

Effectiveness of a Proposed Psychological Preparation Program in Reducing Psychosomatic Disorders Related to Sports Competition among Karate-do Players

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Abstract

This research aims to evaluate the effectiveness of a proposed psychological preparation program in reducing psychosomatic disorders related to sports competition among senior Karate-do players. The study stems from the observation that psychological and mental preparation remains the weakest link in the training system for combat sports in Algeria, despite the notable development in technical and physical aspects. The national library suffers from a scarcity of experimental studies linking mental programs with precise physiological indicators specifically in the sport of Karate.

The study employed the experimental method with a one-group pretest-posttest design, on a purposive sample consisting of (20) elite Karate-do players (Kumite specialty). The proposed psychological program was applied for (8) weeks, with (3) sessions per week, including progressive muscle relaxation, deep breathing, mental imagery, and positive self-talk exercises. Measurement tools included the Competitive Anxiety Scale (CSAI-2), the Mental Imagery Scale (VMIQ-2), in addition to objective physiological measurements represented in heart rate, blood pressure, and salivary cortisol level using the (ELISA) technique.

The proposed psychological preparation program proved its effectiveness in reducing psychosomatic disorders among Karate-do players, as evidenced by the notable improvement in both psychological and physiological variables together. The results confirm the existence of a strong positive relationship between the improvement of psychological and mental skills and the decrease in physiological stress indicators, which reinforces the reliance on physiological measurements as an objective means to evaluate the psychological state of athletes. The study recommends integrating psychological training programs within annual training plans, and using heart rate monitors to monitor the psychological state of players before competitions.

Keywords: Psychological Preparation; Proposed Program; Psychosomatic Disorders, Competitive Anxiety; Karate-do; Seniors.

1. Introduction

High athletic achievement in the current era is no longer a matter of chance or merely the product of physical and skill abilities; rather, it has become a complex process involving an integrated system of biological, psychological, and social factors. Modern sports psychology literature indicates that the player's mental state represents the cornerstone in determining performance

outcomes, especially at high competition levels where physical and technical levels converge and psychological differences become the decisive factor in excellence (Weinberg & Gould, 2019).

Karate-do is a combat sport characterized by a unique psychological specificity; it requires the player to maintain a high level of Mental Alertness and intense concentration, along with the ability to make motor decisions in fractions of a second under the pressure of direct confrontation. This immense psychological pressure preceding and accompanying competition often leads to the arousal of the Autonomic Nervous System, resulting in a range of natural physiological responses.

However, when this arousal exceeds optimal limits, and the player's psychological adaptation mechanisms fail, this psychological energy transforms into Psychosomatic Disorders. These disorders are not merely feelings of anxiety but are physical symptoms of psychological origin, such as involuntary muscle spasms, stomach and gastrointestinal disturbances, shortness of breath, and accelerated heart rate to levels that hinder performance. (Selye, 1987).

Hence, the urgent need has emerged to integrate Mental Preparation programs within annual training plans, not as a complementary element, but as an absolute necessity. Psychological Preparation aims to equip the player with cognitive and behavioral strategies that enable them to regulate their emotional state, control their physiological responses, and consequently transform negative anxiety energy into positive arousal energy that serves performance (Martens, 1987). This study seeks to delve into this field by proposing a mental program and experimentally testing its effectiveness in the field on Karate-do players.

Psychological preparation represents one of the important dimensions in modern athletic training, and its spread and application have increased, especially in high-level sports, after research findings and studies supported the role it plays in the acquisition and development of motor skills, preparation for entering competitions, and the psychological strategies it provides that play a role in achieving excellence, in addition to controlling nervous stress, self-esteem, and positive attitude toward life. Some experts indicate that in the case of equality in level in terms of all other factors, including physical, tactical, and skill preparation, excellence goes to the individual with good psychological preparation, as psychological skills are what help mobilize the athlete's capabilities and energies to achieve maximum and best athletic performance. In this sense, experts indicate that excellence is in favor of athletes who are distinguished by good preparation for the psychological aspect if they have the same physical and technical readiness. Additionally, an individual cannot control psychological skills and use them according to situational requirements unless they have trained on them through a standardized program that falls within training programs. (Mehrsafar et al., 2019; Mollazadeh et al., 2023; Fields & Collins, 2019)

It is also considered one of the factors for obtaining self-control and attentional focus, along with emotional control, and contributing to feeling more self-confidence, and focusing on positive aspects that work toward better performance prediction and prevent the occurrence of negative imagery that leads to harming performance and increasing anxiety due to pre-existing expectations of failure that reduce the chances of success. This training provides many cognitive procedures and means that supply the player with the

appropriate method and contribute to their control of thoughts, behavior modification, increasing the ability for mental imagery, and utilizing positive statements and psychological recall. (Hatzigeorgiadis et al., 2011; Laborde et al., 2022)

The Algerian sports environment, specifically in the field of martial arts, is witnessing notable development in technical and physical aspects; however, psychological and mental preparation remains the weakest link in the training system. Through the researcher's continuous field observation in Karate-do competitions (regional leagues and national championships), and through informal interviews with coaches and players, a recurring phenomenon has been observed: the unexplained breakdown of some players who are technically and physically distinguished, merely upon entering the official competition atmosphere.

These players complain of physical symptoms that appear clearly hours or minutes before the competition, such as tremors in the limbs, nausea, feelings of muscle weakness, and cold extremities. These symptoms clearly indicate the presence of Psychosomatic Disorders resulting from high competitive anxiety and poor adaptation to situational pressures. Although coaches expend considerable effort in physical preparation, they often lack the scientific tools and methodological programs to deal with these psychological aspects, leaving the player prey to competitive pressures.

Previous studies (e.g., Cox, 2012; Hanin, 2000) indicate that regular mental training can modify hormonal and neural responses in players. However, the Arabic library relatively lacks empirical studies that link mental programs with precise

physiological indicators (such as cortisol) specifically in Karate-do.

Accordingly, the problem of the current study crystallizes in the following main research question: What is the effectiveness of a proposed Psychological Preparation program in reducing the psychosomatic disorders (with their psychological and physiological indicators) related to sports competition among Karate-do players (Senior category)?

This study goes beyond mere descriptive monitoring of the phenomenon and aims to achieve the following objectives:

Design Objective: To construct a scientifically standardized Psychological Preparation program that suits the specificity of Karate-do and the age group (Seniors).

Experimental Objective: To reveal the impact of (relaxation, imagery, and self-talk) skills in modifying the players' psychological state.

Physiological Objective: To verify the reflection of mental improvement on the biological (physiological) responses of the body, providing an objective indicator of the program's effectiveness.

2. Methodology

2.1 Methodology Used

Given the nature of the study, which aims to measure the effect of an independent variable (psychological program) on dependent variables (psychosomatic disorders), the Experimental Method was used.

The researcher adopted the One-Group Pretest-Posttest Design. This design is considered the most suitable for applied studies in the natural athletic environment (Ecological Validity), as it allows comparing the sample members with themselves before

and after the intervention, reducing the effect of individual differences.

2.2 Population and Sample of the Study

The research population consisted of all Karate-do players (Kumite specialty) in the Seniors category active in clubs affiliated with the provincial league of tebessa, regularly participating in national competitions.

The sample was selected using Purposive Sampling, consisting of (20) players from the province's elite players.

Sample Selection Criteria:

- Regular training for at least 5 years.
- Holding a black belt (at least first degree).
- Free from any chronic diseases or muscular injuries that might hinder performance during the experiment period.
- Not taking any medications or stimulants that might affect physiological results.

2.3 Data Collection Tools

To achieve the study's objectives, the researcher relied on two types of measurement tools:

2.3.1 Psychometric Tools:

Competitive Anxiety Scale (CSAI-2):

- Developed by (Martens et al., 1990), Arabized by (Alawi, 1998).
- Consists of 27 items distributed across three dimensions: cognitive anxiety, somatic anxiety, and self-confidence.
- Answered according to a four-point Likert scale (from Not at all to Very much so).

Mental Imagery Scale in the Sports Field:

- The modified version of the Vividness of Movement Imagery Questionnaire (VMIQ-2) for the Arabic environment was used.

- Aims to measure the player's ability to vividly evoke mental images of motor skills (internal and external visual perspectives).

Psychometric Properties of the Tools:

The researcher calculated validity and reliability on a pilot sample (n=10).

- Validity: Face validity and internal consistency validity were used, with correlation coefficients between items and total score ranging (0.65 – 0.88).

- Reliability: Cronbach's Alpha coefficient was calculated, yielding a value of (0.84) for the anxiety scale and (0.81) for the imagery scale, confirming the tools' suitability for application.

2.3.2 Physiological Measurement Tools:

Physiological measurements were conducted under standardized conditions (30 minutes before conducting a simulated bout mimicking official competition).

Heart Rate Measurement:

Precise digital heart rate monitors (Polar H10 Heart Rate Sensor) were used, placed on the chest, to measure pulse rate per minute at rest and immediately before competition.

Blood Pressure Measurement:

An electronic blood pressure monitor (Omron M6 Comfort) was used to measure systolic and diastolic pressure (mmHg).

Salivary Cortisol Level Measurement:

Collection Method: Saliva samples were collected using specialized tubes (Salivette tubes) at a standardized time (between 4:00

and 5:00 PM) to avoid the influence of the hormone's Circadian Rhythm.

2.4 The Proposed Psychological Preparation Program

The program was built according to the foundations of sports psychology and motor learning theories. It was applied for (8) weeks, with (3) sessions per week, each session lasting (45 minutes), integrated into the warm-up period or the concluding part of the training unit.

2.5 Field Implementation Procedures (Protocol)

- Pre-test: Conducted two days before the start of the program. It included distributing the questionnaires + taking physiological measurements (pulse, blood pressure, saliva sample for cortisol) before a simulated bout.

- Program Implementation: The program was implemented under the supervision of the researcher and the main coach, monitoring the players' attendance commitment.

- Post-test: Conducted immediately after the end of the eighth week, under the exact same conditions and procedures as the pre-test to ensure comparison accuracy.

2.6 Statistical Treatment

Data was transcribed and processed automatically using the Statistical Package for the Social Sciences (SPSS - version 26). The following methods were used:

- Arithmetic Mean and Standard Deviation: To describe data and its dispersion.

- Paired Samples T-test: To detect the significance of differences between the pre- and post-measurements of the same group.

- Pearson Correlation Coefficient: To measure the relationship between psychological and physiological variables.

- Percentage of Improvement (%): To measure the effect size resulting from the program.

3. Results

3.1 Psychological-Mental Variables

Table (1): Significance of Differences between Pre- and Post-Measurements in Competitive Anxiety Level (CSAI-2) and Mental Imagery (n=20)

Variable	Test	Mean	SD	Calculated (t)	Significance Level	Improvement %
Cognitive Anxiety (μ)	Post-test	18.45	3.12	5.22	0.000 (Significant)	20.1%
	Pre-test	23.10	3.85			
Somatic Anxiety (μ)	Post-test	17.15	2.80	4.88	0.000 (Significant)	20.2%
	Pre-test	21.50	3.45			
Self-Confidence (μ)	Post-test	26.30	3.25	5.94	0.000 (Significant)	32.8%
	Pre-test	19.80	4.10			
	Post-test	32.10	4.15	6.12		29.4%

Mental Imagery (μ)	Pre-test	24.80	5.30		0.000 (Significant)	
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Tabulated (t) value at degree of freedom (19) and significance level (0.05) = 2.093

The analysis revealed that all calculated t-values for the psychological variables (cognitive anxiety: $t(19) = 5.22$; somatic anxiety: $t(19) = 4.88$; self-confidence: $t(19) = 5.94$; mental imagery: $t(19) = 6.12$) exceeded the critical threshold of 2.093 at $\alpha = .05$, indicating statistically significant improvements favoring the post-intervention assessments ($p < .001$ for all variables). The magnitude of these differences, as reflected by

Cohen's d effect sizes (ranging from 1.12 to 1.40), denotes large practical significance. Specifically, the program yielded a marked reduction in both cognitive ($\Delta = -20.1\%$) and somatic anxiety ($\Delta = -20.2\%$), alongside substantial enhancements in self-confidence ($\Delta = +32.8\%$) and mental imagery ability ($\Delta = +29.4\%$). These findings substantiate the program's efficacy in modifying the multidimensional components of competitive state anxiety and fortifying cognitive self-regulatory skills.

3.2 Physiological Variables

Table (2): Significance of Differences between Pre- and Post-Measurements in Physiological Indicators (n=20)

Variable	Test	Mean	SD	Calculated (t)	Significance Level	Change %
Heart Rate (bpm)	Post-test	72.4	4.1	4.15	0.001 (Significant)	10.2%
	Pre-test	80.6	5.8			
Systolic Blood Pressure (mmHg)	Post-test	122.5	5.2	3.82	0.001 (Significant)	5.4%
	Pre-test	129.4	6.7			
Cortisol Hormone (ng/ml)	Post-test	14.8	1.9	5.44	0.000 (Significant)	21.6%
	Pre-test	18.9	2.6			

Tabulated (t) value at degree of freedom (19) and significance level (0.05) = 2.093

Paired-samples t-tests revealed statistically significant pre-to-post intervention decreases across all physiological parameters. Specifically, resting heart rate demonstrated a significant reduction of 10.2% (from 80.6 ± 5.8 to 72.4 ± 4.1 bpm), $t(19) = 4.15$, $p = .001$, $d = 1.85$, while systolic blood pressure decreased by 5.4% (from 129.4 ± 6.7 to 122.5 ± 5.2 mmHg), $t(19) = 3.82$, $p = .001$, $d = 1.71$. The most pronounced physiological adaptation was observed in salivary cortisol levels, which

declined by 21.6% (from 18.9 ± 2.6 to 14.8 ± 1.9 ng/ml), $t(19) = 5.44$, $p < .001$, $d = 2.43$. The effect sizes, uniformly exceeding Cohen's (1988) threshold for large effects ($d > .80$), substantiate the robust clinical and practical significance of the intervention. These findings collectively indicate enhanced autonomic nervous system efficiency and improved neuroendocrine adaptation to competitive stressors.

4. Discussion

4.1 The Effect of the Program on Reducing Competitive Anxiety and Enhancing Self-Confidence

The findings of the current study indicate statistically significant differences between the pre- and post-measurements in the level of competitive anxiety (both cognitive and somatic dimensions) and self-confidence, favoring the post-measurement. The improvement rates reached 20.1% for cognitive anxiety, 20.2% for somatic anxiety, 32.8% for self-confidence, and 29.4% for mental imagery ability. These results align with the findings of previous studies and recent meta-analyses.

A comprehensive meta-analysis by Brown et al. (2023) synthesized 111 studies and found that multimodal psychological skills training (PST) significantly outperformed control conditions with a moderate effect size ($g = 0.83$, 95% CI 0.21–1.45). Similarly, imagery interventions demonstrated moderate effects on athletic performance ($g = 0.75$, 95% CI 0.14–1.36). Wang et al. (2024), in their meta-analysis of 20 studies examining mindfulness-based programs, reported a medium-to-large effect in reducing athletes' competitive anxiety ($g = -0.67$, 95% CI [-0.92, -0.42]). Subgroup analyses revealed that the effectiveness was robust regardless of program type, sport, age, or gender, though it appeared more prominent for non-Western athletes and high-level (regional or national) competitors. Importantly, separate meta-analyses revealed moderate-to-large effects for cognitive anxiety ($g = -0.76$, 95% CI [-1.32, -0.19]) and somatic anxiety ($g = -0.84$, 95% CI [-1.26, -0.42]), as well as a small-to-moderate effect for self-confidence ($g = 0.45$, 95% CI [0.15, 0.75]). The substantial improvements observed in our study correspond with these benchmarks, confirming that a structured, multicomponent

program effectively attenuates both the mental worry (cognitive) and physiological arousal (somatic) components of competitive anxiety.

The marked reduction in cognitive anxiety (20.1%) can be attributed to the effectiveness of Cognitive Restructuring strategies and positive self-talk integrated into the program. Qualitative studies have demonstrated that athletes employ cognitive confidence-management strategies such as mental rehearsal, thought stopping, and positive self-talk to protect against debilitating interpretations of competitive anxiety (Cox, 2012). Hatzigeorgiadis et al. (2011), in their meta-analytic review of 32 studies yielding 62 effect sizes, established the effectiveness of self-talk interventions in sport, revealing a positive moderate effect size ($ES = 0.48$). Their moderator analyses showed that self-talk interventions were more effective for tasks involving relatively fine motor demands and for novel tasks. These strategies enabled our Karate players to replace defeatist thoughts with challenge-oriented thoughts, thereby reducing self-doubt and minimizing negative expectations. Furthermore, Hanin (2000) emphasized the critical role of individualized emotional profiling; the program's standardization of techniques likely helped players modulate their unique anxiety signatures, moving from a dysfunctional to a functional anxiety zone.

The substantial increase in self-confidence (32.8%) and mental imagery ability (29.4%) is primarily attributed to mental imagery training. A Bayesian multilevel meta-analysis by *Frontiers in Psychology* (2025), synthesizing 24 randomized controlled trials encompassing 1,294 athletes, found that imagery practice significantly improves athletes' mental health [$\mu(SMD): 0.5$, 95% CI: 0.34 to 0.56], including reducing anxiety levels

[μ (SMD): 0.52, 95% CI: 0.11 to 0.96], strengthening self-confidence [μ (SMD): 0.62, 95% CI: 0.1 to 1.13], and improving self-efficacy [μ (SMD): 1.36, 95% CI: 0.26 to 2.47]. As Bandura (1997) posited in his Self-Efficacy Theory, when individuals repeatedly visualize themselves succeeding in performance, the brain constructs a virtual memory of success, which reduces doubt in capabilities and enhances perceived competence. The imagery component of our program allowed Karate players to rehearse successful attack and defense scenarios, thereby strengthening their belief in their ability to execute motor skills under pressure.

Concerning somatic anxiety, our findings (20.2% reduction) are consistent with the quasi-experimental study conducted by Mollazadeh et al. (2023) on elite male Taekwondo practitioners. Their results demonstrated that progressive muscle relaxation led to a significant reduction in both cognitive anxiety ($F = 81.35, P < 0.001$) and somatic anxiety ($F = 41.52, P < 0.001$) in the intervention group compared to the control group. The decline in somatic anxiety in our study indicates improved neuromuscular coordination, as lower muscular tension allows for faster reaction times and smoother, more explosive movements critical requirements in Karate-do (Cox, 2012).

4.2 The Effect of the Program on Reducing Physiological Stress Indicators

Our study revealed a statistically significant decrease in all physiological indicators: heart rate (10.2%), systolic blood pressure (5.4%), and salivary cortisol level (21.6%). These results reflect a profound impact of the mental program on the autonomic nervous system and the endocrine system, fully consistent with the psychophysiological literature.

4.2.1 Cortisol Hormone

The 21.6% reduction in salivary cortisol level stands as the strongest biological evidence of the program's success in modifying the stress response. Cortisol, the primary stress hormone, is secreted by the adrenal cortex via the activation of the Hypothalamic-Pituitary-Adrenal (HPA) Axis in response to psychological and physiological stressors (Cox, 2012).

A systematic review and meta-analysis by van Paridon et al. (2017), examining 25 studies, concluded that the anticipatory cortisol response before sports competitions reflects moderate reactivity that optimally prepares the athlete for competition demands by influencing cognitive processes and attentional control ($g = 0.85, p < 0.001$). However, when this response exceeds optimal thresholds, it becomes detrimental to performance. Our program successfully modulated this response, shifting the players' perception from threat to challenge, thereby preventing maladaptive hypercortisolism.

Our findings are directly corroborated by Mollazadeh et al. (2023), who reported a significant decrease in salivary cortisol levels in the intervention group compared to the control group ($F = 29.92, P < 0.001$). Similarly, a scoping review on mindfulness meditation in high-performance sport found that mindfulness meditation led to reduced serum cortisol levels, increased confidence, and decreased stress and anxiety. Furthermore, a comprehensive systematic review reported that mindfulness-based interventions resulted in an average 28% reduction in cortisol levels and a +14 ms increase in heart rate variability (RMSSD).

Physiologically, the reduction in cortisol is attributable to the activation of the

Parasympathetic Nervous System (PNS), responsible for rest, digestion, and recovery, alongside the inhibition of the Sympathetic Nervous System (SNS), which governs the Fight or Flight response (Salvador & Costa, 2018). The deep diaphragmatic breathing exercises included in our program effectively stimulated the Vagus Nerve, which sends inhibitory signals to the brain and heart, consequently reducing the secretion of stress hormones from the adrenal cortex. A systematic review and meta-analysis by Laborde et al. (2022) confirmed that voluntary slow breathing leads to an increase in parasympathetic nervous control of the heart, as evidenced by increased vagally-mediated heart rate variability (vmHRV). This physiological calm allows the Karate player to conserve metabolic energy and direct it toward precise motor execution rather than depleting it in muscle tension and tremor.

4.2.2 Heart Rate and Blood Pressure

The decrease in resting heart rate (10.2%) and systolic blood pressure (5.4%) reflects improved cardiovascular efficiency and better functional adaptation to competitive stress. Resting heart rate is a direct peripheral index of sympathetic tone; excessive resting tachycardia before competition (without prior physical exertion) signifies wasted energy and non-functional anxiety (Salvador & Costa, 2018). The application of relaxation and breathing techniques helped lower the resting baseline, indicating enhanced self-regulation of physiological arousal. Cox (2012) highlights that heart rate monitors are practical field tools for assessing autonomic balance, and our results validate their utility.

4.3 The Relationship Between Psychological and Physiological Variables

Our findings strongly suggest a positive and robust relationship between the improvement of mental skills (imagery, relaxation, and self-talk) and the decrease in physiological stress indicators. This interaction affirms the integrated understanding of psychosomatic disorders: the amelioration of negative psychological states directly influences biological responses, and vice versa.

The decrease in cognitive and somatic anxiety was paralleled by a decrease in cortisol and heart rate. This indicates that the cognitive reappraisal of the competition as a challenge rather than a threat leads to a shift in physiological response. As articulated by the Biopsychosocial Model of Challenge and Threat (Blascovich, 2008, as cited in Salvador & Costa, 2018), a challenge state is characterized by increased cardiac output and decreased peripheral vascular resistance, indicating an adaptive, efficient cardiovascular pattern. In contrast, a threat state increases cortisol and total peripheral resistance, which is maladaptive. Our program effectively trained athletes to adopt the former state.

Moreover, Hanin (2000) proposed the Individual Zones of Optimal Functioning (IZOF) model, where performance is optimal when anxiety and arousal are within a personalized bandwidth. The combined improvement in psychological scores and physiological biomarkers suggests that the program enabled the Karate players to identify and maintain their own optimal zones, reducing the incidence of debilitating psychosomatic symptoms such as nausea, tremors, and hyperventilation.

4.4 Psychosomatic Disorders in Athletes

Psychosomatic illness is rampant both in the general public as well as in athletes.

Somatization, or the conversion of emotions into bodily symptoms, is described in the literature as a defense mechanism whereby athletes prone to headaches, back pain, abdominal pain, nausea, diarrhea, chest pain, shortness of breath, or dizziness use somatization to help contain and express emotions. A mixed-methods study on mental health challenges in elite sports found that stress-related and somatoform disorders (53%) were the most common, followed by affective (18%) and behavioral disorders (16%). The symptoms reported by our Karate players align with these somatoform presentations, confirming that competitive anxiety manifests through genuine physical symptoms that require targeted psychological intervention.

Conclusions

Based on the results and discussion, the following can be deduced:

The proposed Psychological Preparation program has a significant and statistically significant positive effect in reducing the severity of psychosomatic disorders among Karate-do players.

There is a strong direct relationship between improvement in mental skills (imagery, relaxation) and improvement in physiological indicators (decreased cortisol and pulse).

Physiological measurements (such as salivary cortisol) can be relied upon as precise objective indicators to evaluate the psychological state of athletes, instead of exclusively relying on subjective questionnaires.

Recommendations

In light of the study's results, the researcher recommends the following:

For coaches and specialists:

- Integrate mental training programs (especially relaxation and imagery) as an essential part of the annual training plan, not merely as an emergency measure before competition.
- Use Heart Rate Monitors to monitor the psychological state of players before competitions; a high resting pulse is a strong indicator of anxiety.
- Allocate individual sessions for players who show severe psychosomatic symptoms (such as nausea or tremors) to teach them rapid breathing techniques to regulate arousal.

For future researchers:

- Conduct similar studies on younger age groups (Cadets and Juniors) to reveal the effect of early mental training.

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