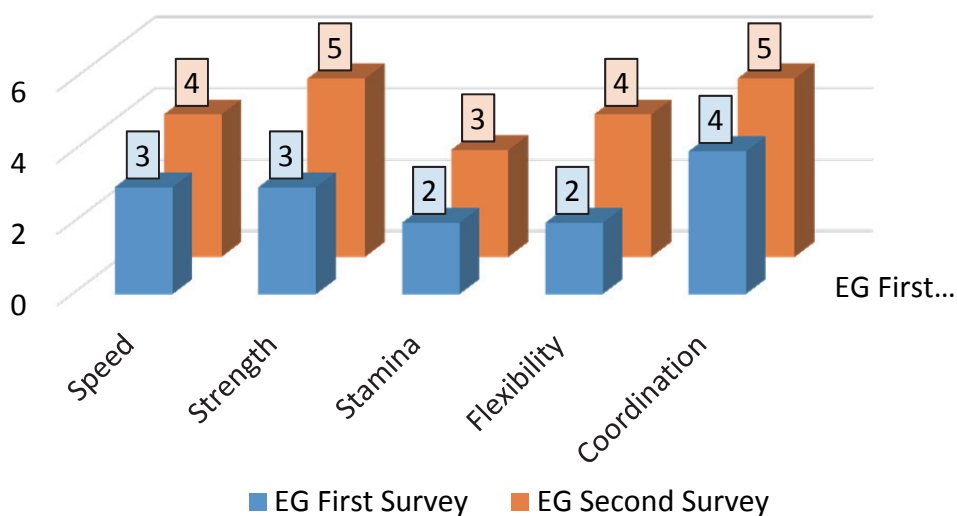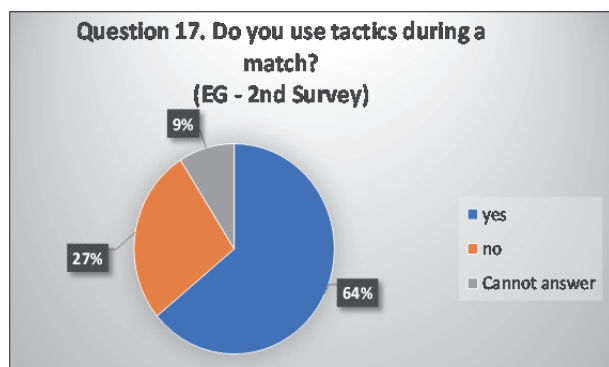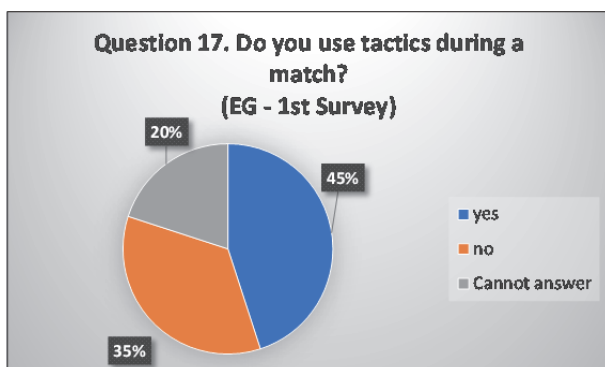

Figure 1. *Results from the question: "How do you rate your speed, strength, stamina, flexibility and coordination?" for the experimental group in surveys 1 and 2*
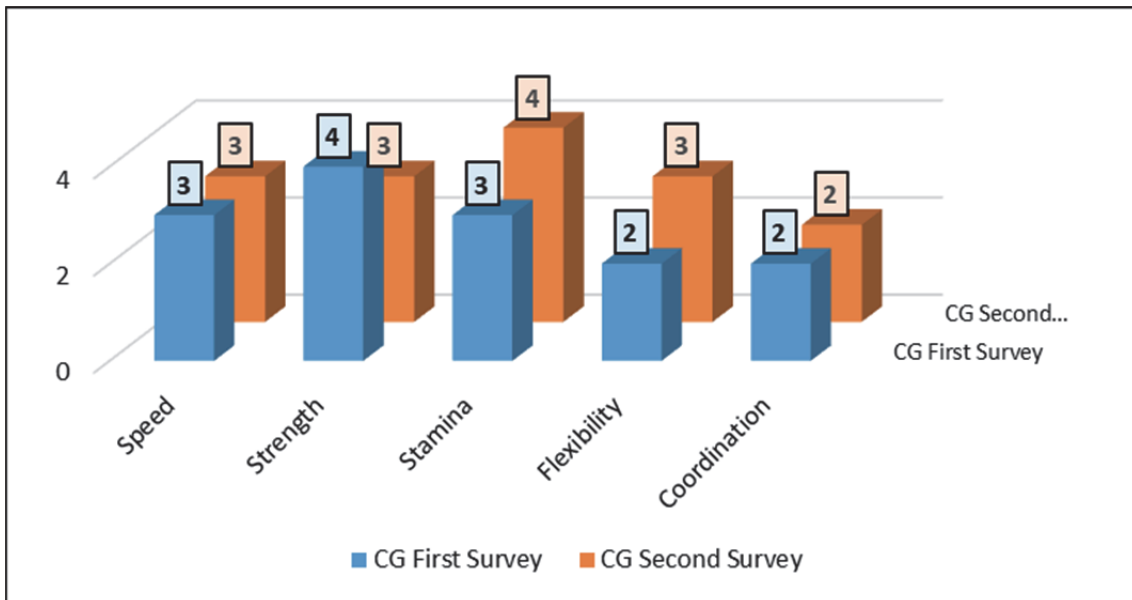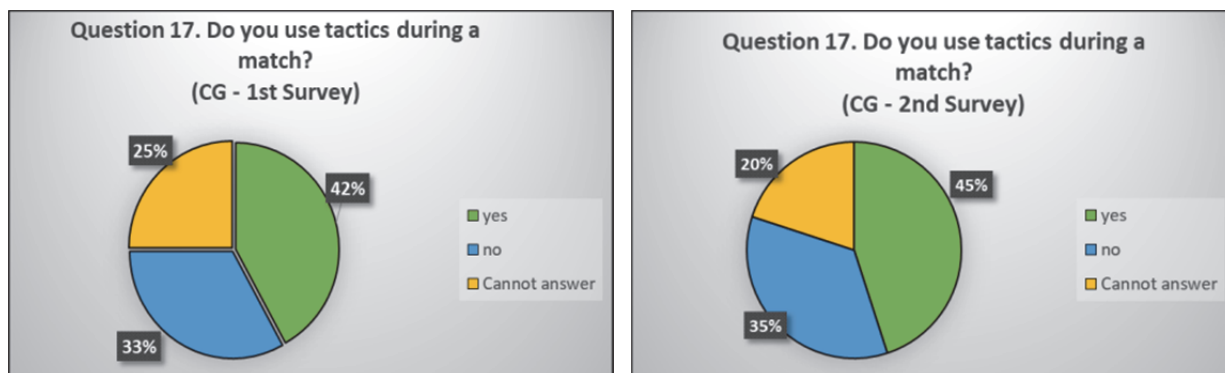
Figure 2. Results from the question: "How do you rate your speed, strength, stamina, flexibility and coordination?" for the control group in surveys 1 and 2

Do you use tactics sequence during a match?
The results of the self-assessment regarding tactics are visualised in Figure 3 and indicate the following: in the experimental group during the first survey 45% of respondents replied with 'yes', 35% answered 'no', and 20% gave 'Cannot answer'. In the second survey for the same group, the following change is reported: those who indicated 'no' dropped to 27%, which is a decrease of 8 percentage points, those who gave 'yes' are 64%, which is an increase of 19 percentage points, and those who answered with 'Cannot answer' is 9%, down 11 percentage points. In the control group, during the first study, 33% of the respondents indicated the answer 'no', 42% indicated 'yes', and 25% answered with 'Cannot answer'. In the second survey of the same group, it was observed that those who gave 'no' rose to 35%, which is a growth of 2 percentage points, those who answered 'yes' were 45%, which is an increase of 3 percentage points, and those who indicated 'Cannot answer' are 20%, a drop of 5 percentage points.

Figure 3. *Results from the question: "Do you use tactics during a match?"*
for EG and CG in the 1st and 2nd surveys

Spine Flexibility Test Result

The Spine Flexibility test has been implemented in the research toolkit as a measure of the quality of flexibility of the spine and quadriceps in a static position and thus occupies its central place in the general assessment of the physical fitness of the athletes. Taekwon-do-specific frontal leg techniques precisely require flexibility in the areas tested and the results give a clear idea of the possible amplitudes when performing leg kicks.

In Figure 4, we offer a graphical representation of the difference between the first and second survey of the two groups – experimental and control in the Spine Flexibility test.
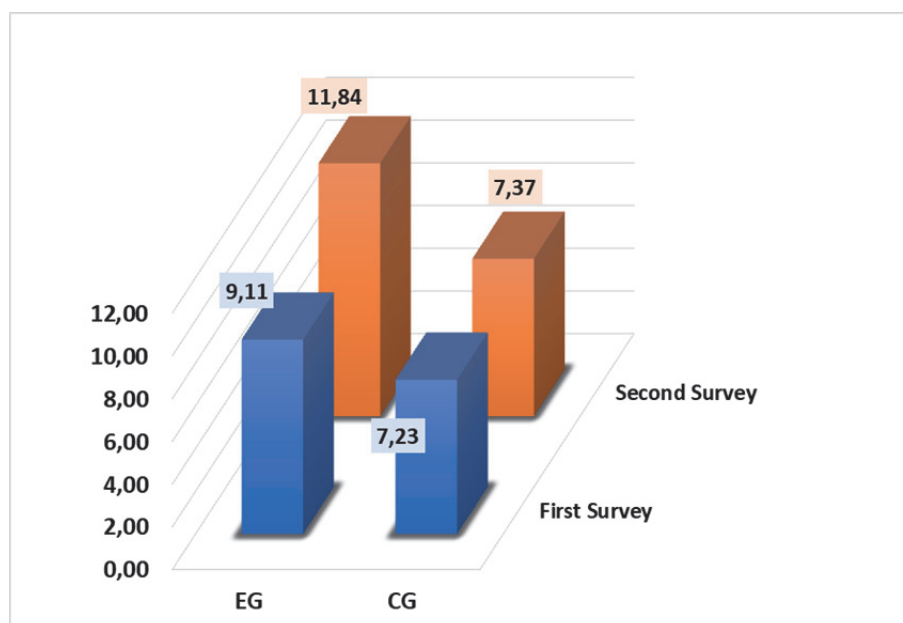
Figure 4. *Changes in performance in the Spine Flexibility Test for EG and CG*
in the I and II surveys

The alteration in mean arithmetic values between the studied groups in the two periods is presented. It is established that the average distance in the experimental group increases from 8,40 cm to 10,87 cm, while in the control group this increase is from 7,13 cm to 7,33 cm.

Statistical confirmation of these results is also available from the related groups test (samples in Table 4). The obtained results provide a basis for statistical significance of the data from a comparison of the values between related groups. We observe a change in the value of the experimental group with a growth of 2,47 cm – a statistically significant result with a confidence of 99%. The increase in the range of flexibility in the control group is 0,20 cm, which is a statistically insignificant result with a confidence factor of 95%.

Table 4. *Test for related samples in the Spine Flexibility Test for EG and CG in the I and II surveys*

Survey	First Survey			Second Survey			Confidence P (%)
Groups	$\bar{x}$	s	V (%)	$\bar{x}$	s	V (%)	
EG	9,11	5,67	62,22	11,84	5,35	45,15	99
CG	7,23	4,81	66,57	7,37	4,55	61,72	< 95

Table 5 displays the numerical changes in the average values of the tested groups between the first and second surveys The changes are presented in average absolute growth and average relative growth. Figure 5 and Figure 6 show the graphical representation of the results.
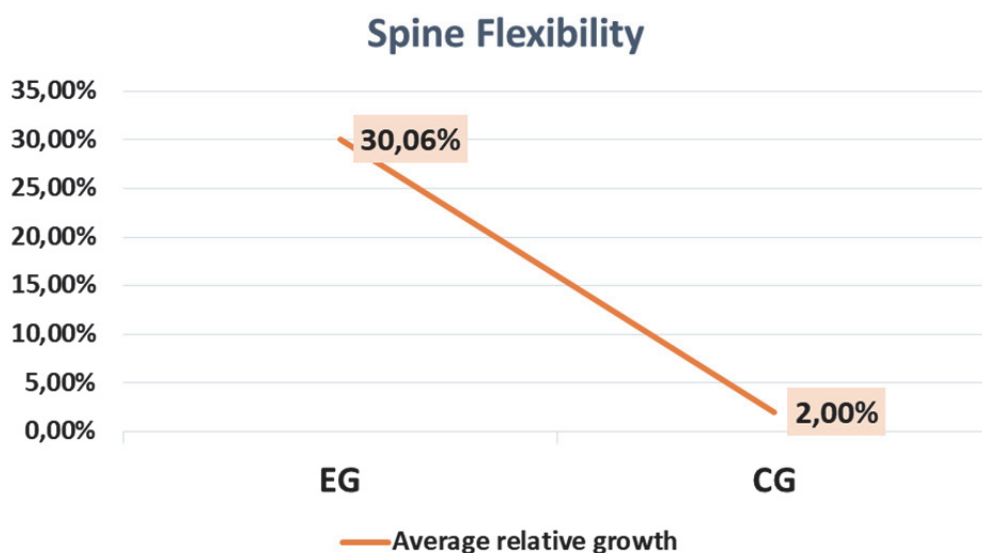
Table 5. *Average absolute and relative increase (in %) in the performance in the Spine Flexibility Test for EG and CG in the I and II surveys*

Surveyed Group	$\bar{x}$	d	d (%)
EG	11,84	2,74	30,06
CG	7,37	0,14	2,00
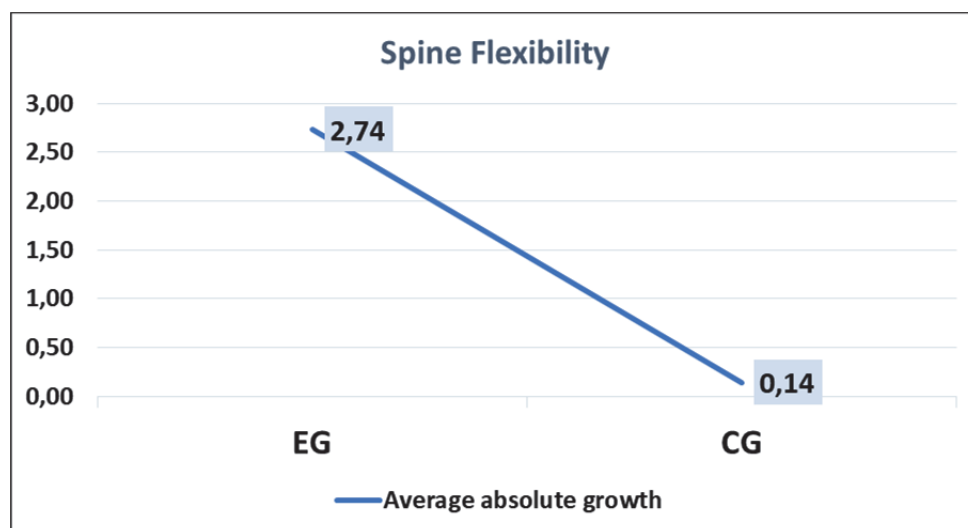
Figure 5. *Average absolute growth in cm in the Spine Flexibility Test for EG and CG in the I and II surveys*

Figure 6. *Average relative growth in % in the Spine Flexibility Test for EG and CG in the I and II surveys*

The difference in growth in the experimental group (+2,47 cm) compared to the control group (+0,20 cm) is noticeably large, which is also confirmed by the change in the average relative growth. There is an increase of 29,37% in the experimental group, while in the control group we observe a growth of only 2,80%.

Increasing the range of motion and, accordingly, stretching the muscles on the rear of the thigh is the goal of the method applied to the target group. In our opinion, the information show and clearly confirm the positive influence of the applied model for enhancing the quality of flexibility and increasing the amplitude of movement of the lower limbs. Evidence for the success of the methodology is obtained by the increased results in the experimental group both by means of a change in the average values and by means of the average absolute and relative growth and the test of statistical significance.
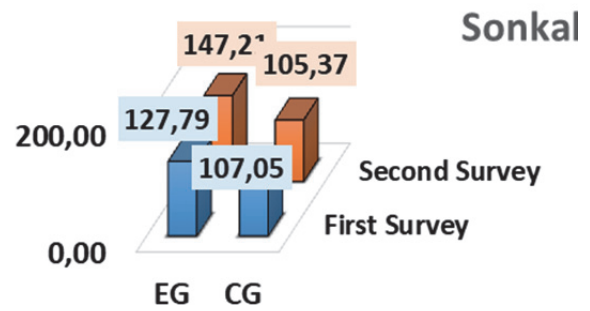
Result of the Impact Force Test

Impact force is a fundamental feature of any martial art. The ability to strike an opponent depends on many factors, and testing in this particular case is performed on a platform to measure the power of the attack delivered. The test comes as close as possible to the competitive discipline in Taekwon-do – Power Test.

During analysis of the Impact Force Test, it is necessary to examine several sub-indicators – tests for different types of impact and their fluctuations in the experimental and control groups between the first and second survey, measured in kilograms. The following five types of strikes are included here, playing the role of a sub-indicator in the overall strikes strength test: *Ap Joomuk, Sonkal, Yeop Chagi, Dollyeo Chagi* and *Tora Yeop Chagi*. The examination of the subtests included in the general impact force test are presented graphically in Figures 7 to 11.
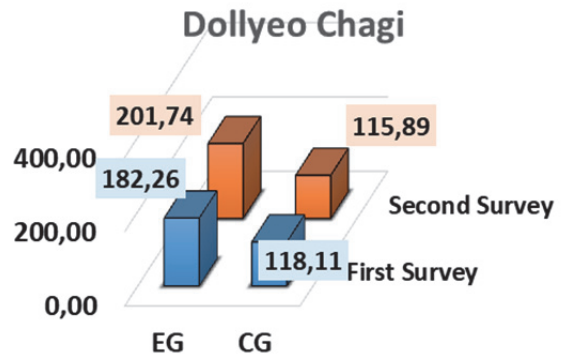
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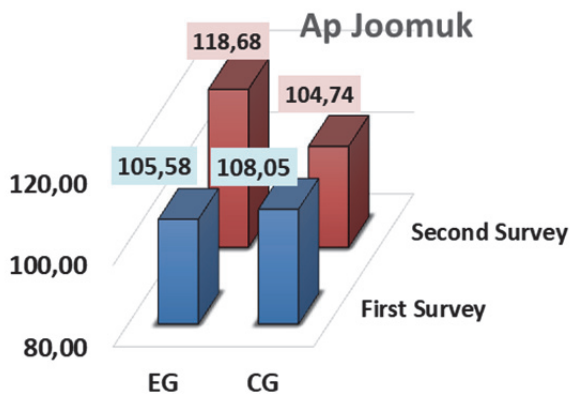
Figure 7. *Changes in the performance of the Impact Force Test (Ap joomuk) for EG and CG in the I and II surveys*
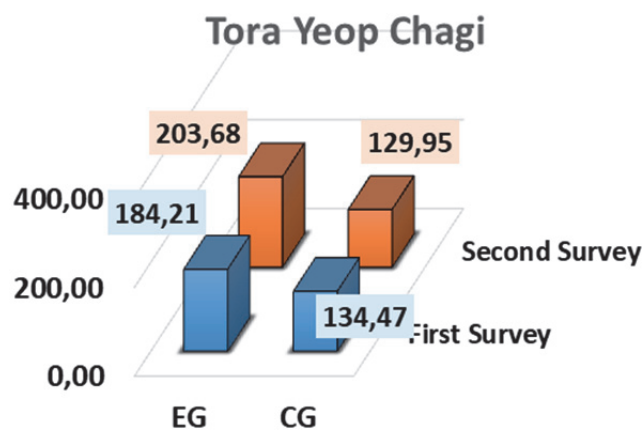

Figure 8. *Changes in the performance of the Impact Force Test (Soncal) for EG and CG in the I and II surveys*
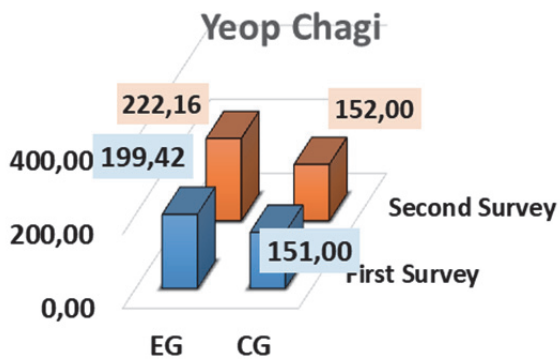
Figure 9. *Changes in the performance of the Impact Force Test (Yeop chagi) for EG and CG in the I and II surveys*

Figure 10. *Changes in the performance of the Impact Force Test (Dollyeo chagi) for EG and CG in the I and II surveys*

Figure 11. *Changes in the performance of the Impact Force Test (Tora yeop chagi) for EG and CG in the I and II surveys*

In the various subtests, the following values were recorded in the first and second survey of the mean value of both experimental and control groups:
- **Ap Joomuk**: EG (first survey: 105,58 – second survey: 118,68); CG (first survey: 108,05 – second survey: 104,74);
- **Sonkal**: EG (first survey: 127,79 – second survey: 147,21); CG (first survey: 107,05 – second survey: 105,37);
- **Yeop chagi**: EG (first survey: 199,42 – second survey: 222,16); CG (first survey: 151,00 – second survey: 152,00);
- **Dollyeo Chagi**: EG (first survey: 182,26 – second survey: 201,74); CG (first survey: 118,11 – second survey: 115,89);
- **Yeop chagi**: EG (first survey: 184,21 – second survey: 203,68); CG (first survey: 134,47 – second survey: 129,95).

Table 6 lays out the statistical confidence of the results, expressed in more than 99% for the experimental and part of the control groups and in less than 95% for part of the control only. Also, the higher coefficients of variation V (%) again in the control groups compared to the experimental groups indicates that the values are more heterogeneous or the dispersion is greater than the mean, a conclusion also supported by the standard deviation values.

Table 6. *Test for related samples in the Impact Force Test for EG and CG in the I and II surveys*

| Survey	First Survey			Second Survey			Confidence (P%)
Groups	$\bar{x}$	s	V (%)	$\bar{x}$	s	V (%)	
EG Ap Joomuk	105,58	40,01	37,89	118,68	43,02	36,25	99%
CG Ap Joomuk	108,05	58,08	53,75	104,74	76,38	72,92	97%
EG Sonkal	127,79	70,71	55,34	147,21	72,72	49,40	99%
CG Sonkal	107,05	58,08	54,25	105,37	58,72	55,73	<95%
EG Yeop Chagi	199,42	66,50	33,35	222,16	64,68	29,11	99%
CG Yeop Chagi	151,00	74,94	49,63	152,00	72,34	47,60	<95%
EG Dollyeo Chagi	182,26	90,12	49,44	201,74	97,50	48,33	99%
CG Dollyeo Chagi	118,11	73,80	62,49	115,89	71,19	61,43	<95%
EG Tora Yeop Chagi	184,21	73,30	39,79	203,68	75,58	37,11	99%
CG Tora Yeop Chagi	134,47	68,77	51,14	129,95	74,45	57,30	<95%

The variation in the mean value between the first and the second survey in the experimental and control groups in all five subtests is presented in tabular form in

Table 7 and in graphical form by means of Figures 12 – 15. The change is expressed in terms of absolute and relative values, as adopted in the research methodology. Comparing EG and CG for each subtest, we detect the following:

- **Ap Joomuk**: growth at EG (absolute value: 13,11 – relative value: 12,41%); decrease in CG (absolute value: –3,32 – relative value: -3,07%);
- **Sonkal**: growth at EG (absolute value: 19,42 – relative value: 15,20%); decrease in CG (absolute value: –1,68 – relative value: –1,57%);
- **Yeop chagi**: growth at EG (absolute value: 22,74 – relative value: 11,40%); slight increase in CG (absolute value: 1,00 – relative value: 0,66%);
- **Dollyeo chagi**: growth at EG (absolute value: 19,47 – relative value: 10,68%); decrease in CG (absolute value: –2,21 – relative value: –1,87%);
- **Tora Yeop Chagi**: EG (absolute value: 19,47 – relative value: 10,57%); CG (absolute value: –4,53 – relative value: –3,37%).

Table 7. Average absolute and relative increase (in %) in the performance of the Impact Force Test for EG and CG in the I and II surveys

| Surveyed Group	$\bar{x}$	d	d (%)
EG Ap Joomuk	118,68	13,11	12,41
CG Ap Joomuk	104,74	–3,32	–3,07
EG Sonkal	147,21	19,42	15,20
CG Sonkal	105,37	–1,68	–1,57
EG Yeop Chagi	222,16	22,74	11,40
CG Yeop Chagi	152,00	1,00	0,66
EG Dollyeo Chagi	201,74	19,47	10,68
CG Dollyeo Chagi	115,89	–2,21	–1,87
EG Tora Yeop Chagi	203,68	19,47	10,57
CG Tora Yeop Chagi	129,95	–4,53	–3,37
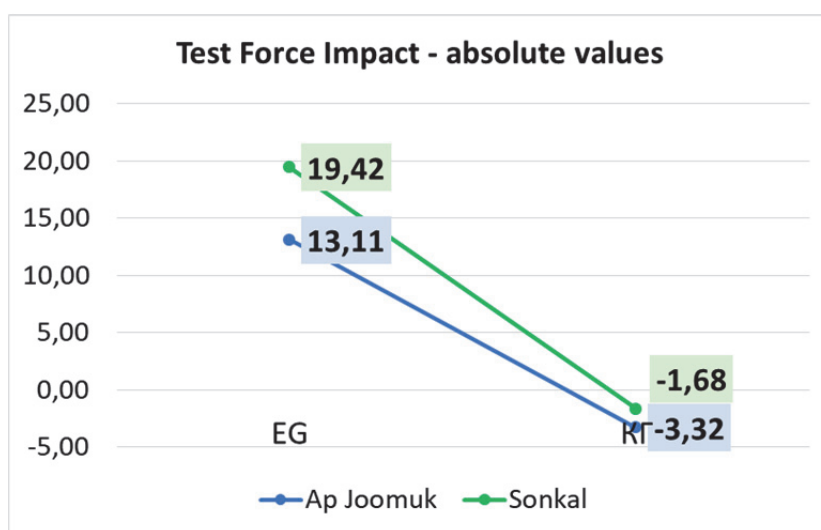
Figure 12. Average absolute growth in kg. in Impact Force Test (Ap joomuk and Sonkal) for EG and CG in the I and II surveys
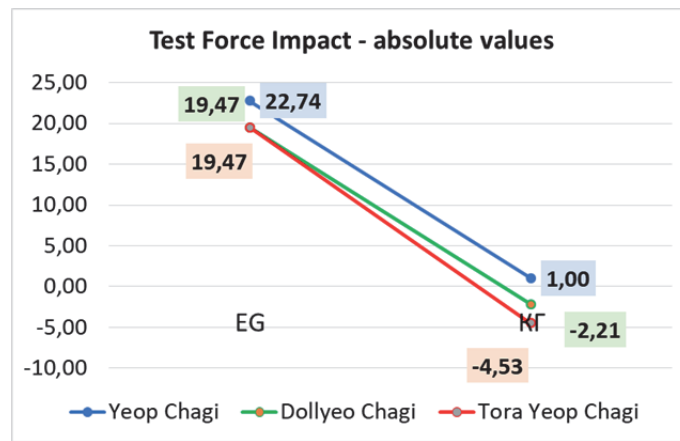
Figure 13. *Average absolute growth in kg. on Impact Force Test (Yeop chagi, Dollyeo chagi and Tora yeop chagi) for EG and CG in the I and II surveys*
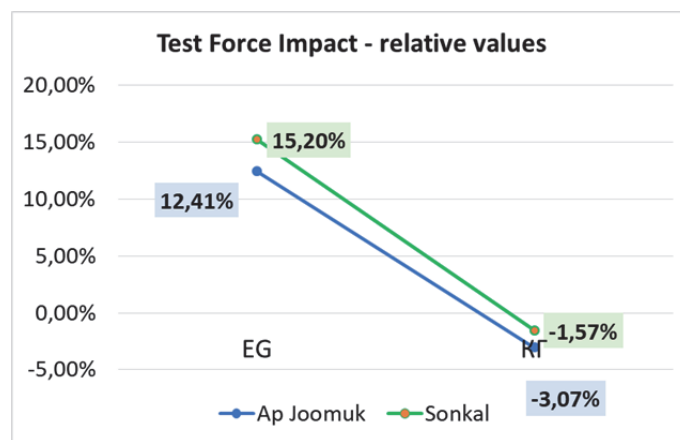
Figure 14. *Average relative increase in % in Impact Force Test (Ap joomuk and Sonkal) for EG and CG in the I and II surveys*
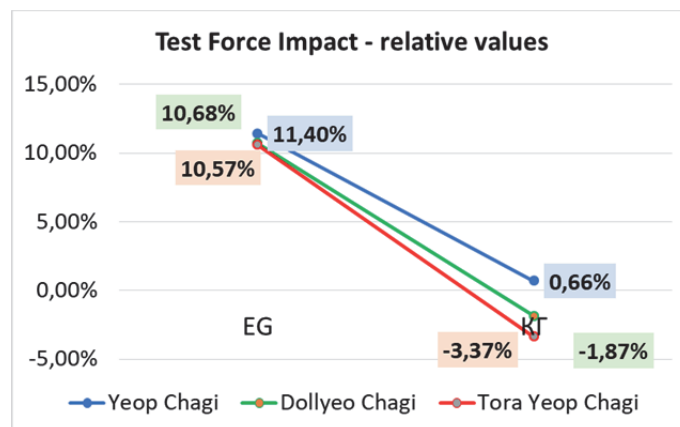
Figure 15. *Average relative increase in % according to the Impact Force Test (Yeop chagi, Dollyeo chagi and Tora yeop chagi) for EG and CG in the I and II surveys*

As a result of the conducted research on the influence of the applied methodology on the experimental group compared to the clearly fixed control group, a number of conclusions can be drawn. First, the two time surveys performed, using all types of tests, make it possible to objectively observe, analyse and evaluate the

impact of the methodology by comparing the second versus the first time survey in both the experimental and control groups. Second, the implemented experimental method has been proved to enhance the performance of the practitioners of the experimental group in the Impact Force Test compared to the control groups. This, in our opinion, is due to the means and methods implemented in the program to increase physical and technical qualities, which have a direct impact on the power of the strike in Taekwon-do.

Result of Patterns Test

The level of technical mastership in Taekwon-do is tested through the discipline Patterns (Tul). All possible techniques studied in the training process exist in the patterns. They give an opportunity for an adequate and realistic idea of the skill and mastery of each one of them. The examination of technical abilities is inextricably linked to the other evaluated qualities in the performance of the specified pattern. Technical content correlates with strength, breathing, balance and rhythm or the definition in Taekwon-do is that they are interrelated.

The scores are as follows: Technical Content from 0 to 10 points, Strength from 0 to 6 points, Balance from 0 to 6 points, Breathing from 0 to 6 points and Rhythm from 0 to 6 points. The overall evaluation of the various characteristics provides the final result, which actually is the object of analysis in the present study.

The average number of points of the total assessment in the first and second survey is presented in fig. 16.
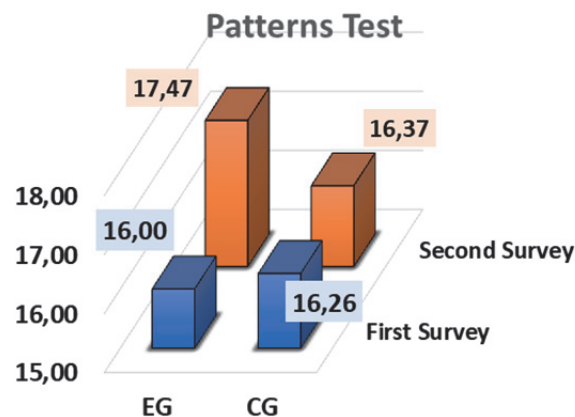
Figure 16. Changes in performance by Patterns Test for EG and CG in the I and II surveys

With regards to the experimental group, the average time in the first survey is 16 points versus 17,47 points in the second survey. In the control group, we note a change from 16,26 points to 16,37 points from the first to the second survey.

In terms of statistics, these results are checked for significance, which is expressed in the confidence coefficient P (%), presented in Table 8. The data indicate 99% and higher for the experimental groups and below 95% for the control groups. There are higher values in the coefficients of variation V (%) for the control group in the second survey, indicating greater heterogeneity of the values, a finding also supported by the standard deviation values.

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Table 8. *Test for related samples in Patterns Test for EG and CG
in the I and II survey*

| Survey / Groups	Първо изследване			Второ изследване			Достоверност P (%)
	$\overline{x}$	s	V (%)	$\overline{x}$	s	V (%)	
EG Patterns Test	3,47	0,77	22,23	4,84	0,76	15,79	99
CG Patterns Test	4,26	0,87	20,45	4,05	0,91	22,49	< 95

Table 9 lays out the change in average values through the mean absolute increase and mean relative increase between the first and second surveys in points. Graphically, the average absolute and relative growth is presented in figures 17 and 18. The results confirm the conclusions already made, namely that the average absolute growth in the experimental group is equal to a growth of 1,47 points or in a relative growth value of 9,21%. Compared to these results, the control group also indicates a slight increase in absolute values of 0,11 points, resulting in a relative increase of 0,65%.

Table 9. *Average absolute and relative increase (in %) in Patterns Test for EG and CG
in the I and II surveys*

Surveyed Group	$\overline{x}$	d	d (%)
EG Total points	17,47	1,47	9,21
CG Total points	16,37	0,11	0,65
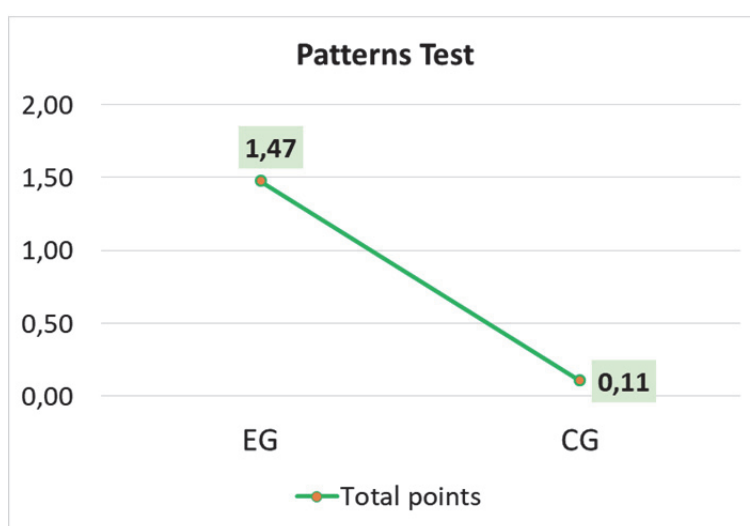
Figure 17. *Average absolute increase in cm in Patterns Test for EG and CG
in the I and II survey*
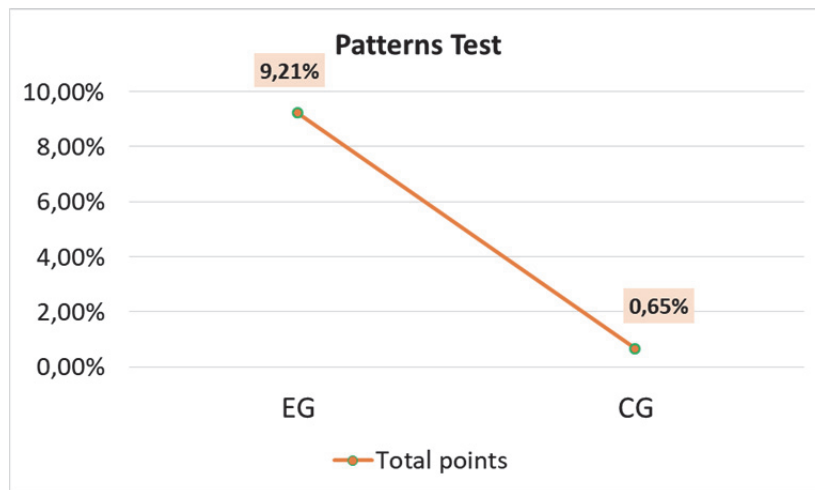
Figure 18. *Average relative increase in % in Patterns Test for EG and CG in the 1st and 2nd survey*

Doubtlessly, the growth in the experimental group is clear, visible and statistically significant which is a proof of the positive impact of the applied method in terms of technique. The individual additional elements of training and the corresponding corrections in the game of patterns in the experimental group raise the technical level according to the studies performed. The same conclusion cannot be drawn up for the control group, which, due to lack of the methodology, gives completely unsatisfactory results.

The Patterns test, through its general assessment, enables the evaluation of the impact of sports methodology on technical preparation, depending on the training of the various physical qualities and on the strength, balance, rhythm and breathing evaluated in the test. The obtained results show unequivocally that there is a statistically significant effect which is a positive one – a conclusion which complements the conclusions drawn up so far.

SAM test result

The SAM test is a basic test for studying self-confidence, activity and mood in the context of the general psychophysical condition of athletes. In this regard, this test is incorporated in the current methodology as a basic criterion for evaluating the effect of systematic training techniques in the implemented sports methodology on psychophysical performance by increasing self-esteem, activity, mood and mental performance. The test contains 30 pairs of opposite states, 10 for each one: self-confidence, activity and mood, using a nine-point scale. The mean values of the scores of self-esteem, activity and mood are investigated and their shift between the control and experimental groups in the first and the second survey is compared.

Figure 19 presents the received aggregated and average arithmetic values by group (self-esteem, mood and activity) in the two studied groups – experimental and control, during the first and second survey.
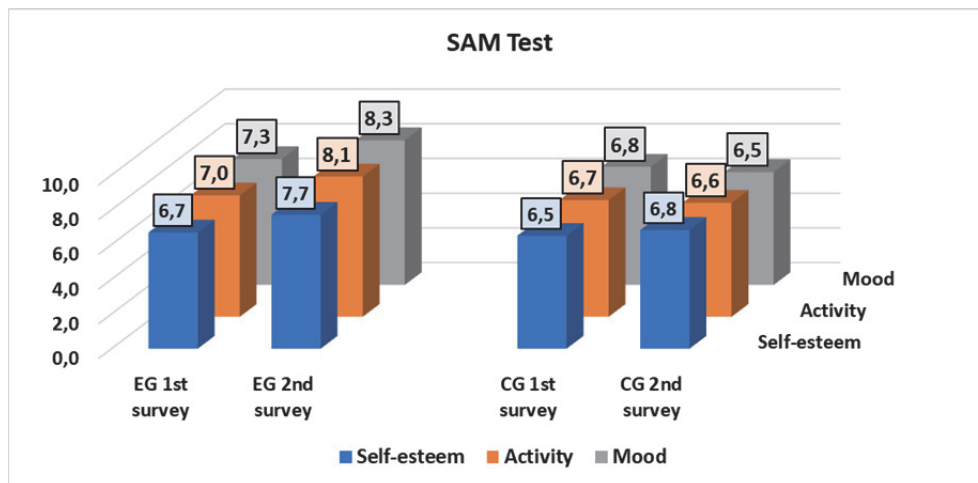
Figure 19. *Changes in the performance of the SAM Test for EG and CG in the I and II survey*

Itcan be deducted from the figure that in the experimental group in the first survey, the values in points for self-esteem are 6,7; for activity they are 7 and for mood they are 7,3. During the second survey for the same group, the results are: for self-esteem – 7,7; for activity – 8,1 and for mood – 8,3. For the control group, the results during the first survey are as follows: self-esteem 6,5; for activity they are 6,7, and for mood – 6,8, and during the second survey they are: self-esteem 6,8; for activity – 6,6 and for mood – 6,5.

Presented in Table 10, in addition to the average values of the first and second survey for the experimental and control groups for the three types of groups of the psychophysical state, are the confidence values *P* (%) and the statistical significance of the obtained results when comparing the values between related groups, are over 99% for the experimental groups and below 95% for the control groups.

Table 10. *SAM Test for EG and CG in the I and II survey*

	Survey	First Survey			Second Survey			Confidence
Group SAM		$\bar{x}$	*s*	*V* (%)	$\bar{x}$	*s*	*V* (%)	*P* (%)
EG	Self-esteem	6,7	0,7	10,5	7,7	0,3	4,3	99
	Activity	7,0	0,4	6,4	8,1	0,2	2,6	99
	Mood	7,3	0,4	6,1	8,3	0,3	3,2	99
CG	Self-esteem	6,5	0,3	4,7	6,8	0,3	4,9	< 95
	Activity	6,7	0,4	5,6	6,6	0,4	5,8	< 95
	Mood	6,8	0,4	5,6	6,5	0,4	6,1	< 95

The shift in the psychophysical state, measured by the indicators of absolute and relative change, is demonstrated in Table 11.

Table 11. *Average absolute and relative increase (in %) in SAM Test for EG and CG in the 1st and 2nd surveys*

Surveyed Group		$\overline{x}$	d	d (%)
EG	Self-esteem	7,71	1,02	15%
	Activity	8,08	1,09	16%
	Mood	8,33	1,08	15%
CG	Self-esteem	6,83	0,33	5%
	Activity	6,56	–0,16	–2%
	Mood	6,50	–0,31	–4%

The change in absolute values between the first and the second survey (illustrated graphically in Fig. 20 is the highest in the experimental group compared to the control group in all three indicators (aggregated groups). Also, the growth in Activity is the largest with 1,09 points, followed by Mood with 1,08 points. The lowest value is Self-esteem with 1,02 points. The lowest scores are obtained in the control group, with a positive change existing only in Self-esteem, 0,33 points, while in Activity and Mood it is negative, i.e. we note a decrease of 0,16 and 0,33 points respectively.
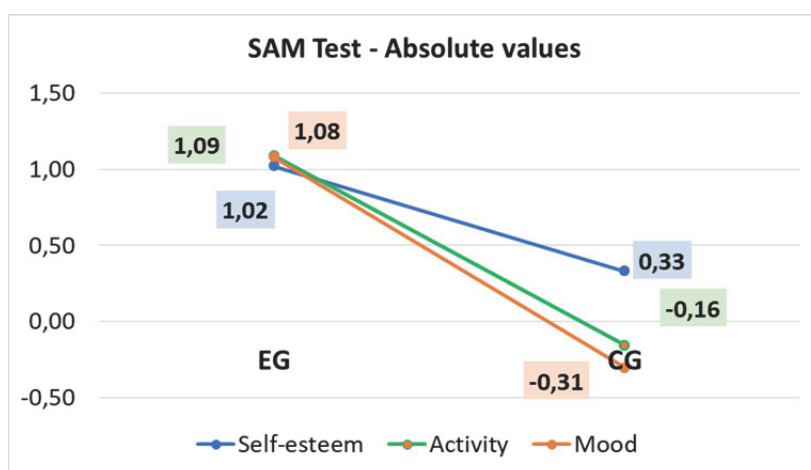

Figure 20. *Average absolute increase in points in the SAM Test for EG and CG in the I and II surveys*

Very similar is the result measured by means of relative values displayed in fig. 21. As it has already become clear via the results in terms of absolute values, here, too, the logic is preserved as the biggest change is shown by the experimental group. With them, the changes are indicated in percentages growth, as follows: Activity 16%, Mood 15% and Self-esteem 15%. The results for the control group are as follows: Self-esteem increased by 5%, Activity decreased by 2%, and Mood decreased by 4%.

As a fundamental conclusion from the analysis we can point the positive role of the applied sports methodology on the Activity, Mood and Self-confidence of the athletes. The application of the method of ideomotor impact and the method of

muscle relaxation in sports methodology enhances mental performance and leads to sustainable positive mental changes.
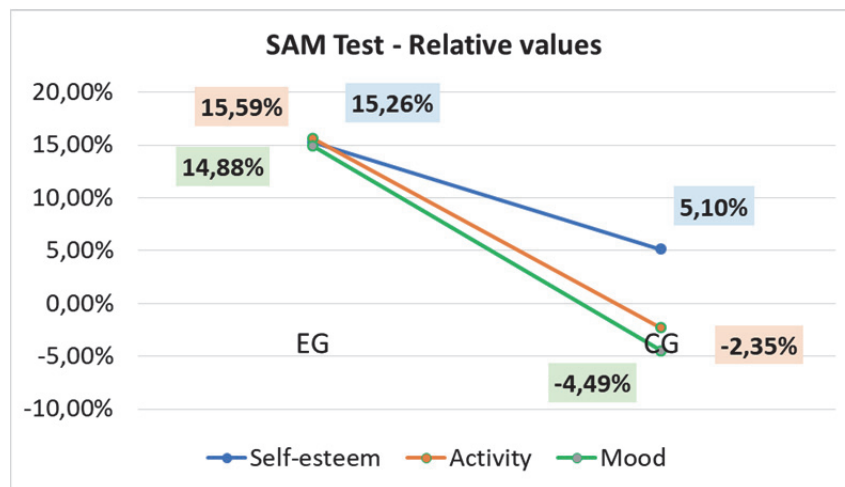
Figure 21. *Average relative increase in % in the SAM Test for EG and CG in the I and II survey*

Correlations analysis

By means of the correlation analysis, an attempt is made to detect relations and dependencies, on the one hand, between the indicators of physical, mental and psychophysical preparation, and on the other hand, to derive the influence of sports methodology on those links and dependencies. The methodology in the correlation analysis focuses on the search for relationships and dependence between the indicators measured by the relevant tests in each independent area – physical, mental and psychophysical activity in the experimental group. The statistical package IBM SPSS 26 was used for the performance of the correlation analysis.

Table 12 presents the correlations dependencies between the results of the experimental group in the psychophysical activity tests.

In the offered matrix of Table 12, the following statistically significant relationships are established (correlation dependence with a significance level of less than 0,05):

Strong negative correlation:
R (Side Splits Test and Dollyeo Chagi Test) = –0,74
R (Yeop Chagi Test and Impact Force Test) = –0,71
R (Patterns Test and Side Splits Test) = –0,59
Significant positive correlations
R (Spine Flexibility Test and Pads Test) = 0,52
R (Impact Force Test and Pads Test) = 0,68
R (Cooper Test and SJT Test) = 0,49
R (Impact Force Test and SAM Test) = 0,49
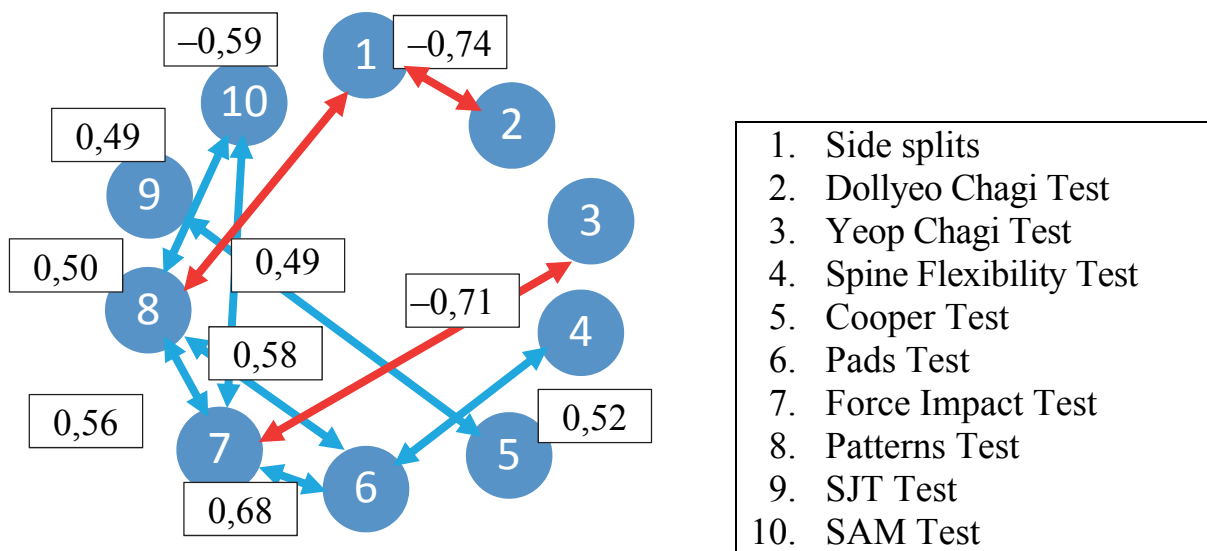R (Patterns Test and Pads Test) = 0,58
R (Patterns Test and Impact Force Test) = 0,56
R (Patterns Test and SAM Test) = 0,50

Table 12. *Correlations analysis of psychophysical activity*

Correlations		Side splits	Dollyeo chagi	Yeop Chagi	Spine Flexibility	Cooper Test	Pads Test	Force Impact	Patterns Test	SJT	SAM
Side splits	Pearson Correlation	1	-0,74**	0,04	0,09	-0,21	-0,36	-0,03	-0,59**	-0,12	0,04
	Sig. (2-tailed)		0,00	0,89	0,72	0,39	0,13	0,90	0,00	0,62	0,88
Dollyeo chagi	Pearson Correlation	-0,74**	1	-0,09	0,27	-0,36	0,26	0,25	0,34	-0,06	-0,27
	Sig. (2-tailed)	0,00		0,73	0,26	0,13	0,28	0,31	0,14	0,81	0,27
Yeop Chagi	Pearson Correlation	0,04	-0,09	1	0,08	0,41	0,40	-0,71**	0,37	-0,15	0,08
	Sig. (2-tailed)	0,89	0,73		0,76	0,09	0,09	0,00	0,13	0,53	0,76
Spine Flexibility	Pearson Correlation	0,09	0,27	0,08	1	0,32	,52**	0,14	0,08	-0,20	0,09
	Sig. (2-tailed)	0,72	0,26	0,76		0,18	0,02	0,58	0,73	0,41	0,72
Cooper Test	Pearson Correlation	-0,21	-0,36	0,41	0,32	1	0,35	0,43	0,28	0,49**	-0,25
	Sig. (2-tailed)	0,39	0,13	0,09	0,18		0,14	0,06	0,26	0,01	0,31
Pads Test	Pearson Correlation	-0,36	0,26	0,40	,52**	0,35	1	0,68**	0,58**	-0,20	-0,08
	Sig. (2-tailed)	0,13	0,28	0,09	0,02	0,14		0,00	0,00	0,41	0,74
Force Impact	Pearson Correlation	-0,03	0,25	-0,71**	0,14	0,43	,68**	1	0,56**	-0,23	0,49**
	Sig. (2-tailed)	0,90	0,31	0,00	0,58	0,06	0,00		0,00	0,34	0,01
Patterns Test	Pearson Correlation	-0,59**	0,34	0,37	0,08	0,28	0,58**	0,56**	1	0,41	0,50**
	Sig. (2-tailed)	0,00	0,14	0,13	0,73	0,26	0,00	0,00		0,09	0,01
SJT	Pearson Correlation	-0,12	-0,06	-0,15	-0,20	0,49**	-0,20	-0,23	0,41	1	-0,33
	Sig. (2-tailed)	0,62	0,81	0,53	0,41	0,01	0,41	0,34	0,09		0,16
SAM	Pearson Correlation	0,04	-0,27	0,08	0,09	-0,25	-0,08	0,49**	0,50**	-0,33	1
	Sig. (2-tailed)	0,88	0,27	0,76	0,72	0,31	0,74	0,01	0,01	0,16	

Figure 22 graphically visualises the correlation dependence laid out in Table 12.

1. Side splits
2. Dollyeo Chagi Test
3. Yeop Chagi Test
4. Spine Flexibility Test
5. Cooper Test
6. Pads Test
7. Force Impact Test
8. Patterns Test
9. SJT Test
10. SAM Test

Figure 22. *Correlation diagram of psychophysical tests*

The data presented in Table 12 and Figure 22 indicate on the one hand, the psychophysical dependencies between combat physical performance and activity, and mental readiness, on the other. The results reveal a strong negative correlation between the results of the Side Splits Test and the Pads Test (–0,74), between the Patterns Test and the Side Splits (–0,59) and between the results of the Yeop Chagi Test and Impact Force (–0,71). The explanation for these three pairs of negative correlations is that both scales measure improvement in the opposite direction. In the first and second pairs (of the Side Splits Test and the Pads Test (–0,74) and the Patterns Test and the Side Splits Test (–0,59)), if minimising the distance to the floor in the side split is the desired improvement, then, in Dollyeo Chagi, the improvement is in the maximisation of the number of kicks per unit of time, and in the Patterns Test – a growth in technical indicators. The logical dependence in the second pair is similar (Yeop Chagi Test and Impact Force (–0,71)). If minimisation of Yeop Chagi time is a corrective for speed and precision in improvement, then maximisation of the stroke is a proof of upgrade in strength and technique in executing the kicks correctly and efficiently.

A significant positive correlation is also recorded between the results of the Spine Flexibility Test and the Pads Test (0,52), between the results of the Impact Force Test and the Pads Test (0,68), between the results of the Cooper Test and the SJT Test (0,49), between the Patterns Test and the Impact Force Test (0,56), between the Patterns Test and the Pads Test (0,58), between the Patterns Test and the SAM Test (0,5) and between the results of the Impact Force Test and the SAM Test (0,49).

CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations can be drawn up based on the conducted research, applied methodology and the obtained results.

Conclusions

1. A lack of a unified theory concerning the problems of technical and tactical preparation in ITF Taekwon-do training is established when analysing the literary sources.
2. There is a lack of methodological guidelines in technical and tactical terms for ITF Taekwon-do training.
3. After analysis of the mental fitness, it is found that better results were found when examining the experimental group in the second survey (Perception of time, Situational Judgment, etc.).
4. Physical fitness marks a significant improvement in the experimental group. The explosive power of the lower limbs, the speed of the reaction, the flexibility in the hip joint and the coordination in the execution of techniques are significantly upgraded.
5. The model we propose for improving the technical and tactical training in ITF Taekwon-do is effective and leads to optimisation of the structure of the training process.
6. When examining the correlational dependences of mental and physical training, significant dependences on a number of indicators are established.
7. The applied model leads to a significant enhancement of the technical indicators in the experimental group.

Recommendations

1. To optimise the methodology for mastering the technical and tactical skills in the learning and training process in ITF Taekwon-do preparation.
2. To draw up a unified methodology for improving the physical quality of endurance.
3. To introduce new and contemporary methods for upgrading the level of mental fitness.
4. To prepare a test battery and implement it in practice to assess the psychophysical readiness of ITF Taekwon-do practitioners.
5. To approve a methodology for tactical training and its application in the training process.

Contributions

On the basis of the conducted theoretical and practical study and the conclusions presented in this dissertation, the following more significant contributions can be highlighted:

1. In the actual dissertation, a scientifically based theory for optimisation of the technical and tactical training in Taekwon-do is developed.

2. A theoretical and retrospective analysis of the development of ITF Taekwon-do from ancient times to the present day is performed.
3. Training models are developed and tested to optimise the technical and tactical preparation in the Taekwon-do training process.
4. The models and methodology applied by us to optimise the technical and tactical fitness are effective and lead to the improvement of the entire structure.
5. The applied test battery is highly informative and leads to a complex evaluation of the technical and psychophysical preparation of the trainees. The results are objective and serve as a good basis for optimising the learning and training process in Taekwon-do.
6. The discovered correlational dependencies are of particular value for the innovative approach in training and the development of new models in the educational process of Taekwon-do.