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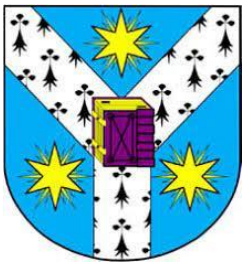
FACULTY OF PHYSICAL EDUCATION AND SPORT
DOCTORAL SCHOOL IN SPORT SCIENCE AND PHYSICAL EDUCATION



THE CONTRIBUTIONS OF TRADITIONAL KARATE PRACTICE TO THE PREVENTION AND REHABILITATION OF SPINAL POSTURAL DISORDERS

THESIS SUMMARY

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Keywords: scoliotic posture, shoulder asymmetry, pelvic oblicity, trunk rotation angle**.**

PART 1. THEORETICAL FOUNDATION OF THE RESEARCH THEME

Theoretical analysis of human body posture reveals the complex interaction between the musculoskeletal and neuromuscular systems. A correct posture is influenced by multiple factors, including individual anatomical characteristics, physical activity level, and daily life habits. An in-depth examination of postural disorders has highlighted clear correlations between muscular imbalances and spinal deviations.

Muscle hypotonia or overuse may facilitate the development of faulty postural patterns. Biomechanical analysis shows that weakened and shortened pectoral muscles contribute to shoulder protraction and may increase thoracic kyphosis (Kaur et al., 2023); lumbar hyperlordosis is often associated with anterior pelvic tilt (Jeon & Jang, 2017), while reduced lumbar curvature can result from hamstring hyperactivity and weakness of the hip flexors (Carpenter et al., 2017). Moreover, muscular imbalances may play a role in the development of scoliotic postures (Kim et al., 2022; Oshikawa et al., 2020).

The rising incidence of postural disorders among children and adolescents is largely attributable to modern sedentary lifestyles, characterized by prolonged screen time and insufficient physical activity. Research confirms that such behaviors negatively impact spinal development and contribute to the onset of deviations (Cheragh et al., 2023; Hutson et al., 2021).

Karate, as both a sport and a martial art, offers multiple benefits for correcting and maintaining proper posture. Studies indicate that regular karate training supports postural stabilization, enhances neuromuscular control, and helps reduce muscular imbalances (Piepiora, 2025).

The techniques practiced in karate stimulate deep trunk musculature, which contributes to maintaining spinal alignment. Furthermore, specific exercises in this discipline promote flexibility, reducing segmental stiffness and facilitating spinal mobility.

Nonetheless, research also shows that training type (kata vs. kumite) and karate style can influence athletes' posture differently. Kata training—marked by controlled

movements and static positions—can lead to posterior pelvic tilt, decreased lumbar lordosis, and flattening of the spine's physiological curves, especially among elite athletes. Conversely, kumite—characterized by dynamic movements and rapid direction changes—tends to exaggerate lumbar lordosis and increase the risk of developing functional asymmetries (Gaweł & Zwierzchowska, 2024; Hosseinzadeh, 2019; Drzał-Grabiec & Truszczyńska, 2014).

These imbalances are primarily caused by the predominant use of the dominant side during guard stance and technique execution.

PART 2. APPLIED RESEARCH

CHAPTER 4. SPINAL ASSESSMENT IN CHILDREN AND ADOLESCENTS PRACTICING KARATE – PRELIMINARY STUDY

Research premises

In the current context, various karate training styles exhibit differing impacts on body alignment, a factor of particular importance during growth periods. This highlights the need for an objective assessment of posture in young practitioners, in order to better understand how the specific demands of the discipline influence musculoskeletal development. Accordingly, the present study aims to conduct a detailed analysis of the spinal alignment in children and adolescents practicing karate, with the goal of informing corrective interventions and developing appropriate preventive strategies.

Purpose, objectives, tasks, variables and hypotheses

The aim of this study is to identify postural disorders in the sagittal and frontal planes of the spine among karate practitioners aged 11 to 18 from the northeastern region of Romania. In this regard, we propose to achieve the following objectives and tasks:

1) Identifying and selecting research subjects from among traditional karate practitioners aged 11 to 18 in the northeastern region of Romania;

2) Selecting and applying assessment tools designed to measure postural parameters in order to detect spinal postural disorders in both the sagittal and frontal planes;
3) Collecting, analyzing, and interpreting the results obtained.

Research variables

Table 4.1 – Research variables

<table>
<tr><td colspan="5">INDEPENDENT VARIABLES</td></tr>
<tr><td colspan="5">Genul (female/male)</td></tr>
<tr><td colspan="5">Age of the subjects (11-14/15-18)</td></tr>
<tr><td colspan="5">Level of experience (intermediate/advanced)</td></tr>
<tr><td colspan="5">DEPENDENT VARIABLES</td></tr>
<tr><td colspan="2">SAGITTAL PLANE</td><td colspan="3">FRONTAL PLANE</td></tr>
<tr><td>Thoracic kyphosis angle</td><td>Lumbar lordosis angle</td><td>Trunk rotation angle</td><td>Scapulo-humeral girdle asymmetry</td><td>Pelvic obliquity</td></tr>
</table>

Research hypothesis

Main Hypothesis 1

Karate practitioners aged 11–18 from northeastern Romania present postural disorders of the spine.

- **Sub-hypothesis 1.1** Karate practitioners exhibit postural disorders specific to the sagittal plane.
- **Sub-hypothesis 1.2** Karate practitioners exhibit postural disorders specific to the frontal plane.

Main Hypothesis 2

There are gender-based differences in postural parameter values among karate practitioners aged 11–18 from northeastern Romania.

- **Sub-hypothesis 2.1** There are gender-based differences in sagittal plane postural parameter values.
- **Sub-hypothesis 2.2** There are gender-based differences in frontal plane postural parameter values.

Main Hypothesis 3

There are differences in postural parameter values between the two age groups (11–14 years and 15–18 years).

- **Sub-hypothesis 3.1** There are differences between the two age groups in sagittal plane postural parameter values.
- **Sub-hypothesis 3.2** There are differences between the two age groups in frontal plane postural parameter values.

Main Hypothesis 4

There are differences in postural parameter values depending on the level of experience (intermediate or advanced) of the karate practitioners.

- **Sub-hypothesis 4.1** There are differences between the two experience levels in sagittal plane postural parameter values.
- **Sub-hypothesis 4.2** There are differences between the two experience levels in frontal plane postural parameter values.

Partial conclusions

1. The majority of practitioners displayed normal values for physiological spinal curvatures, with 91.6% within the physiological range for thoracic kyphosis and 58.9% for lumbar lordosis. However, 40% of subjects exhibited lumbar straightening, which may suggest a biomechanical adaptation specific to karate training.
2. In terms of frontal plane deviations, a high prevalence of postural asymmetries was observed, with 60% of practitioners presenting scapulo-humeral

asymmetries and 75.8% displaying pelvic obliquity. These findings support the hypothesis that martial arts practice may significantly influence postural alignment.

3. The most frequent scoliotic attitudes identified were C-shaped scoliosis (32.6%) and lumbar scoliosis (30.5%), followed by thoracic scoliosis (14.7%) and S-shaped scoliosis (13.7%). Only 8.4% of subjects exhibited no form of deviation in the frontal plane.
4. Regarding gender differences, no significant variation was found in thoracic kyphosis values. However, girls exhibited more pronounced lumbar lordosis, consistent with existing literature, while boys tended toward greater pelvic obliquity, although the difference lacked statistical significance.
5. No statistically significant differences were found between age groups in terms of the postural parameters analyzed in either the sagittal or frontal planes. Likewise, no meaningful differences were observed between practitioners with intermediate versus advanced experience levels, regardless of the plane of analysis.
6. The results indicate that while karate practice does not cause severe postural changes, clear trends toward asymmetry—particularly in the frontal plane—were evident and may warrant corrective intervention. These imbalances are most likely due to dominant-side overuse, the technical specificity of karate exercises, and the absence of compensatory elements in training
7. In this context, the necessity arises for designing and implementing an intervention program that leverages the benefits of martial arts while incorporating targeted corrective exercises. Accordingly, the next phase of research will focus on testing the effectiveness of a program based on karate-specific techniques, adapted to both preventive and therapeutic objectives, with the aim of correcting the identified postural imbalances and supporting the harmonious development of young practitioners.

CHAPTER 5. EFFECTIVENESS OF KARATE-SPECIFIC TRAINING ELEMENTS IN CORRECTING POSTURAL DISORDERS

Research premises

Following the results of the preliminary research, it was found that in the sagittal plane, the majority of subjects presented values within physiological limits, while in the frontal plane, significant postural deviations were identified, including scoliotic attitudes in 91.6% of participants. These findings justified the implementation of a targeted intervention focused on correcting frontal plane deviations. Supporting this approach, the specialized literature highlights the association between muscular imbalances and poor postural control, particularly when there is a significant disparity in muscle mass between limbs (Ryew et al., 2019; Vannatta et al., 2023). A muscle asymmetry level exceeding 10% is considered clinically relevant, being associated with decreased movement efficiency and an increased risk of injury; this asymmetry is calculated by comparing the difference in muscle mass relative to the larger limb. In this context, muscular imbalances are not only indicators of uneven development but also potential aggravating factors of postural disorders. Furthermore, body mass influences the distribution of the center of gravity, which may contribute to the development of postural deviations. For this reason, the present study also included an analysis of muscle mass distribution in the limbs using the Tanita MC-580 analyzer, as literature suggests that the relationship between weight, height, and muscle mass distribution has important functional implications for postural alignment.

Purpose, objectives, tasks, variables and hypotheses

The purpose of this study was to evaluate and analyze the effects of practicing traditional karate-specific techniques on selected postural parameters, with the aim of correcting scoliotic postures among karate practitioners aged 11 to 18 from northeastern Romania. In this regard, the following objectives and tasks were established to support the fulfillment of the research aim:

1) Identifying and selecting research subjects from among traditional karate practitioners in northeastern Romania, aged 11 to 18, by December 2023—an objective that generated the following tasks;
2) Selecting and applying analysis tools to measure the postural parameters used in identifying scoliotic attitudes, with an initial assessment conducted by January 2024 and a final assessment after March 2024—an objective that generated the following tasks;
3) Implementing an intervention program composed of techniques specific to traditional karate, aimed at improving the analyzed postural parameters, by March 31, 2024. To achieve this objective, the following tasks were formulated;
4) Collecting, analyzing, and interpreting the results obtained following the final assessment in April 2024.

Research variables

Table 5.1. – Research variables

<table>
<tr><td colspan="6">INDEPENDENT VARIABLES</td></tr>
<tr><td colspan="6">Intervention program</td></tr>
<tr><td colspan="6">Gender</td></tr>
<tr><td colspan="6">Age</td></tr>
<tr><td colspan="6">Level of expercience</td></tr>
<tr><td colspan="6">DEPENDENT VARIABLES</td></tr>
<tr><td>Trunk rotation angles (TKA)</td><td>Scapulo-humeral girdle asymmetry (SHGA)</td><td>Pelvic obliquity (PO)</td><td>Weight difference between the upper limbs</td><td>Weight difference between the lower limbs</td><td>Body Mass Index (BMI)</td></tr>
</table>

Research hypothesis

Main Hypothesis 1.

We assume that the intervention program can contribute to the improvement of postural parameters in karate practitioners with scoliotic attitudes. This main hypothesis is associated with the following 3 secondary hypotheses:

Secondary Hypothesis 1.1. *We assume that the intervention program positively influences postural parameters in both genders.*

Secondary Hypothesis 1.2. *We assume that the intervention program positively influences postural parameters in both age groups.*

Secondary Hypothesis 1.3. *We assume that the intervention program positively influences postural parameters in both intermediate and advanced practitioners.*

Main Hypothesis 2.

The intervention program may reduce the muscle mass difference between the upper limbs, as well as between the lower limbs, in karate practitioners. This main hypothesis is associated with the following 3 secondary hypotheses:

Secondary Hypothesis 2.1. *The effect of the intervention program on muscle mass balance does not show significant variation according to the gender of the subjects.*

Secondary Hypothesis 2.2. *The effect of the intervention program on muscle mass balance does not show significant variation according to the age of the subjects.*

Secondary Hypothesis 2.3. *The effect of the intervention program on muscle mass balance does not show significant variation according to the practitioners' training level.*

Main Hypothesis 3.

We assume there is an association between limb muscle mass and the postural parameters of karate practitioners.

Secondary Hypothesis 3.1. *We assume that the difference in muscle mass between the upper limbs is associated with the postural parameters of karate practitioners.*

Secondary Hypothesis 3.2. *We assume that the difference in muscle mass between the lower limbs is associated with the postural parameters of karate practitioners.*

Main Hypothesis 4.

We assume there is an association between Body Mass Index (BMI) and the postural parameters of karate practitioners.

Intervention program using karate-specific techniques

The intervention program incorporating karate-specific techniques was designed as a good practice guide for maintaining correct posture and addressing postural imbalances in the frontal plane. The primary goal of the exercises was to enhance postural stability, correct potential muscular asymmetries, and optimize body alignment through bilateral stimulation of the muscles responsible for supporting the spine and pelvic girdle. The program was conducted over a period of 12 weeks (3 months), during regular training sessions at sports clubs, and followed a consistent structure throughout the intervention period.

Each session lasted approximately 30 minutes and was introduced in the final third of a standard 90-minute training session. In other words, participants followed the coach's regular training routine for the first 60 minutes, and during the last 30 minutes—at the end of the fundamental phase—they participated in the proposed intervention program. The program was divided into three sequences and included a total of 12 exercises based on martial arts techniques, particularly those from traditional karate (Table 5.4 and Appendix 6).

The technical procedures selected for the first sequence were performed under anaerobic lactacid conditions, with an emphasis on explosive and repetitive movements.

The second sequence involved isometric exercises, each based on holding muscular contractions at the final position of attack and blocking techniques practiced in the first sequence.

The third sequence included stretching exercises designed to promote relaxation and maintain flexibility in the muscles engaged during the first two stages.

Partial conclusions

1) The intervention program led to significant improvements in frontal plane postural parameters, highlighting its effectiveness in reducing scoliotic attitudes. Notable decreases were observed in trunk rotation angle, scapulo-humeral girdle asymmetry, and pelvic obliquity.
2) Gender did not significantly influence the response to the intervention, suggesting that the techniques used had similar effects on posture in both girls and boys. Age was also not a statistically significant factor, although the 11–14 age group showed a slightly more favorable trend in reducing trunk rotation angle (TRA), without reaching statistical significance.
3) Regarding the level of athletic experience, both intermediate and advanced practitioners showed comparable improvements in postural parameters, confirming that the program was accessible and adaptable across varying experience levels.
4) In terms of body composition, the intervention program did not significantly reduce muscle mass differences between paired limbs, either in the upper or lower body. However, the identified muscular asymmetries remained within physiological limits (<10%), and were thus considered functional rather than pathological. No relevant correlations were found between upper limb muscle mass asymmetries and postural parameters. In contrast, statistically significant correlations were observed in the lower limbs, indicating that muscular imbalances may affect pelvic alignment.
5) Regarding the influence of Body Mass Index (BMI) on the effectiveness of the program, statistically significant differences were noted particularly at the pelvic level. Normoweight participants achieved the most favorable post-intervention outcomes, suggesting that balanced body weight may facilitate a more efficient response to corrective exercises. While overweight practitioners also showed improvements, the changes were less pronounced. These findings emphasize the importance of considering BMI in the evaluation and customization of postural intervention programs.

6) The results of the intervention program suggest not only objective postural improvements among participants, but also a potential increase in body awareness that contributed to these changes. Research shows that developing postural awareness is a key factor in the long-term modification of motor habits and posture, through the active engagement of attention to the body during daily activities (Cramer et al., 2018). Moreover, posture-centered interventions—such as those based on somatic education or movement re-education techniques—have demonstrated significant effectiveness in cultivating postural perception and reducing automatic behaviors that favor faulty posture (Kodish, 2004). Therefore, it is plausible that the postural improvements observed in this program can be attributed not only to the exercises themselves, but also to the activation of a process of bodily introspection and the development of conscious attention to postural alignment.

Research contributions

This study offers a valuable practical contribution to the fields of physical education, kinesiology, and sports training by validating an effective intervention protocol structured around martial arts–based exercises, specifically karate techniques, which can be integrated into regular club training routines.

The novelty of this research lies in the design and implementation of an original intervention program inspired by traditional karate techniques, specifically adapted for corrective and preventive purposes. Structured into three functional segments—dynamic toning exercises, isometric techniques in karate positions, and stretching exercises—the program was incorporated into the final third of each standard training session. Its innovative character resides both in the careful selection of exercises targeting muscles involved in postural control and in the tailored adaptation to the specific needs of young practitioners, without interfering with the athletic goals of their training regimen.

The proposed program can serve as a replicable model of intervention for other sports disciplines or as a complementary therapy in the postural rehabilitation of physically active children and adolescents.

Moreover, the use of modern, scientifically validated postural assessment tools (Posture Screen Mobile and the Tanita MC-580 body composition analyzer) enabled the collection of objective, reproducible, and relevant data, which strengthened the reliability of the results.

Optimized version of the Intervention Program

Based on the data obtained from the assessment and analysis of the evaluated parameters in this research, we propose a series of modifications to the program in order to enhance its effectiveness.

Since slight but significant differences in lower limb muscular asymmetry were observed among girls and children aged 11–14, the guide should be supplemented with unilateral exercises aimed at correcting muscular imbalances, as well as with recommendations for additional sets for the weaker limb—particularly for these groups. Additionally, we propose modifying the execution of certain techniques through the use of sandbags to increase strength and endurance in the lower limbs and to prevent the exacerbation of pelvic asymmetries. Specifically for the female group, where a significant increase in lower limb asymmetry was noted, it is necessary to introduce targeted interventions that address asymmetric postural habits and activate pelvic stabilizer muscles.

Considering the physiological and neuromuscular development differences between the 11–14 and 15–18 age categories, the exercise dosage in the intervention program was adjusted accordingly. Females in the 15–18 age group are in a more advanced stage of somatic maturation and demonstrate greater neuromuscular recruitment capacity, better joint stability, and generally higher levels of strength and motor control. In contrast, the 11–14 age group is undergoing active growth, with more pronounced postural instability and an increased risk of overload in the case of inappropriate training loads. For these reasons, we considered it necessary to adjust the

exercise volume by increasing the number of sets for the 15–18 age group. This differentiation aims to maximize the effectiveness of the intervention while ensuring safety and adaptability for each age category.

For athletes with elevated BMI, the data revealed a clear association with pelvic obliquity, which was not fully corrected by the standard intervention. Therefore, it is recommended that the guide include specific elements tailored to this group.

The optimized version of the intervention program can be found in Appendix 1.

FINAL CONCLUSIONS

The integrated analysis of this research, from the theoretical foundations to the practical intervention, highlights the importance of a multidisciplinary approach in the prevention and correction of postural disorders among children and adolescents practicing karate. Musculoskeletal imbalances and poor postural habits, frequently encountered in young populations, can be effectively counteracted through adapted corrective exercises integrated into regular training routines. The study confirmed a high incidence of scoliotic attitudes (91.6%) and postural asymmetries, particularly in the frontal plane, emphasizing the need for early intervention. The implementation of a postural rebalancing program led to significant improvements in body alignment, demonstrating that corrective exercises, when applied in collaboration with coaches, can serve as effective tools in medical rehabilitation. Furthermore, integrating such interventions into regular sports practice not only optimizes functional outcomes but also supports the development of body awareness and postural self-assessment, skills essential for maintaining healthy posture in the long term.

DISEMINATION OF RESULTS

To capitalize on the practical potential of the present research and the intervention program developed through these studies, the dissemination of results was directed toward both academic and sports environments.

Peer-reviewed full papers in impact factor journals indexed in Web of Science

Bălăiasa, D. G., Cojocariu, A., Abalașei, B. A., Neculăeș, M., & Ungurean, B. C. (2025). Karate Training and Postural Health: A Study on Spinal Deviations among Young Karate Practitioners from Northeastern Romania. *Revista Romaneasca pentru Educatie Multidimensionala, 17*(1), 422-438. https://doi.org/10.18662/rrem/17.1/959

Full-length scientific articles published in BDI-indexed journals

Bălăiasa, D.G. (2024).Karate techniques as a method for correcting postural scoliosis, *Sport and Society*, 25(1), https://doi.org/10.36836/2025/01/02

Bălăiasa D.G., Cojocariu A., Abălașei B.A., Neculăeș M., Ungurean B.C (2024). The impact of karate on body posture: a synthesis of scientific evidence, *Sport and Society*, 24(2), https://doi.org/10.36836/2024/02/18

Additionally, the research findings were presented at scientific conferences in the fields of kinesiology, sports, and physical education:

- **Conference "Updates in Physiotherapy"**, organized by the College of Physiotherapists Iași–Vaslui–Neamț on **May 24, 2025**, in Iași. The presented topic was: *"The effectiveness of karate-specific training elements in correcting postural disorders."*
- **Conference "Progress, Challenges, and Innovations in Functional Rehabilitation: Synergy Among Specialists"**, held between **April 11–13, 2025**, in Iași. The presentation delivered was: *"Intervention on scoliotic attitudes using martial arts-specific techniques."*
- **Conference "The National Conference of Master's and PhD Students in Sports and Physical Education Science"**, part of the *10th International Conference of the Universitaria Consortium in Physical Education, Sports, and Physiotherapy: THE FOOTBALL OF THE FUTURE – BETWEEN SCIENCE, SOCIETY AND SPORTS*, organized on **November 23–24, 2024**, at Alexandru Ioan Cuza University of Iași.

During this scientific event, two studies were presented:

1. *"The Impact of Karate on Body Posture: A Synthesis of Scientific Evidence"*, in the section *"Personal Development, Health and Physical Education & Sport and Society"*
2. *"Prevalence of Spinal Deviations Among Young Karate Practitioners"*, under the category *"Fitness and Disability: Addressing Accessibility and Inclusivity"*

At the practical level, the proposed intervention program was promoted among coaches and instructors from traditional karate clubs at the following national events:

- **National Training Camp for Children**, held during the **Finals of the National Traditional Karate Championship for Children**, **April 11–13, 2025**, in Galați, Dunărea Sports Hall.
- **National Training Camp for Cadets, Juniors, Youth, and Seniors**, held during the **Finals of the National Championship**, **April 25–27, 2025**, in Bucharest, Romsilva Arena.

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