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**DOCTORAL SCHOOL IN SPORTS SCIENCE AND PHYSICAL EDUCATION**

# OPTIMIZATION OF ATHLETE TRAINING IN TAEKWONDO THROUGH INNOVATIVE STRATEGIES SPECIFIC TO THE PSYCHOLOGICAL COMPONENT OF TRAINING

DOCTORAL THESIS ABSTRACT

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2025

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*Keywords: taekwondo, stress, anxiety, mindfulness, psychological preparation, performance*

# *INTRODUCTION*

Taekwondo is more than just a sport; it is also a complicated means of personal development that is critical for the physical, emotional, and cognitive growth of children and adolescents. This activity inherently fosters qualities such as self-discipline, respect, tenacity, and self-control, equipping young people with not just physical talents but also critical tools for character development and emotional management. Regular taekwondo training has been demonstrated to improve concentration, self-control, and resilience, all of which influence practitioners' social behavior and academic success. Thus, taekwondo moves beyond the confines of a simple contact sport to become an active participant in the educational process of young people.

Despite the obvious benefits, research on taekwondo in Romania is limited, focusing primarily on physical or technical-tactical elements. Psychological training is an important but often overlooked component of sports success. Managing competitive tension, staying focused, and making quick decisions are all essential mental abilities for high-performance athletes. However, most taekwondo clubs in Romania lack sports psychologists and expert resources in this area. This gap emphasizes the need for alternate options that are easily accessible to coaches and may incorporate mental training into the training regimen.

Starting with this reality, the proposed research intends to create a unique way for optimizing taekwondo athletes' training by combining psychological tactics that are immediately applicable in training. The method combines specific exercises for improving response time and balance with mindfulness practices that have been shown to be beneficial in lowering stress and increasing attention. The goal of this interdisciplinary approach is to develop an accessible and effective protocol that helps athletes deal with the mental problems that high-level tournaments and intensive training sessions present.

The use of this strategy in sports clubs could be a significant step toward professionalizing psychological training in taekwondo. By actively incorporating the mental dimension into the training process, the study contributes to a more holistic approach to sports performance in which physical and psychological aspects are handled in tandem. As a result, athletes not only enhance their performance, but they also become more balanced, robust, and equipped to deal with the pressures of high-performance sports.

# PART 1. THEORETICAL FOUNDATION OF THE RESEARCH TOPIC

## *CHAPTER 1. THEORY AND METHODOLOGY OF SPORTS TRAINING*

The human body comprises incredibly complex components that constantly interact and manifest in motor activity. This complexity needs a balanced approach to sports training that takes into account all structural levels—physical, psychological, and cognitive—to assist athletes' overall growth. Although the sciences of exercise physiology, sports psychology, and nutrition evolved independently, an integrated approach focusing on athletes' actual demands is required. Current constraints can be overcome by successful collaboration between researchers and coaches, allowing athletes to maximize their athletic potential and personalize interventions to their unique needs (Bompa et al., 2019).

Sport has a significant social and cultural dimension, and it is acknowledged not just for its physical benefits but also for its impact on mental health, interpersonal interactions, and stress reduction (Georgian & Lorand, 2016). Over time, the structure of training has evolved in response to scientific advances, practitioner experiences, and competitive pressures, resulting in a coherent theoretical and methodological framework. To effectively respond to modern conditions, sports science must match with specific performance goals through rigorous and interdisciplinary planning (Issurin, 2010).

The active involvement of governments and the media's promotion of sporting achievements have raised public interest and support for athletic performance, especially in light of the current expansion of sports in body maintenance and recuperation. In this setting, success is determined not only by skills but also by the athlete's attitude toward the activity, resulting in a synergy of competencies, motivation, and moral values (Năstase, 2012). Sports also provide an excellent framework for research and testing, with progress monitoring essential for changing training tactics and meeting planned goals (Duggan et al., 2021). As a result, sports training theory and methodology continue to be important instruments for directing and maximizing performance improvement.

### *1.1. CHARACTERISTICS OF SPORTS TRAINING*

Sports training has evolved significantly in recent decades, owing to scientific advances and a better understanding of the human body in the context of physical exertion. However, certain approaches remain out of date, although the hypotheses that underpin them have been disproven (Renshaw et al., 2019). Sports are now viewed as a dynamic, ever-changing phenomenon driven by personal and

environmental influences, as well as changes in equipment, laws, and training methods (Pol et al., 2020). The coach is an important part of this process because he or she is a leader who has been educated via formal and informal experience (Menezes, 2021), and athletic success necessitates an integrated grasp of the physical, psychological, and educational components.

Training, which is defined as a pedagogical process that involves the organism's systematic adaptation to intense efforts (Ministry of Education, 1973), aims to optimize performance through individualization, progression, and periodization (Kasper, 2019). The adaptation process is biologically regulated by mechanisms such as the general adaptation syndrome, which includes the stages of alert, resistance, and tiredness. The repetition of supraliminal efforts causes functional and morphological changes in the organism (Nan, 2013), which promotes athletic improvement provided scientific training methods are followed. At the same time, sports science emphasizes the importance of multidisciplinary approaches, as athlete training is inextricably linked to the psychological and social elements that influence performance.

Athletes are viewed as adaptive organisms in complex systems, with dynamic, nonlinear, and interrelated responses to the environment that demand ongoing training adjustment (Pol et al., 2020). Thus, enhancing performance requires not only the application of technical knowledge but also the integration of interpersonal skills, empathy, and the ability to adapt to the circumstances to assure long-term development in modern sports.

### *1.2. COMPONENTS OF SPORTS TRAINING IN THE MARTIAL ARTS*

Sports training is a complex process made up of numerous essential components—also known as training factors—that work together to help athletes develop fully and attain peak performance. Each component serves a distinct purpose and is essential in current training.

*Physical training* is the foundation upon which the entire athletic process is based. It seeks to improve the fundamental motor skills—strength, speed, endurance, flexibility, and coordination—that will enable the athlete to meet competitive expectations.

*Technical training* focuses on mastering the specific executions of the sport by learning and automating the appropriate skills. It is a crucial condition for performance since movement precision impacts competitive efficiency.

*Tactical preparation* entails creating game tactics and improving the athlete's ability to make rapid and efficient decisions during competitions. This component relies heavily on adaptability in response to the opponent and context.

*Theoretical preparation* teaches athletes about regulations, nutrition, recovery, exercise physiology, and training methods, which helps them develop a profound and aware grasp of their own athletic path (Bompa & Buzzichelli, 2019).

*Psychological preparation* is essential in high-performance sports, with the goal of developing mental abilities such as motivation, attention, stress management, and self-confidence. This component contributes to the athlete's resilience and emotional stability.

*Artistic training*, which is specialized for sports with an aesthetic dimension (e.g., gymnastics, figure skating), improves expressiveness, fluidity, and the beauty of movement, all of which contribute to the overall impression of the performance.

*Biological training* seeks to maintain and improve the athlete's health by balancing diet, hydration, sleep, and recuperation. This approach promotes injury prevention and long-term performance.

Together, these components form an integrated system in which the harmonic growth of each aspect contributes to top performance in modern sports.

### 1.2.1. PHYSICAL TRAINING IN MARTIAL ARTS

Physical training is the foundation of any athlete's development, necessary for optimizing motor abilities and correctly executing the technical requirements specific to each sports discipline. This component promotes peak performance and improves the athlete's general health. In this sense, modern training systems incorporate scientific methodologies for program design and monitoring, with the goal of promoting efficient growth while decreasing the risk of injury and overtraining (Halson 2014).

Physical characteristics such as strength, speed, endurance, flexibility, and coordination are considered natural motor skills that can be improved with specialized training. They are an important measure of athletic potential since they help maintain sustained and efficient effort throughout time (Triboi & Păcuraru, 2013).

Physical training is classified into two broad categories: general and specific. General physical training, which is similar to all sports, strives to improve the body as a whole and to establish a solid foundational physical condition. Specific physical training tailors this foundation to the specific needs of the sport, directing effort based on competitive demands.

Furthermore, high-intensity sports like athletics, team sports, and martial arts help to improve bone mineral density, which is important for avoiding injuries

and maintaining a healthy physical condition. In comparison, low-intensity sports like swimming and cycling have a smaller impact (Jin et al., 2023). Increased bone density promotes motor skill development and lowers the incidence of fractures, resulting in longer athletic careers (Fong et al., 2007).

### 1.2.2. TECHNICAL TRAINING IN MARTIAL ARTS

At the end of the growth and development period, athletes enter a stage where the focus changes to technical refinement, allowing them to reach their peak performance potential (Zhang & Wang, 2023a). Technical training encompasses all motor actions relevant to a sporting discipline, conducted in an optimal, efficient, and energy-efficient manner. The other parts of training, particularly physical preparation, directly influence this component, laying the groundwork for proper execution. Physical shortcomings will always result in limitations in precision and technological efficiency (Nan, 2013).

The value of technical training varies per sport. In aesthetic sports such as gymnastics or figure skating, technical execution is critical to performance. In team or combat sports, however, technique is critical for making quick decisions in unpredictable and demanding situations. Technical skills are executed through a complex interaction of fine and gross motor functions, physical abilities (strength, speed, coordination), cognitive ability, and tactical decision-making (Nuccio, 2017).

Athletes can become aware of and optimize their execution by analyzing movement mechanics, minimizing wasteful energy use, and enhancing efficiency (Zhang & Wang, 2023b). Simultaneously, technical training must be conducted in accordance with didactic principles, allowing for the steady and appropriate development of practical skills. Although there has been research on theoretical training for athletes, the existing literature lacks particular methods for technical training. In this context, the coach's and athlete's roles as active participants in the educational process are critical for developing a robust set of motor skills for competition (Pityn et al., 2017).

### 1.2.3. TACTICAL TRAINING IN MARTIAL ARTS

Tactical training is an important component of sports training, defined as a set of motor means that assist the performance of competitive action to attain a certain goal (Triboi & Păcuraru, 2013). It entails developing the athlete's ability to use numerous types of action based on the competitive setting, as well as adapting to the unique characteristics of each sport branch. Depending on the method, three types of tactics can be distinguished: passive tactic (counterattack), active tactic (initiating

activities that determine the opponent's replies), and mixed tactic (combining the two).

Creativity is a key component of modern tactical training; it allows athletes to make unexpected and efficient judgments, giving them a competitive advantage. However, existing tactical training approaches are frequently strict and standardized, placing little emphasis on the development of tactical inventiveness (Memmert, 2015). The development of this dimension would enable sportsmen to react more efficiently in uncertain situations and adjust their strategy in real time. Tactical training is organized into three stages of learning: tactical knowledge (information regarding methods and forms of action), tactical skills (the athlete's ability to adjust actions to the situation), and tactical habits (motor automations utilized effectively in a competitive context). Tactical thinking emerges under stress and time limits, indicating an athlete's ability to make quick and effective decisions in high-pressure situations (Triboi & Păcuraru, 2013).

Thus, tactical training includes not only teaching pre-established techniques but also the development of flexible, innovative, and adaptable thinking, which is required for success in modern sports.

### 1.2.4. PSYCHOLOGICAL TRAINING IN MARTIAL ARTS

Sports psychology has advanced significantly over the last two decades, yet many players and coaches are still unwilling to seek the help of sports psychologists due to a lack of knowledge of how mental abilities affect performance (Gee, 2010). Psychological effects are more difficult to evaluate than physiological effects, leading to an underestimation of their significance.

As sports medicine has grown in popularity, the emphasis has switched from treating injuries to preventing them and supporting athletes' mental health. Collaboration between psychologists and sports doctors is becoming increasingly important, particularly given the high prevalence of emotional issues among elite athletes (Mann et al., 2007). Emotional states have a substantial influence on motor learning, and anxiety and arousal levels in top sports can have a negative impact on decision-making and competition performance (Moran, 2016; Park et al., 2020).

One of the most promising ways for promoting psychophysiological balance is biofeedback, which enables athletes to monitor physiological parameters such as heart rate, respiration, and brain activity in real time. Heart rate variability (HRV) is a key factor, as it is linked to emotional self-regulation and stress control, both of which are important goals in performance sports training. VRC training helps athletes attain physiological coherence, which improves concentration and competitive performance.

Recent meta-analyses indicate the usefulness of biofeedback in improving performance by regulating psychophysiological parameters; however, methodological constraints, notably small sample numbers, raise concerns regarding the results' validity (Jimenez Morgan & Molina Mora, 2017). Furthermore, athletes' subjective feelings of anxiety and stress influence the success of the intervention; therefore, future studies should link objective data to subjective psychological assessments.

# *CHAPTER 2. STRESS AND ANXIETY IN MARTIAL ARTS*

## *2.1. THE NEGATIVE EFFECTS OF STRESS AND ANXIETY ON MARTIAL ARTS PRACTITIONERS*

Stress is an unavoidable part of modern life, affecting people's psychological, physical, and social well-being. According to Piñeiro-Cossio et al. (2021), sports can help manage stress and improve mental health. However, in performance sports, stress assumes a unique form, especially during competition seasons when the pressure intensifies. Personal disputes, fear of failure, and expectations from coaches and family are all sources of stress (Garinger et al., 2018), in addition to training challenges.

Competitive stress in contact sports like judo and taekwondo causes large increases in hormone levels such as cortisol and adrenaline. These physiological responses are visible during confrontations, whether official or simulated (Slimani et al., 2018). Higher levels of cortisol and anticipatory anxiety correlate with defeats (Cintineo & Arent, 2019), while extreme emotional reactions impact decision-making during competition.

Sport anxiety is divided into three dimensions: cognitive (bad ideas), somatic (physiological responses), and self-confidence, which are all influenced by the proximity of contests (De Oliveira et al., 2022). Using the CSAI-2 questionnaire, researchers linked different types of anxiety to cortisol and uric acid levels, indicating that stress has a direct impact on physiological responses. The nature of confrontation in judo increases psychological and physiological pressure, influencing both the athlete's emotional state and performance (Papacosta et al., 2016).

Recent meta-analyses (Rossi et al., 2022) have found that defeated athletes are more stressed, tense, and anxious than victors. This finding emphasizes the importance of tailored psychological interventions targeted at increasing emotional control and reducing burnout. Mental training thus becomes a crucial component of modern combat sport preparation, particularly for young athletes who are more susceptible to pre-competition stress (World Taekwondo Federation, 2021).

Another important issue is dealing with the fear of injury, which is common in sports like taekwondo, which has a high incidence of concussions. The scoring system, which favors head strikes, adds to the risk, and fear of damage can produce mental blockages. As a result, coaches play an important role in helping athletes acquire focus and self-control while also managing their attention and emotions under pressure (Kazemi et al., 2005).

Rapid weight loss is a common issue in weight-class sports, with more than 90% of athletes doing so before competition (Castor-Praga et al., 2021). These treatments, while helpful in the short term, have negative consequences both

physiologically (high blood pressure, dehydration) and mentally (sadness, bewilderment, impatience). They are also significantly impacted by coaches, parents, and the whole sports culture, emphasizing the importance of nutritional and psychological education for athletes.

Mental exhaustion can also have an impact on performance, reducing aerobic endurance and coordination but not anaerobic performance (Campos et al., 2022). This type of tiredness is commonly neglected, yet it has a significant influence on sports that require quick decisions and exact reactions.

Therefore, the athlete's psychological state not only influences physical and technical preparation but also determines their athletic performance. Competitive stress, worry, and fear of injury are all elements that, if not addressed properly, can lead to a drop in performance and even the abandoning of sports. As a result, psychological training techniques like mindfulness, personal development-oriented coaching, and biofeedback are becoming increasingly important instruments in the training of modern athletes. Although several federations have made substantial progress in this respect, athletes' psychological assistance remains an area that demands further improvement and investment.

### *2.2. POSITIVE EFFECTS OF MARTIAL ARTS ON CHILDREN'S DEVELOPMENT*

In the context of modern sports, martial arts stand out for their diversity, with around 200 identifiable styles, each with its unique set of characteristics but all aiming for the same thing: the perfection of self-defense abilities and the holistic development of the practitioner. The reasons for training in these disciplines are diverse, including enhancing physical fitness, building mental discipline, increasing self-confidence, competing, and using martial arts as a supplemental form of treatment (Bu et al., 2010). In addition to the physiological components, emphasis is focused on the psychosocial benefits, which include values such as respect, self-control, and perseverance, all of which are essential for personal and physical success.

Sports performance and self-defense require not just physical and technical skills, but also the development of executive functions such as creativity, adaptability, working memory, and self-control. Athletes who can deal with uncertain events must be able to comprehend complex information rapidly and make real-time decisions. According to research, integrated approaches that combine cardiovascular exercises, martial arts training, and yoga can greatly improve executive functioning. As a result, a close association emerges between athletic performance and higher cognitive processes, with these skills developing optimally in dynamic contexts unique to open-skilled sports like martial arts.

Sports are classified into two groups based on the setting in which they take place. Open-skill sports, which take place in dynamic and unpredictable contexts, necessitate sophisticated cognitive processes such as attention, planning, adaptation, and the capacity to regulate impulsive reactions, all of which are necessary for success. Closed-skill sports, on the other hand, take place in controlled situations with modest cognitive demands. According to recent research, practicing martial arts, which are classified as open-skill sports, improves executive functions such as working memory, divided attention, and inhibitory control, allowing athletes to make quick and accurate decisions in competitive situations.

Historically, martial arts have stressed self-regulation, and the ideals of self-control and discipline are still key cornerstones. Athletes who practice martial arts learn not only combat techniques but also how to control their emotional emotions, block instinctive impulses, and respond consciously in tight situations. Thus, creativity and mental flexibility are developed by rigorous training in a dynamic and unpredictable setting (Giordano et al., 2021). According to studies, professional athletes have a higher capacity for self-assessment and health orientation than recreational practitioners, which helps them adopt a healthy lifestyle and increase self-awareness (Kotarska et al., 2019).

Recent studies have shown that frequent martial arts practice, particularly karate and taekwondo, improves cognitive abilities in children and adolescents. The effect includes improving selective attention, working memory, and response time, all of which are necessary for sports and daily activities (Giordano et al., 2021). Furthermore, an inverse link exists between level of practice and aggression, with athletes with advanced belts exhibiting more regulated and goal-oriented actions (Skelton, Glynn, & Berta, 1991). Furthermore, martial arts-based training programs have been linked to a reduction in aberrant behavior and an improvement in emotional intelligence, which improves the ability to adapt to different social settings (Lindell-Postigo et al., 2023).

Tai chi is unique among martial arts in terms of health advantages. Tai chi helps with stress reduction, balance, and postural control, but it also improves cognitive performance. According to research, this activity benefits both young and elderly people by slowing cognitive decline and increasing mental agility (Bu et al., 2010; Wayne et al., 2014; Xue et al., 2022).

Taekwondo, which originated in Korea and is now recognized worldwide, mixes combat methods with an integrated philosophy emphasizing self-control, respect, integrity, and perseverance (Ng-Knight et al., 2022). Practitioners of this discipline profit not only from better physical health but also from significant mental and social development. Taekwondo's philosophy is expressed through five core principles: courtesy, honesty, perseverance, self-control, and indomitable spirit, which influence practitioners' behavior and foster a balanced existence. Training

consists of both physical activities and meditation and mental preparation, all of which contribute to the individual's harmonic growth (Dziwenka & Johnson, 2015). Recent research shows that Taekwondo training improves executive functions such as attention, working memory, inhibition, and decision-making capacity. These effects are caused by a mix of great physical effort and high cognitive demands, such as anticipating opponent actions and making quick decisions under pressure (Pujari, 2024).

Furthermore, consistent Taekwondo practice is linked to greater self-confidence, less academic stress, and the development of communication and leadership abilities. These advantages extend beyond the training hall, positively influencing children's and adolescents' social conduct and academic achievement (Lee & Kim, 2012; Cho, Park & Lee, 2018).

Taekwondo training also improves emotional self-regulation, which is necessary for dealing with tough conditions during competitions. Coaches emphasize the significance of tranquility and respect in the dojang, and breathing and concentration techniques are utilized to regulate emotional responses. This procedure not only relieves stress and anxiety but also promotes positive self-image and self-efficacy. According to studies, advanced Taekwondo practitioners had a reduced aggressive behavior evaluation score and a higher ability to adjust to scholastic and social contexts (Ng-Knight et al., 2022; Skelton, Glynn, & Berta, 1991).

Overall, martial arts, particularly Taekwondo, are effective tools for the entire development of the individual. The practice of these disciplines not only increases physical fitness and athletic performance, but it also helps to develop cognitive functions, strengthen emotional equilibrium, and improve social skills. Integrating ethical ideals and historic ideas into a modern training program optimizes the benefits, making sports into an educational environment as well as a platform for ongoing self-improvement (Mutz et al., 2020).

Research studies point out that there are training programs that blend conventional approaches with modern cognitive and emotional development methodologies. Evaluating athletes' distinct psychological profiles and tailoring interventions to these unique characteristics can result in considerable improvements in competitive performance while also supporting a healthy lifestyle. Furthermore, more research on the long-term effects of Taekwondo and other martial arts will help to elucidate the cognitive and emotional mechanisms involved, allowing for the development of effective training programs (Parmigiani et al., 2009).

*2.3. METHODS TO IMPROVE STRESS AND ANXIETY IN ATHLETES*

Martial arts, with roughly 200 different styles, promote not just self-defense but also the development of physical health, mental discipline, and self-esteem. Their exercise improves executive skills such as creative thinking, working memory, and self-control, which have a positive impact on open-skilled sports performance. Practitioners of martial arts, particularly those at the performance level, exhibit considerable increases in inhibition, attention, and information processing. Self-regulation, which is unique to these activities, improves self-control, balance, and adaptation in the face of obstacles.

Taekwondo, as a martial arts discipline, has a profound impact on personal development. Its practice blends physical techniques with ethical ideals like self-control, tenacity, and respect, providing cognitive, social, and psychological benefits. Taekwondo has been shown in studies to improve attention, working memory, self-control, and confidence. It also encourages prosocial conduct and school adaptation, particularly among children and adolescents, while also helping to improve leadership, communication, and cooperative abilities.

Psychological preparation is essential in Taekwondo since competitors confront competitive stress, physical exertion, and high expectations. Modern support tactics include mindfulness, which has been shown to reduce anxiety and sadness and improve concentration. Mindfulness meditation promotes emotional regulation and equilibrium and prevents mental tiredness. Athletes become more robust and capable of dealing with competitive pressure, concentrating their attention, and avoiding mental obstacles in vital situations.

Mindfulness, along with other psychological practices, is increasingly being used in athletes' training because of its several benefits, including emotional balance, attentiveness, stress reduction, and performance improvement. In this regard, Daniel Siegel's Wheel of Awareness (figure 2.1) is a useful tool for integrating bodily sensations, emotions, and relationships into self-awareness. Mindfulness enables athletes to connect with their own experiences and manage their behavior in reaction to stimuli, improving performance and overall well-being.

## *THEORETICAL CONCLUSIONS*

Specialized literature constantly highlights the importance of balanced training in sports, which includes not only physical and technical development but also psychological development. Effective training begins with the consolidation of basic abilities and progresses to the perfection of details, and the inclusion of the mental dimension in this process has proven to be critical for long-term performance and athlete development.

Although the philosophy and methodology of sports training are always improving, many novel psychological principles remain underutilized in current practice. Traditional approaches, which are primarily concerned with physical and technical-tactical factors, may impede athletes' ability to reach their full potential. Martial arts, by definition, encourage a comprehensive approach to personal growth.

They promote not only physical and technical training but also mental equilibrium, self-discipline, and adherence to moral principles. However, as sports have become more globalized, the educational dimension has often been overlooked in favor of immediate competitive performance.

In this context, psychological training serves as the link between all other training components, assisting athletes in dealing with pressure, self-motivation, and emotional management. This training is especially important for juniors (aged 14 to 18), who are experiencing considerable psychological changes.

Future research should focus on developing and testing a psychological training program for junior taekwondo practitioners. These exercises will seek to improve emotional control, reduce competition tension, boost self-confidence, and aid attention, all of which will help to produce a well-rounded athlete—both physically and psychologically.

# PART 2. OWN CONTRIBUTIONS

## *CHAPTER 3. PRELIMINARY STUDY ON INNOVATIVE METHODS OF OPTIMIZING SPORTS BEHAVIOR IN TAEKWONDO*

### *3.1. RESEARCH PREMISES*

Stress and anxiety are becoming more prevalent in today's culture, spurred by the quick pace of life and daily expectations. The persistent stimulation of the bodily stress reaction ("fight or flight") can result in major psychological imbalances, such as anxiety and depression. Adolescents and young adults are more vulnerable, and studies show that women are more likely to suffer from anxiety disorders. In this context, Jon Kabat-Zinn's mindfulness techniques have been clinically confirmed as helpful ways to reduce stress and anxiety symptoms. Mindfulness is a purposeful, nonjudgmental focus on the present moment. Furthermore, the Jacobson method of progressive muscle relaxation has been shown to reduce both mental and physical strain.

The proposed study is to evaluate the effects of these strategies on Taekwondo athletes, who are frequently subjected to competition stress. The study is based on the notion that systematic use of these psychological treatments can greatly reduce stress and anxiety. The methodology divides athletes into three groups: one who will practice mindfulness, one who will employ the Jacobson technique, and a control group. The goal is to compare the results and determine the most effective method of psychological intervention in sports training.

### *3.2. PURPOSE, OBJECTIVES, TASKS AND HYPOTHESES OF THE RESEARCH*

The purpose of this research is to develop a method that coaches and athletes can use independently, without requiring a specialist's presence, to reduce anxiety and stress in taekwondo practitioners, thereby helping them achieve better results in competitions.

The conduct of this research started from the formulation of the hypotheses below:

- **Main Hypothesis 1**. The application of a mindfulness program can reduce stress and anxiety in taekwondo practitioners.
    - *Secondary Hypothesis 1.1*. It is estimated that the application of a mindfulness program will reduce stress during training for taekwondo practitioners.

- *Secondary Hypothesis 1.2*. It is estimated that the application of a mindfulness program will alleviate the anxiety of taekwondo athletes.

- **Main Hypothesis 2**. The application of the Jacobson relaxation technique during training can reduce stress and anxiety in taekwondo practitioners.

  - *Secondary Hypothesis 2.1*. The application of the Jacobson relaxation technique can reduce stress in taekwondo athletes.

  - *Secondary Hypothesis 2.2.* The application of the Jacobson relaxation technique can reduce/attenuate the anxiety of taekwondo practitioners.

- **Main hypothesis 3.** There is a link between stress and anxiety in taekwondo athletes.

### *3.3. RESEARCH METHODS*

Several investigation procedures were used to complete this research, including the bibliographic study, testing, statistical analysis, and graphical depiction. In the first section of the paper, the bibliographic study method was used to examine the evolution of sports training theory in light of new discoveries in the field, as well as to emphasize the importance of psychological preparation in the development of athletes, particularly martial arts practitioners. Although their benefits to mental balance are well acknowledged, athletes are not immune to stress and anxiety, which are exacerbated by a variety of external circumstances that affect performance.

The testing approach was employed in the applied component of the study, with the goal of measuring stress, anxiety, and heart rate levels before and after the psychological intervention plan was implemented. The goal was to determine the efficacy of the offered strategies in lowering these parameters.

The statistical analysis was carried out using the SPSS program (version 20.0), with the following tests: the Wilcoxon test for comparing paired samples, the Mann-Whitney U test for differentiating independent groups, ANCOVA for controlling covariate variables, and the Spearman correlation coefficient for investigating relationships between variables.

Additionally, the graphical approach was employed to visually depict the results. Tables and charts offered a clear image of the evolution of the investigated variables as well as the differences found across groups, making it easier to read and understand the results.

*3.4. ORGANIZATION AND CONDUCT OF RESEARCH*

### 3.4.1. RESEARCH SUBJECTS

This pilot study included a sample of 36 taekwondo practitioners aged 14 to 16, recruited from two sports clubs in Iași connected with the Romanian Taekwondo Federation. The subjects were randomly assigned to three groups: a control group, a group that received mindfulness-based intervention, and a group that used the Jacobson progressive relaxation method.

Athletes were chosen based on well-defined criteria such as age and competitive level, with at least one year of experience and participation in at least one official tournament required. The groups were formed based on the scores from the STAI Trait Anxiety Inventory, which measures how likely the subjects are to feel anxious, to make sure the groups were evenly matched in the study.

### 3.4.2. TESTS AND MEASUREMENTS USED

Salivary cortisol has been used as a physiological marker of stress. We collected saliva samples using the Salivette Cortisol device between 4:00 PM and 8:00 PM to reflect the physiological level of activation. Salivary cortisol is a non-invasive, reliable, and sensitive method, providing an accurate picture of the biological response to stress. The values were expressed in nmol/L and analyzed in a specialized laboratory.

We performed heart rate monitoring by applying a digital pulse oximeter, LK87, to the fingertip. This indicator provides a quick measure of the physiological response to stress and effort, expressed in beats per minute (bpm). Normal values for adolescents are between 60 and 100 bpm at rest.

The STAI—State-Trait Anxiety Inventory—is a standardized psychological tool consisting of 40 items (20 on each scale), and higher scores indicate increased levels of anxiety. It is used to evaluate:

• STAI-S (State)—the level of anxiety felt at the time of testing;

• STAI-T (Trait)—the individual's general and stable tendency towards anxiety.

### 3.4.3. INNOVATIVE METHODS APPLIED

A. MINDFULNESS

In this research, the mindfulness technique was implemented at the end of each training session for three months, with a frequency of three sessions per week. Initially, the sessions were led by a collaborating psychologist, with the author of the paper gradually taking on the role of facilitator. The athletes were then urged to engage in mindfulness on their own, both inside and outside of training sessions.

The technique used was "The Wheel of Awareness," created by Daniel Siegel (2018). This technique is a mental training tool that cultivates awareness of subjective experience by exploring four essential dimensions: sensory perceptions (hearing, seeing, tasting, smelling, touching), bodily sensations (heart rate, tension, temperature), mental activity (thoughts, emotions, memories), and interpersonal relationships (interactions and social connections). The central element of the wheel, the hub, symbolizes consciousness itself—the inner space from which the entire present experience can be observed.

The protocol included:

1. Visualization of the mental wheel for structuring the experience;

2. Guided exploration of each quadrant, without judgment or analysis;

3. Reflection on consciousness as an active and undisturbed process;

4. Gradual return to the waking state by focusing on breathing.

This practice aims not only at relaxation but also at developing emotional self-regulation, concentration, and mental resilience. Studies confirm the effectiveness of mindfulness techniques in regulating the stress response, reducing anxiety, and improving performance (Hölzel et al., 2011; Lengacher et al., 2019; Foster & Chow, 2020). Meditative practices such as mindfulness support the activation of the prefrontal cortex, hippocampus, and corpus callosum, promoting brain integration and reducing cortisol levels (Siegel, 2018).

In sports, mindfulness helps avoid mental blocks (choking under pressure), improves focus in competition, and accelerates emotional recovery after failures or intense matches (Mojtahedi et al., 2023; Josefsson et al., 2019). In the case of taekwondo athletes, who frequently face competitive stress, demanding training, and the pressure of weight loss, this technique offers a valuable tool for psychological stability and maintaining motivation (Febrianty et al., 2021; Costa et al., 2018).

Mindfulness also stimulates self-awareness and non-reactive perception, helping athletes to observe and accept negative thoughts or disturbing emotions without rejecting or over-controlling them (Farb et al., 2010; Blanck et al., 2018).

Thus, it becomes possible to improve overall well-being and prevent mental exhaustion.

The integration of the "Awareness Wheel" technique into a training program can contribute to:

• increased cognitive and emotional performance;

• improving focus and motivation;

• development of self-control and empathy (Siegel, 2014; Lin et al., 2018);

• reduction of anxiety and stress symptoms (Loucks, 2020; Wielgosz et al., 2019).

### B. *THE JACOBSON PROGRESSIVE RELAXATION METHOD*

Progressive muscle relaxation is a stress management technique that physiologist Edmund Jacobson created in the early twentieth century, and it aims to reduce muscle tension while promoting physical and mental serenity (Piffare et al., 2015). The method entails voluntary contraction of specific muscle groups, followed by relaxation and concentration on the physical sensations experienced. By repeating this technique, the individual becomes aware of and learns to control the body's tensions. This oscillation of tension and relaxation has a positive impact on the psychological state, encouraging emotional self-regulation and lowering stress.

The study employed this approach systematically for three months, three times per week, at the end of each training session. The implementation approach was clearly staged: first, a partnering psychologist instructed the group, and then the technique was performed under their observation for the first few weeks. Subsequently, the study's author took over workout supervision, and the athletes were encouraged to practice alone.

The Jacobson approach is frequently used in clinical psychology to reduce anxiety and is recommended for the treatment of panic disorders, phobias, and post-traumatic stress (Torales et al., 2020). It is also beneficial in treating migraines (Meyer et al., 2018), tinnitus (Seydel et al., 2010), and temporomandibular joint disorders (Ferendiuk et al., 2019).

Progressive relaxation improves athletic performance by reducing muscle tension, minimizing burnout, and sustaining focus during vital periods. Before contests, people frequently use it to provide a calm mental state and proper psychological preparation (Weinberg & Gould, 2019). It also provides post-training benefits, such as speeding up physical recovery and lowering stress levels.

According to studies (Conrad et al., 2007; Piffare et al., 2015), this technique can reduce mental and muscular fatigue, lower blood pressure, improve sleep quality, improve mental clarity and concentration, and reduce emotional reactivity.

Its theorized mechanism of action is a link between deep muscular relaxation and a calm mental state. By teaching athletes to observe and control their internal tensions, they become more aware of their own emotional responses and better equipped to handle pressure during competitions.

Compared to other self-regulation approaches, the Jacobson method is simple to learn, non-invasive, and does not require any specific equipment, making it perfect for use in performance sports. In the case of taekwondo athletes, frequent use of this strategy has been shown to improve psychological resilience, reduce stress symptoms, and maintain an ideal mental state during training and competition.

### *3.5. RESULTS AND DISCUSSION*

In the study, participants were tested at two key moments: before the application of intervention techniques (initial moment) and after three months of implementation (final moment) to evaluate the effects of the methods on stress and anxiety levels. Each group of subjects received a separate analysis, and the results obtained were statistically interpreted and graphically presented, reflecting the evolution of physiological and psychological indicators.

**DATA DISTRIBUTION**

To verify the normal distribution of the initial and final heart rate variables, descriptive statistics and the Shapiro-Wilk test, suitable for small samples (n = 12 for each group), were used. This stage was essential for selecting the appropriate statistical tests in interpreting the results, allowing for the precise comparison of changes resulting from the applied interventions.

The Shapiro-Wilk test indicated statistically insignificant values for all three groups at the initial heart rate, suggesting a normal distribution of the data. Additionally, for the final heart rate, for group 3 ($p = 0.576$) and group 1 ($p = 0.142$), the data adhere to the normality assumption. Group 2 recorded a marginal value ($p = 0.091$), but without reaching a threshold of statistical significance (Table 3.3).

The results obtained for the initial values of salivary cortisol show that groups 1 and 3 exhibit significant deviations from the normal distribution, while group 2 has a normal distribution according to the Shapiro-Wilk test. This aspect indicates a lack of homogeneity between groups regarding the initial distribution of cortisol, which may influence the comparative interpretation of the results.

Regarding the final values of salivary cortisol, no group exhibited a normal distribution. Although for group 1 the p-value is very close to the significance threshold (p = .059), groups 2 and 3 showed significant deviations from normality. These findings suggest that the final data do not follow a normal distribution, an aspect that must be considered when choosing appropriate statistical methods for analysis.

The results for anxiety as a trait and anxiety as a baseline state show that these variables follow a normal distribution in all three groups, with p-values above 0.05. This suggests a homogeneous and appropriate distribution for the application of parametric statistical analyses in these cases.

In contrast, for anxiety as a final state, only groups 2 and 3 had a normal distribution, while group 1 significantly differed from normality (p = 0.024), meaning we need to be more careful when looking at the statistical results for this group.

### 3.5.1. HYPOTHESIS TESTING

#### TESTING SECONDARY HYPOTHESIS 1.1

For the starting levels of salivary cortisol, the results show that group 1 (p = .000) and group 3 (p = .003) have significant differences from what we expect in a normal distribution, while group 2 (p = .467) does not have these differences and follows a normal distribution according to the Shapiro-Wilk test (Appendix 4). These results suggest that the initial distribution of cortisol is not homogeneously normal across groups, which may influence the subsequent interpretation of the results (Table 3.4).

We applied the Wilcoxon test for the first group (the one where the mindfulness technique was used), analyzing the differences between the initial and final values of salivary cortisol and heart rate. The results indicated that there are no statistically significant differences between the values measured before and after the intervention, as the obtained p-value was greater than 0.05.

The lack of clear results can be due to a few reasons, like having a small number of participants, the short time the technique was used, and outside factors—such as daily stress, poor sleep, or an unhealthy diet—that can influence the measured body levels and lessen the impact of the technique.

Although a slight improvement in average heart rate and salivary cortisol levels was observed (Bridge, Jones & Drust, 2011), this improvement is not sufficient to confidently assert that the mindfulness method is effective in reducing stress among taekwondo practitioners.

Taekwondo is, by its nature, a sport in which athletes are in a constant state of alertness, which generates a higher level of stress and anxiety. Such an outcome implies the need for a longer period of intervention application, especially in the case of experienced athletes, who find it harder to adapt to changes and are more rigid regarding their training routine (Sappington & Longshore, 2015).

**TESTING SECONDARY HYPOTHESIS 1.2**

The results of the Wilcoxon test indicate that, in the case of the group that benefited from the intervention based on the mindfulness technique, there was no significant decrease in anxiety levels between the initial and final moments of the study. This lack of statistical significance can be explained by several factors, including the relatively short duration of the intervention and the need for individualized adaptation of the practices. Birrer et al. (2012) suggest that athletes who are more experienced might need longer and more tailored mindfulness programs based on their mental needs and the requirements of their sport, which could explain the findings of this study.

The Mann-Whitney U test showed no important differences between the groups regarding their starting or ending anxiety levels, indicating that the interventions did not significantly affect anxiety as a state. Additionally, the results of the Kruskal-Wallis test support these conclusions, as no significant differences were identified between the three groups at the end of the intervention.

Contrary to the initial hypothesis, the obtained data do not support the idea that the mindfulness technique significantly reduces athletes' anxiety during the analyzed period. The specialized literature provides evidence regarding the effectiveness of mindfulness in reducing anxiety; however, these effects are more pronounced in longer-duration programs and when the practice becomes a constant component of athletes' routines (Noetel et al., 2019; Josefsson et al., 2019).

Another important aspect to mention is that the effectiveness of mindfulness interventions can be influenced by the initial level of anxiety, the regularity and quality of the practice, as well as individual differences in stress response (Gardner & Moore, 2017). Moreover, recent research suggests that to achieve more consistent effects, mindfulness techniques should be combined with other emotional regulation methods, such as self-compassion and cognitive restructuring (Gross et al., 2021).

**TESTING THE MAIN HYPOTHESIS 1**

Since both secondary hypotheses were disproven, the main hypothesis 1 could not be supported. Thus, under the conditions applied in this study, the

mindfulness program did not prove effective in reducing stress and anxiety levels among taekwondo practitioners. This result suggests that, to achieve significant effects, interventions of this type might require a longer duration, a higher frequency of sessions, or a more specific adaptation to the individual needs of the athletes.

**TESTING SECONDARY HYPOTHESIS 2.1**

The p-value of 0.610 shows that there was no meaningful difference between the starting and ending heart rates in group 2, and the Wilcoxon test results for cortisol levels ($p = 0.239$) also support that the intervention did not have a significant effect.

These findings suggest that the Jacobson progressive relaxation technique, applied under the conditions of this study, did not result in a significant reduction in physiological stress. It is possible that the high variability of individual responses and the influence of external factors, such as sleep quality, hydration, nutrition, or daily routine, may have affected the efficiency of the intervention. Additionally, the duration of application might be insufficient for athletes to effectively learn and integrate this relaxation method (Pelka et al., 2016; Klainin-Yobas et al., 2015; Laborde, Mosley & Thayer, 2017).

The ANCOVA analysis of the final salivary cortisol levels showed no significant difference in stress levels based on group membership ($p = 0.420$), meaning the differences between the groups are not important. Although the specialized literature supports the efficacy of the Jacobson method in reducing stress by lowering cortisol levels and relaxing the autonomic nervous system (Manzoni et al., 2008), the results obtained in this study suggest that its effectiveness may vary depending on the individual characteristics of the athletes and the duration of the intervention (Berger et al., 2020).

Therefore, the fact that the application period was insufficient to produce noticeable physiological changes could explain the lack of a significant effect.

**TESTING SECONDARY HYPOTHESIS 2.2**

The Wilcoxon test for group 2 did not find any important differences between the starting and ending anxiety levels ($p = 0.937$), indicating that Jacobson's progressive relaxation technique did not significantly lower the participants' anxiety. Also, the analysis comparing the two groups using the Mann-Whitney U test ($p = 0.322$) showed no significant differences between the experimental group and the control group, further supporting the idea that the intervention was not effective in this situation.

These results contradict some research in the specialized literature that supports the effectiveness of progressive relaxation in reducing anxiety and stress in athletes (Lucibello, Parker & Heisz, 2019; Moore et al., 2019). However, other authors emphasize that the effectiveness of these interventions depends on several factors, including the duration of the program, the consistency of application, the initial level of anxiety of the athletes, and individual characteristics (Pelka et al., 2017; Rice et al., 2016; Faleide et al., 2021).

**TESTING THE MAIN HYPOTHESIS 2**

The secondary hypotheses were refuted; thus, the main hypothesis 2 could not be demonstrated. The results showed that the Jacobson technique did not produce significant effects on anxiety and stress in this context. It is therefore recommended to extend the duration of psychological intervention programs and, possibly, to combine them with other techniques, such as mindfulness or cognitive-behavioral interventions, to enhance their effectiveness in reducing athletes' stress and anxiety (Gross et al., 2015).

**TESTING THE MAIN HYPOTHESIS 3**

The correlation study revealed a strong positive association between the initial and final levels of anxiety, implying that the initial level is a favorable predictor of the final level. This finding is consistent with the specialist research, which highlights that anxiety remains stable over time and is mostly influenced by external interventions (Spinhoven et al., 2021).

A notable link was also found between gender and the final level of salivary cortisol, indicating a moderate connection that may show how hormones and body responses to stress differ between men and women. A similar connection was found between gender and anxiety levels, showing that gender affects anxiety, with women often reporting higher levels—something backed by biological and social differences noted in research.

These findings partially validate hypothesis 3. Although several variables (beginning and final anxiety, gender, and final cortisol) showed substantial connections, the results did not support other links, such as those between initial cortisol or pulse levels and final stress or anxiety. Biological characteristics such as gender may influence athletes' anxiety, which appears to remain relatively stable over time. The final cortisol level is also likely to differ based on this circumstance. These findings are consistent with earlier research emphasizing the complexity of stress reactions, which are influenced by various physiological and psychological components (Turner-Cobb, 2021).

# PARTIAL CONCLUSIONS

The findings of this study indicate that implementing mindfulness training did not result in a substantial reduction in stress and anxiety among taekwondo practitioners. Although the specialist literature suggests that mindfulness can help with emotional regulation and stress reduction (Creswell, 2017), no significant improvements in cortisol levels or heart rate were detected in this study. Furthermore, the athletes' anxiety levels did not change much, contrary to the findings of several prior research studies that highlight the efficiency of this strategy in lowering anxiety (Khoury et al., 2015). Possible causes include the program's short duration, the level of participant participation, and individual variances in responsiveness to the technique.

Similarly, the Jacobson progressive relaxation technique did not significantly reduce stress and anxiety levels. Although earlier research has shown that the approach is beneficial in lowering psychophysiological stress (Manzoni et al., 2008), its application in the context of this investigation produced no significant outcomes. The anxiety levels of athletes who used the Jacobson technique did not improve significantly when compared to the control group, contradicting earlier research that shows the effects of progressive relaxation on anxiety (Vancampfort et al., 2018). The brief duration of the intervention or its lack of coordination with other complementary approaches could explain this finding.

The connections found in the study revealed that anxiety as a trait has a consistent nature over time, with a substantial association between the early and final moments. Furthermore, a correlation was found between gender and final cortisol levels, implying that there are gender differences in stress response, which is corroborated by recent research (Zorn et al., 2023). In contrast, no clear connections were found between cortisol and anxiety, implying that perceived stress and physiological stress may have distinct sources and processes of manifestation.

In conclusion, neither mindfulness nor Jacobson's progressive relaxation was beneficial in lowering stress and anxiety among taekwondo competitors for the short time studied. These findings highlight the importance of lengthier and more targeted psychological therapies, tailored to the requirements of the activity and each individual. Future studies should look at making the interventions longer, using different ways to measure results like electroencephalography or heart rate variability analysis, and mixing the techniques studied with other methods for managing emotions, like breathing exercises or guided imagery.

## *CHAPTER 4. FUNDAMENTAL RESEARCH - CONSIDERATIONS ON THE IMPACT OF PSYCHOLOGICAL TRAINING ON THE PREPARATION OF ATHLETES IN TAEKWONDO*

### *4.1. RESEARCH PREMISES*

Sports are gaining popularity due to their favorable impact on physical and mental health in today's stressful and complex world (Piñeiro-Cossio et al., 2021; Mutz et al., 2020). Sports are frequently linked with competitiveness and performance, but they also include a qualitative, emotional dimension that has a significant impact on practitioners' well-being (Bing & Kim, 2021). Sports performance is a complex notion that includes both physiological and psychological components (Kellmann & Beckmann, 2018).

However, psychological training is frequently disregarded in favor of physical training, although mental abilities such as concentration, motivation, and emotional self-regulation are critical to success (Beckmann & Elbe, 2015; Bühlmayer et al., 2017). Taekwondo, an Olympic sport practiced in over 200 nations (International Olympic Committee, 2021), has strong physical demands, but an increasing number of studies emphasize the importance of mental preparation for peak performance (Kazemi et al., 2010; Kim & Nam, 2021).

Although taekwondo has been recognized for its physical and educational benefits (Kim et al., 2021), research on the impact of psychological therapies on athlete performance remains scarce. According to recent research, top athletes have stronger self-confidence and lower levels of anxiety than others (Jung-Hoon et al., 2022), emphasizing the relevance of psychological support in sports training.

Given the scarcity of sports psychologists in many Romanian teams, this study suggests an approach that coaches can immediately apply. The method combines active workouts to improve response speed and balance with a mindfulness technique tailored to athletes. Following a pilot study, this combination was found to be helpful in reducing stress and anxiety levels among taekwondo practitioners, giving a practical tool for optimizing mental training even in the absence of a specialist.

### *4.2. PURPOSE, OBJECTIVES, TASKS AND HYPOTHESES OF THE RESEARCH*

The purpose of this research is to propose a training plan that integrates a mindfulness technique with a series of specific dynamic games, aiming to reduce stress and anxiety in athletes, as well as simultaneously develop the reaction speed and balance of taekwondo practitioners, in order to improve sports performance.

The realization of this research started from the formulation of the hypotheses below:

- **Main Hypothesis 1.** Adapted mindfulness (+dynamic games) can contribute to reducing stress and anxiety levels among taekwondo practitioners.
    - *Secondary Hypothesis 1.1*. It is assumed that the implementation of an adapted mindfulness program will lead to a significant reduction in stress levels among taekwondo practitioners.
    - *Secondary Hypothesis 1.2*. It is anticipated that the implementation of an adapted mindfulness program will contribute to the alleviation of anxiety in taekwondo athletes.
    - *Secondary Hypothesis 1.3.* Adapted mindfulness applied within training sessions influences the reaction speed of taekwondo practitioners.
    - *Secondary Hypothesis 1.4.* Adapted mindfulness applied during training can influence the static balance of taekwondo practitioners.
- **Main hypothesis 2.** The application of the proposed methods will lead to an improvement in the performance of taekwondo athletes, reflected in superior results in competitions.

*4.3. RESEARCH METHODS*

We completed this investigation using a variety of investigative methods, such as bibliographic analysis, testing, statistical analysis, and data graphical display.

The bibliographic analysis served as the foundation for writing the paper's theoretical section, which focused on the evolution of sports training theory in light of recent research in the field. This stage also provided an opportunity to emphasize the importance of psychological training in performance sports, with a focus on taekwondo. Although this discipline helps athletes maintain their mental equilibrium, practitioners are not immune to stress and anxiety, which are more common in the setting of external influences that can have a negative impact on their performance.

The testing approach was used in the research's practical component, with the goal of assessing participants' stress levels, anxiety, reaction time, and balance before and after the intervention program was implemented. This strategy sought to discover any changes that occurred as a result of implementing the specified techniques.

We conducted the statistical analysis using the SPSS program (version 20.0), applying numerous relevant tests to validate the hypotheses. The Wilcoxon test

was used to compare two related groups, the Mann-Whitney U test was used for comparing two separate groups, the ANCOVA test helped control for other influencing factors, and the Spearman correlation was used to look at the relationships between the variables studied.

Graphical representation was employed to help explain the data in a straightforward and accessible way. Tables and charts were employed to demonstrate the differences and relationships between variables, allowing for a better visual and comparative comprehension of the research findings.

## *4.4. ORGANIZATION AND CONDUCT OF RESEARCH*

### 4.4.1. RESEARCH SUBJECTS

This research was conducted on a sample of 60 taekwondo practitioners registered with the Romanian Taekwondo WT Federation, coming from three sports clubs in Iași and one in Botoșani. To be able to participate in the study, the subjects had to meet certain selection criteria: an age between 14 and 18 years, a minimum level of sports experience defined by at least one year of practice, and participation in at least one official competition. These criteria were established to ensure a level of homogeneity regarding the experience and training of the athletes included in the analysis.

The subjects were divided into two equal groups: an experimental group and a control group. The allocation was based on the scores obtained on the STAI Anxiety Questionnaire—the trait anxiety component—to ensure a balanced distribution regarding the predisposition to anxiety. The scores were analyzed using the Independent Samples test, and the p-value ($p = 0.0474$) shows that there are no significant differences between the two groups, confirming they are similar before the intervention was applied (Table 4.3).

### 4.4.2. INNOVATIVE METHODS APPLIED

*A. MINDFULNESS*

In this study, Dr. Daniel Siegel's mindfulness approach, "The Wheel of Awareness," was used. This method seeks to cultivate a state of "open awareness," in which the individual learns to examine their internal and external experiences without becoming influenced by them.

According to Siegel (2018), good psychological functioning is supported by the integration of various brain regions, such as the prefrontal cortex, hippocampus, and corpus callosum, and mindfulness practice facilitates this

integration, thereby reducing stress, anxiety, and depression. The technique was used at the conclusion of each training session in a peaceful setting that encouraged contemplation. We instructed participants to focus on their breathing in a comfortable position as a way to quiet their brains and anchor their attention in the present moment. The procedure continued with the visualization of the "wheel of awareness," which has a center and four quadrants that represent various aspects of consciousness.

The first quadrant was devoted to the senses. Participants grew more aware of sounds, tactile sensations, scents, and tastes, practicing presence in the "here and now." The athletes then practiced body awareness, which involved scanning their bodies for muscle tensions or discomforts and gradually releasing them. This stage, like body scan procedures, promoted deep physical relaxation (Kabat-Zinn, 2013).

The third quadrant focused on mental activities. Participants watched their thoughts, feelings, and recollections without judging or interpreting them. This method enabled the development of a detached perspective and a healthier relationship with one's own internal dialogue. At the center of the wheel, athletes were urged to become aware of their awareness, which is a metacognitive experience that promotes mental clarity and emotional regulation (Siegel, 2010).

The final quadrant centered on interpersonal interactions, prompting participants to consider how they relate to others and the social environment. This stage emphasized the need for empathy and collaboration in sports and other settings. The session concluded with a gradual return to external reality using deep breaths and bodily awareness. The participants opened their eyes at their rate, preserving the balance gained during the exercise.

This strategy has proven to be an effective tool for athlete development, particularly in taekwondo, where competitive pressure is considerable. The Wheel of Awareness gave participants a systematic framework for emotional self-regulation, attention development, and reducing physical and mental strain. Even though the effects were not statistically significant in this study, the specialist literature suggests that mindfulness techniques should be used in the long run for long-term results in mental health and athletic performance (Kabat-Zinn, 2013; Siegel, 2018).

### *B. SPECIFIC DYNAMIC GAMES*

Motor control and the motor learning process are critical in athlete development, as they have a direct impact on performance. Successful athletes must perform tactics quickly and efficiently, regardless of internal or external pressures. Mindfulness-based training can assist in minimizing overthinking by encouraging the

automatic activation of movements learned during practice rather than conscious control under stress (Bühlmayer et al., 2017; Birrer et al., 2012).

In performance sports, balance is essential for maintaining posture and performing certain actions. Taekwondo's balance component intimately links to motor abilities and performance (Yoo et al., 2018). Training typically involves exercises designed to improve response speed and balance, which can be enhanced by incorporating dynamic games. These provide a pleasant and effective alternative, stimulating development through enjoyable and inspiring activities.

Coaches use several strategies to reach peak performance, including basic techniques, poomsae, sparring, self-defense, and material-assisted workouts (Ouergui et al., 2021). Furthermore, because of the competitive nature of taekwondo, which involves frequent jumps and abrupt changes in direction, balance development is critical for both performance improvement and injury prevention. Short balance-focused training programs (3-6 weeks) have been proven to improve postural stability and reduce the risk of ankle injuries (Park et al., 2021; Lazarou et al., 2017).

At the same time, incorporating dynamic games into the training routine increases athlete motivation and engagement, resulting in a gradual progression without players feeling the tremendous physical exertion (Yu et al., 2018).

The intervention plan was implemented over the course of a mesocycle, which was structured over a six-week period, and strategically integrated a series of dynamic games designed to develop reaction speed and balance, as well as the constant application of the mindfulness technique "Wheel of Awareness," with the goal of improving taekwondo practitioners' performances. The goal of this combination is not only to improve the psychomotor skills required for competition but also to reduce athlete-specific stress and anxiety, increase concentration and emotional self-regulation, and stimulate intrinsic motivation, all within a pleasant, varied training environment tailored to their needs.

### *4.5. RESULTS AND DISCUSSION*

The participants were initially evaluated before the application of the methods in each group, and again at the end of the three-month period following the start of the techniques. The results obtained for each group were analyzed and presented subsequently.

**TESTING SECONDARY HYPOTHESIS 1.2**

The Shapiro-Wilk test highlighted significant deviations from normality in both analyzed groups, with p-values of 0.018 and 0.036, indicating that the initial

distribution of salivary cortisol is not normal. Regarding the final values, the experimental group showed a clear deviation from normality ($p = 0.005$), while for the control group, the results ($p = 0.394$) suggest a normal distribution of the data (Table 4.5, Appendix 10).

Considering these results, especially the lack of normality in the experimental group, the use of nonparametric tests, such as the Wilcoxon test, was necessary to evaluate the formulated hypothesis.

The results of the Wilcoxon test for the experimental group indicated a significant decrease in stress levels after the application of the mindfulness technique, with a $Z = -2.067$ and $p = 0.039$, confirming the effectiveness of the intervention on the involved athletes. In contrast, in the control group, although the results were statistically significant ($Z = -3.610$, $p < 0.001$), the mean analysis showed a marked increase in stress, from 4.86 to 7.57, indicating a deterioration in psychological state in the absence of the intervention (Appendix 10, Figure 5.13).

These findings are in line with the specialized literature, which supports that mindfulness techniques can reduce cortisol levels and improve athletes' emotional responses, thereby contributing to more effective stress management (Creswell, 2017; Gardner & Moore, 2017).

The ANCOVA analysis highlighted that both the initial stress level (CSI) and group membership (experimental or control) significantly influenced the final salivary cortisol scores (CSF), confirming the effectiveness of the mindfulness intervention based on these variables. More precisely, the results show that the intervention was more effective depending on the initial stress level ($F = 5.630$, $p = 0.021$, $\eta^2 = 0.090$) and group membership ($F = 5.108$, $p = 0.028$, $\eta^2 = 0.082$), and the overall model significantly explains the variation in the data ($F = 30.706$, $p < 0.001$).

These results are supported by the specialized literature, which highlights that the effectiveness of mindfulness techniques depends both on the individual characteristics of the athletes and on the context of implementation (Sukys et al., 2019; Jansen et al., 2020; Sipe & Eisendrath, 2012; Beauchemin et al., 2008). The results thus highlight the importance of adapting interventions to the specific characteristics of each athlete and group to maximize the efficiency of stress reduction.

Each athlete responds uniquely to stress, which requires careful analysis of individual results to understand the impact of the intervention. Within the experimental group subjected to the intervention, only 9 out of the 30 participants recorded an increase in stress levels, highlighting that the majority of subjects either experienced a constant maintenance of stress levels or a reduction in them. These findings suggest that the implemented intervention generally generated a positive effect on the majority of participants.

In contrast, in the control group, which did not benefit from the same intervention, only 6 out of the 30 subjects showed a decrease in stress levels. This decrease is significant because it shows that without the intervention applied in the experimental group, stress was more difficult to manage for the majority of subjects in the control group. These 6 subjects who still managed to reduce their stress levels may represent exceptions, either due to individual factors or other uncontrolled reasons within the study.

The Pearson correlation analysis between the initial stress level (CSI) and the final stress level (CSF) in the experimental group showed a moderate and important positive relationship ($p < 0.05$), meaning that athletes who started with high stress levels tended to still have high stress levels even after using the mindfulness technique. This result suggests that some athletes may continue to feel stressed, possibly due to personal factors like how they view their stress, the support they get from others, or their mental resources, which is also backed by research (Chiesa & Serretti, 2010). In the control group, the relationship between the initial stress level (CSI) and the final stress level (CSF) was weak and not significant, meaning there was no clear connection between the two measurements without any intervention.

These results confirm secondary hypothesis 1.1, which states that mindfulness-based intervention can reduce stress among taekwondo practitioners. However, the initial level of stress appears to influence the effectiveness of the intervention, underscoring the need for personalized programs. To achieve more consistent and lasting results, an integrated approach is recommended, which should also include strategies for managing stress from other sources, such as social or academic pressures. Thus, the mindfulness intervention can become part of a broader psychological support program aimed at athletes.

**TESTING SECONDARY HYPOTHESIS 1.2**

In the first stage of the analysis, the distribution of data regarding anxiety as a state was checked, both at the beginning and at the end of the intervention. The results of the Shapiro-Wilk test indicated that the values for both moments (initial and final) follow a normal distribution within both groups, as the p-values were greater than the significance threshold of 0.05.

The analysis conducted compared anxiety levels as a state before and after the intervention in both groups. In the experimental group, a significant reduction in anxiety was observed, suggesting the effectiveness of the adapted mindfulness program in reducing athletes' anxiety levels. This result is supported by the specialized literature, which highlights the benefits of mindfulness in managing

anxiety symptoms and optimizing performance by improving emotional responses (Sipe & Eisendrath, 2012; Gardner & Moore, 2017).

In contrast, in the control group, no significant changes in anxiety were recorded, indicating that in the absence of an intervention, the anxiety level remained stable. This observation is consistent with research showing that athletes who do not participate in intervention programs tend to maintain stable levels of anxiety (Beauchemin et al., 2008).

To validate the results, the Wilcoxon test was also applied, which confirmed the significant reduction in anxiety in the experimental group and the lack of relevant changes in the control group. These findings support the hypothesis that mindfulness interventions can contribute to improving the psychological state of athletes, including reducing anxiety.

Following the Pearson correlation analysis, it was found that in the experimental group there is a significant relationship between initial and final anxiety, indicating that the level of anxiety at the beginning of the study is a good predictor of the level of anxiety at the end, even after the intervention.

This aspect highlights the need to adapt interventions to the initial anxiety level of athletes, especially for those who exhibit a high level (Sukys et al., 2019). Also in the experimental group, a significant negative correlation was observed between final salivary cortisol and final state anxiety, suggesting that the reduction of physiological stress is associated with a decrease in anxiety. These results are supported by previous research showing that mindfulness interventions can reduce cortisol and, consequently, anxiety (Chiesa & Serretti, 2010; Creswell, 2017).

In the control group, initial anxiety was also a strong predictor of final anxiety, confirming the stability of this indicator in the absence of an intervention. In contrast, no significant correlations were identified between stress and anxiety variables, suggesting that, without intervention, perceived stress does not significantly influence athletes' anxiety. These results support the idea that structured mindfulness programs can play an important role in modifying the relationship between stress and anxiety.

The obtained results confirm secondary hypothesis 1.2, highlighting that the adapted mindfulness program had a significant effect in reducing anxiety among taekwondo athletes in the experimental group. At the same time, it is observed that the initial level of anxiety strongly influences the final values, suggesting that the response to the intervention may be conditioned by this variable. Additionally, only in the experimental group was a link observed between final stress and anxiety, indicating that the intervention may modify this relationship. In contrast, the control group did not show significant changes, highlighting the positive impact of the intervention.

Therefore, the results support the effectiveness of the adapted mindfulness technique but also highlight the need for personalizing the intervention based on the athletes' initial anxiety levels to achieve more consistent and lasting effects.

**TESTING SECONDARY HYPOTHESIS 1.3.**

The results of the normality tests showed that the majority of the analyzed variables do not follow a normal distribution, especially the final reaction speed of the right hand and the corresponding errors, both in the experimental group and in the control group. For example, for the experimental group, the significant value of the Shapiro-Wilk test ($p = 0.002$) for the final reaction speed of the right hand indicates a significant deviation from normality, thus justifying the use of nonparametric tests.

The Wilcoxon test applied to evaluate the differences between the initial and final measurements of reaction speed highlighted significant improvements in the experimental group, both for the left hand and the right hand, indicating the effectiveness of the intervention applied during the training sessions. In contrast, the control group did not show significant differences, suggesting that in the absence of a specific intervention, the athletes' reaction speed did not change significantly.

The results of the Mann-Whitney U test highlighted significant differences between the experimental group and the control group regarding final reaction speed, both in the left hand and the right hand, suggesting that the applied intervention had a superior impact compared to conventional training.

The Spearman correlation analysis showed, in the experimental group, a significant negative relationship between reaction speed and the number of errors, indicating that as speed increases, more errors may occur, so it's important to maintain a balance between speed and accuracy. These findings support the importance of integrating psychological training and mindfulness techniques in athlete preparation to optimize performance.

The results confirm secondary hypothesis 1.3, highlighting that mindfulness applied in training had a significant impact on improving reaction speed among athletes in the experimental group, rather than the control group. At the same time, the relationship between speed and errors underscores the need to integrate psychological techniques into training to maintain a balance between speed and accuracy, which supports the importance of personalized interventions in optimizing sports performance.

**TESTING SECONDARY HYPOTHESIS 1.4.**

The Shapiro-Wilk test showed that balance data, especially those obtained with eyes closed, do not follow a normal distribution, which justifies the use of nonparametric tests for analysis. This variability is supported by the specialized literature, which shows that psychological and physiological factors can significantly influence balance performance. Consequently, researchers used the Wilcoxon test to analyze the differences between the initial and final balance measurements in each group.

The Wilcoxon test highlighted that, in most cases, there were no significant differences between the initial and final balance measurements, suggesting that the applied intervention did not have a significant effect on this component. However, research shows that specific exercises can improve dynamic balance, especially in contact sports, which means that more focused or longer interventions may be needed to see significant results.

The results from the Mann-Whitney U test showed that there were no major differences between the experimental group and the control group in most balance-related areas, indicating that the intervention didn't have a strong effect on this aspect. However, Spearman correlations indicated a significant relationship between initial and final balance values under similar conditions, suggesting that athletes with a satisfactory level of balance at the beginning of the study maintained their performance, in accordance with conclusions from the specialized literature that emphasize the influence of experience and core stability on training response (Perrin et al., 2019; Remaud et al., 2012).

The results do not support the idea that the adapted mindfulness intervention had a big effect on the balance of taekwondo practitioners, indicating that more focused or intense interventions might be needed for significant improvements in this area. Moreover, the injuries sustained by some participants in the lower limbs affected their ability to fully benefit from the training program, highlighting the importance of an individualized and integrated approach that includes post-traumatic rehabilitation in the strategies for developing athletes' balance.

**TESTING THE MAIN HYPOTHESIS 1**

The research results largely confirm Hypothesis 1, demonstrating that an adapted mindfulness program can reduce stress and anxiety in taekwondo athletes and, at the same time, can improve reaction speed. These conclusions are supported by the specialized literature, which highlights the benefits of mindfulness interventions in a sports context. Although the intervention was effective in reducing stress, it was observed that athletes with initially higher stress levels maintained

higher values even after the program was applied, indicating the need for individual adaptation of the intervention. While the hypothesis regarding the improvement of balance was not confirmed, the progress recorded in reaction speed validates the efficiency of the program and provides valuable directions for optimizing future training.

**TESTING THE MAIN HYPOTHESIS 2**

The present study analyzed the impact of a specialized training program applied to an experimental group of taekwondo athletes on their competition performance. The results confirmed the hypothesis that the applied interventions can generate a significant increase in competitive performance.

Most athletes in the experimental group showed clear improvement, as seen in their better rankings in the 2024 competitions compared to 2023, thanks to training that included mindfulness techniques and specific sports exercises known to enhance focus, reaction, and adaptability in competitions (Creswell & Lindsay, 2014). Examples such as C.I. and N.A., who went from modest results to winning 1st and 3rd places, support the effectiveness of this type of intervention. Specialized literature supports these conclusions, emphasizing the importance of integrating psychological and physical components in the training of elite athletes (Birrer & Morgan, 2010).

In contrast, the control group did not record comparable progress—some athletes maintained their positions or experienced regression, as was the case with I.E., who dropped from 1st to 3rd place. The absence of a tailored training program for the athletes' specific needs explains this lack of progress. According to the literature, without structured training focused on psychological and physical development, athletes may struggle to improve their performance due to competitive pressure (Raglin, 2012).

Thus, the implementation of a program that combines mindfulness with dynamic exercises focused on reaction speed and balance can significantly contribute to the performance improvement of taekwondo athletes, confirming hypothesis 2. The results support the idea that an integrated approach, which targets both the physical and mental aspects of training, is essential for optimizing performance and effectively managing competitive stress (Gardner & Moore, 2017).

## PARTIAL CONCLUSIONS

The study examined the benefits of a mindfulness program and particular dynamic games on taekwondo players to reduce stress and anxiety and increase reaction speed, balance, and competitive performance. The findings supported the intervention's effectiveness in reducing stress and anxiety among participants in the experimental group, thereby validating the hypotheses related to psychological dimensions. The mindfulness practices used proved effective in boosting concentration and keeping calm in competitive situations, resulting in improved performance.

The applied software produced considerable improvements in reaction time, confirming secondary hypothesis 1.3; however, the effects on balance were not statistically conclusive. The players' ailments and the need for more focused training account for the lack of growth in this area. The competitive performance of the experimental group was much better than that of the control group, which supports the main hypothesis 3 and suggests that combining physical and mental therapies can directly affect competition results.

In conclusion, the proposed program is beneficial in the training of taekwondo athletes, but it should be tailored and adapted to fulfill individual demands fully, especially those connected to injuries.

# FINAL CONCLUSIONS

The current study investigated the impact of a mindfulness program and the Jacobson progressive relaxation technique on taekwondo practitioners, with the primary goal of lowering stress and anxiety, as well as the effect of both interventions on reaction time and balance. Additionally, the existence of substantial relationships between psychological and physiological variables was investigated. The findings presented a complicated viewpoint on the efficacy of comprehensive psychological training in contact sports.

Despite the strong theoretical support offered by the specialist literature, the benefits of mindfulness on stress and anxiety reduction were not significant during the pilot phase of the study. Physiological measurements (salivary cortisol levels and pulse) and psychological assessments (using the STAI questionnaire) showed no significant changes following the intervention. However, extending the program in a longer-term applied research study yielded significant results, confirming the idea that regular mindfulness practice can benefit athletes' mental health.

The disparity between the pilot study's findings and those of the extended investigation emphasizes the relevance of intervention length and practice consistency. To be effective, mindfulness must be integrated on a daily basis and guided constantly; it is less effective when applied only sporadically or superficially. Athletes who actively and consistently participated in the mindfulness program reported significant reductions in self-perceived stress and anxiety, highlighting the relevance of athletes' active participation in such interventions.

Adapting the curriculum to the realities of the sport and the individuals' actual demands was critical. Mindfulness and emotional management skills are especially effective in individual contact sports like taekwondo, as they improve performance under pressure. However, the efficacy of these therapies may vary depending on the athlete's psychological profile, starting level of anxiety, and willingness to try mental training techniques.

The study found that athletes in the experimental group improved their reaction time after incorporating mindfulness and dynamic games into their training regimen. The studies used revealed that the athletes reacted faster to stimuli following the intervention program, which provides a significant advantage in taekwondo tournaments. This progress can be due to specific training that focuses on quick decision-making, body awareness, and adapting to unexpected changes—all skills learned through mindfulness and dynamic exercises.

However, the intervention did not significantly enhance balance. Although some individual progress was seen, it was insufficiently statistically consistent to validate the intervention's efficacy on this dimension. One probable explanation is

because balance, as a complicated motor ability, necessitates more specialist therapies, such as proprioceptive or stabilizing exercises, which were not included in this program.

The study's overall findings suggest that tailored mindfulness, when implemented systematically, can be an effective technique in the training of taekwondo athletes, contributing not just to stress and anxiety reduction but also to improved reaction speed. Furthermore, the athletes in the experimental group performed much better in competition than those in the control group, indicating that the intervention had a positive impact on actual outcomes.

In conclusion, this study emphasizes the importance of comprehensive psychological therapies in performance sports. Adapted mindfulness and dynamic training help athletes enhance their mental and physical skills, improving their ability to concentrate, handle stress, and react effectively during contests. Although not all predictions were confirmed, the findings give a good foundation for constructing complicated, individualized, and long-term taekwondo athlete training programs.

## LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

The creation and execution of the intervention plan were affected by several challenges, including the absence of a sports psychologist in the clubs, difficulties with posturography testing, athletes getting injured during competitions, frequent changes in the lineup of younger participants due to lack of interest or busy schedules, and overlapping training times for the clubs, which forced a reduction of the intervention period from 3 months to 6 weeks.

## DISSEMINATION OF RESULTS


1. **Dumbravu, Ioana-Adnana** & Abălașei Beatrice-Aurelia (2024). Considerations On The Influence Of Mindfulness And Sports Games On The Performance Of Taekwondo Athletes. *Revista Romaneasca pentru Educatie Multidimensionala, Vol. 17 No. 1. DOI: https://doi.org/10.18662/rrem/17.1 Published: 2025-03-28*
2. **Dumbravu, Ioana-Adnana** & Abălașei Beatrice-Aurelia (2024). The psychological component's contribution to the enhancement of martial arts athletes performance. *SPORT AND SOCIETY, Interdisciplinary Journal of Physical Education and Sports10th International Conference of the Universitaria Consortium in Physical Education, Sports and Physiotherapy*, https://doi.org/10.36836/22-24/11/2024

3. **Dumbravu, Ioana-Adnana** & Abălașei Beatrice-Aurelia (2023). Innovative Methods of Optimizing Sports Behavior in Taekwondo. *9th International Conference of Universitaria Consortium - FEFSTIM: Physical Education, Sports and Kinesiotherapy – Active People for a Healthy Future, 19-21 Octomber 2023,* https://fefstim.uvt.ro/wp-content/uploads/2024/02/HX19-E-book-FEFSTIM-2023-Definitivo.pdf
4. **Dumbravu, Ioana-Adnana** & Abălașei Beatrice-Aurelia (2023). Body scheme disorders and mitigation methodology. *II International Scientific and Practical Conference "YOUTH SCIENCE FOR PEACE AND DEVELOPMENT, 8-10 Novermber.* https://archer.chnu.edu.ua/xmlui/handle/123456789/8523 , **ISBN 978-966-423-811-0**

## RECOGNITION

The thesis was written at the "Alexandru Ioan Cuza" University's Doctoral School in Sports Science and Physical Education, following a plan accepted by the Doctoral School Council for Scientific Research.

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