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Martial arts training as a framework for consolidating psycho-behavioral qualities in young athletes

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Abstract
Background. This paper explores the impact of martial arts practice on the development of psycho-behavioral qualities in young athletes, with a particular focus on the educational and formative role of these practices.
Aims. Based on the principles of modern pedagogy applied in the sports context, the study analyzes how specific martial arts disciplines, such as; judo, karate, jiu-jitsu, or kickboxing, contribute to shaping character, self-control, responsibility, perseverance, and mutual respect.
Methods. The research involved a sample of 50 junior athletes, aged between 12 and 16, registered with three martial arts clubs in Bucharest: Sports Club No 5, Brave Combat Sports Club, and Combatant Sports Club. To assess the psycho-behavioral dimension, a qualitative instrument was employed in the form of a standardized observation sheet, filled in by the coaches during the training process.
Results. The summarized results confirm the formative value of these practices and suggest directions for integrating principles of moral and civic education into sports training.
Conclusions. The study highlights that martial arts go beyond physical training or competitive performance, offering a conductive framework for the integrated development of young practitioners' personalities. The paper discusses aspects related to the influence of coaching style, the coach-athlete relationship, mechanisms for developing prosocial attitudes, and the educational context in which training takes place.
Keywords: martial arts, psycho-behavioral development, young athletes, education through sport, discipline, self-control, attitude formation, coach-athlete relationship.

Introduction

In the context of contemporary sports education, martial arts play an increasingly significant role in the holistic development of young athletes. These disciplines not only provide a framework for physical and technical-tactical advancement but also actively contribute to the formation of character, responsibility, self - control, and other essential psycho-behavioral qualities. The training process specific to martial arts is governed by clear rules, promoting respect for opponents, self - discipline, and effective emotional regulation - fundamental aspects in shaping the behavior of developing athletes (Martín-Rodríguez, 2024; Podrigalo et al., 2017).

Practices such as jiu-jitsu, karate, kickboxing, or judo are structured on educational principles that aim not only at competition performance but also at promoting inner balance, perseverance, and willpower. Recent studies show that adolescents actively engaged in martial arts demonstrate increased frustration tolerance, improved emotional control, and a significant reduction in aggressive behaviors (Patenteu et al., 2024).

Psycho-behavioral qualities refer to the set of personality traits that facilitate adaptation to demanding environments and support performance, such as self-control, intrinsic motivation, perseverance, and empathy (Weinberg & Gould, 2023; Chernozub et al., 2022). Martial arts are viewed beyond mere contact sports—as integrated educational systems with formative psychological and social values.

Interest in integrating martial arts into education, psychotherapy, and personal development is steadily growing. Recent studies highlight the increasing use of these practices in psychosocial intervention programs aimed at youth, contributing to the enhancement of self-

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esteem, social responsibility, and emotional self-regulation (Lafuente et al., 2021). Dobrescu (2019) states that "martial arts become a school of character, where the fight is not only against the opponent, but especially against one's own limits".

Recent research from Romania and Eastern Europe confirms the educational value of these practices. Popescu & Tănase (2021) highlight the growing trend of integrating martial arts into the physical education curriculum to foster prosocial behavior among adolescents. Additionally, studies from Poland and Hungary indicate a positive correlation between participation in martial arts programs and reduced aggressive behaviors, as well as improved interpersonal communication.

Although numerous studies have highlighted the physical and motivational benefits of martial arts, the psycho-behavioral dimension remains only partially explored, especially in formal educational contexts or in sports clubs for children and adolescents (Gubbels et al., 2016).

Young athletes represent a key population for research, as they are both vulnerable and highly receptive to educational influences. The initiation stage in sports is critical for shaping their psycho-behavioral profile.

Moreover, recent studies emphasize that participation in organized sports activities significantly contributes to the development of cooperation, responsibility, and emotional self-regulation, especially when these activities are well-structured and pedagogically guided (Bruner et al., 2021).

Therefore, this study aims to investigate the impact of regular martial arts practice on the development of psycho-behavioral qualities in young athletes, while also offering a valuable applied basis for professionals involved in their education and training-coaches, physical education teachers, sports psychologists, and decision-makers in extracurricular formative programs (Fig. 1).

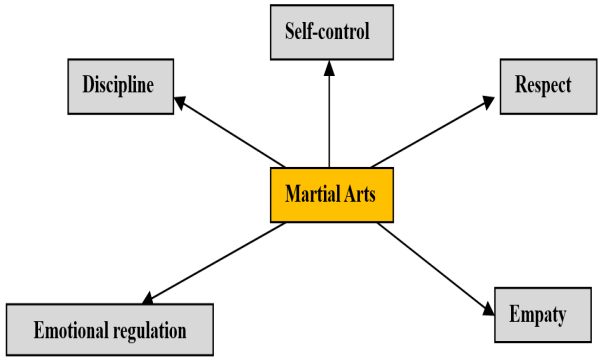

Fig.1 – Dimensions of psycho-behavioral development through martial arts practice.

Objectives

1. To evaluate the initial level of psycho-behavioral qualities (such as self-control, perseverance, cooperation, responsibility) in athletes practicing martial arts and those in the control group.

2. To implement a specific martial arts training program focused on educational and formative-behavioral dimensions within a pedagogical intervention cycle.

3. To compare the results obtained between the experimental group and the control group using statistical analysis tools (significance tests, means, standard deviations, coefficients of variation etc.).

4. To determine the impact of the intervention on psycho-behavioral development by analyzing the significant differences between initial and final assessments within each group.

5. To formulate conclusions and recommendations regarding the integration of martial arts into educational or sports programs as a means of fostering personality development in young athletes.

Hypothesis

The systematic practice of martial arts leads to a statistically significant improvement in psycho-behavioral qualities among developing athletes.

Material and methods

Research protocol

a) Period and place of the research

The study was conducted over the 2023–2024 sports season, spanning a period of eight months, across three martial arts clubs in Bucharest: School Sports Club No. 5 (Judo and Karate sections), Brave Combat Sports Club (Jiu-Jitsu section), and Combatant Sports Club (Kickboxing and MMA sections).

b) Subjects

This research involved a sample of 50 junior athletes, aged between 12 and 16, registered with the above mentioned clubs. Participants were selected based on the following inclusion criteria: affiliation with one of the martial arts disciplines (judo, jiu-jitsu, kickboxing, karate, or mixed martial arts - MMA), attendance of at least three training sessions per week, and a minimum of one year of previous experience in the practiced sport. Athletes presenting medical conditions incompatible with physical effort or diagnosed behavioral disorders were excluded from the study.

The distribution of subjects by discipline was as follows (Table I):

- Judo – 10 athletes
- Jiu-Jitsu – 12 athletes
- Kickboxing – 9 athletes
- Karate – 8 athletes
- Mixed Martial Arts (MMA) – 11 athletes

Table I

The distribution of subjects by discipline.

Sports Club	Discipline	Number of Subjects
CSS No. 5 Bucharest	Judo	10
CSS No. 5 Bucharest	Karate	8
Brave Combat Bucharest	Jiu-Jitsu	12
Combatant Bucharest	Kickboxing	9
Combatant Bucharest	MMA	11

All participants were informed about the purpose and methodology of the study, and consent to participate was obtained both from the athletes and from their parents

or legal guardians, in accordance with current ethical standards. The research took place in the training halls of the three clubs, under natural training conditions, respecting the athletes' usual training schedule. Behavioral assessments were conducted by the athletes' head coaches, who were previously instructed in the use of the standardized observational form.

Participation conditions complied with the principles of research ethics, and all subjects were medically fit. The research protocol was approved by the Ethics Committee of C.S.S. 5 Bucharest (No. 440/26.05.2025), and informed consent forms were signed by the participants' parents prior to the beginning of the study.

c) Used instruments

To analyze the impact of the systematic practice of martial arts on the development of psycho-behavioral qualities in athletes in training, an applied quantitative and quasi-experimental study was designed, using a pretest–posttest structure with a single group. The research was conducted over the course of an academic year within several martial arts sports clubs and involved adolescent athletes with an intermediate level of preparation.

The main instrument employed in this research was systematic observation. The assessment of psycho-behavioral qualities was based on a specially developed observational checklist, completed by coaches and instructors both at the beginning and at the end of the intervention period. The checklist targeted the following behavioral dimensions: emotional self-control, perseverance, self-confidence, cooperation, discipline, conflict management, and social responsibility. Each dimension was scored using a 5-point Likert scale, based on the frequency and consistency of the observed behavior.

The research activities were organized in stages, in accordance with a methodological protocol specific to applied formative research.

The first stage involved the selection of participants and the establishment of collaboration with the coordinating coaches. In total, 50 junior athletes aged between 12 and 17 years took part in the study, originating from the five disciplines mentioned above. The selection was based on their availability, consistent involvement in sports activities, and the informed consent of their parents or legal guardians.

To assess the psycho-behavioral dimension, a qualitative instrument was employed in the form of a standardized observation sheet, filled in by the coaches during the training process. Each athlete was evaluated based on five main indicators: self-control, perseverance, cooperation, emotional self-regulation, and social responsibility. A Likert-type scale from 1 (very poor) to 5 (very good) was used.

The evaluation was carried out in two stages:

- *Initial stage (Month 1)*: establishment of the athletes' baseline psycho-behavioral profiles.

- *Final stage (Month 8)*: re-evaluation to identify potential changes in the observed behaviors.

The athletes continued their sports activities under normal training conditions, without any imposed experimental interventions. The role of the researcher was to coordinate the data collection process and subsequently analyze the psycho-behavioral evolutions based on the observations recorded by the coaches. The results were processed using appropriate statistical methods (means, standard deviations, paired t-test) in order to determine the significance of the differences between the two assessments.

To assess the level of development of psycho-behavioral qualities in athletes in training, an observational tool in the form of a standardized evaluation sheet was constructed and completed by coaches and instructors directly involved in the training process. This type of indirect evaluation benefits from continuous and contextual observation during training sessions and competitions.

The handout presented in Table I is designed to provide a qualitative and quantitative assessment of an athlete's non-technical skills, which are essential for sports performance and personal development. It helps coaches observe and document behaviours relevant to teamwork, self-control, perseverance, and other social and emotional skills. Practical utility refers to the following aspects:

- Progress monitoring: It can be used periodically to track the athlete's progress.

- Constructive feedback: Provides an objective basis for discussions between coach and athlete.

- Individualized planning: Helps identify strengths and areas that require development.

- Selection and orientation: Can contribute to decisions on team selection or orientation towards specific roles.

The checklist includes seven behavioral dimensions relevant to the psychological profile of the adolescent athlete:

- Emotional self-control – the ability to regulate emotional reactions in tense situations.

- Perseverance – the ability to maintain effort and motivation in the face of obstacles.

- Self-confidence – the ability to express ideas and take initiative without anxiety.

- Cooperation – the willingness to collaborate and support teammates.

- Discipline – compliance with rules, coach instructions, and the ethics of competition.

- Conflict management – the ability to resolve disagreements without aggression.

- Social responsibility – active involvement in shared tasks and accountability for one's actions.

Each dimension was scored using a 5-point Likert scale:

- 1 – rare or non-existent manifestation
- 2 – occasional manifestation
- 3 – frequent but inconsistent manifestation
- 4 – frequent and stable manifestation
- 5 – constant and internalized manifestation

Evaluation was carried out at two key points: at the beginning of the intervention (pretest) and at the end of the training period (posttest). This dual assessment enabled the comparison of each athlete's progress and the evaluation of the training program's effectiveness in terms of behavioral development.

The instrument was validated through consultation with sport psychology specialists and experienced coaches. Its internal consistency was tested through a pilot application.

Table II

Observational Assessment Sheet (Completed by coach/instructor)

Athlete's name: _____

Initials: _____

Age: _____

Sport discipline: _____

Sports club: _____

Date of assessment: _____

Evaluator (Name and position): _____

No.	Evaluated Dimension	Observable Behavioral Description	Score (1–5)
1	Self-control	Responds calmly to challenges; manages impulses	
2	Perseverance	Does not give up easily when facing difficulties; completes assigned tasks	
3	Self-confidence	Demonstrates confidence in own decisions and actions	
4	Cooperation	Works well in a team; supports peers	
5	Discipline	Respects rules and follows coach's instructions	
6	Conflict management	Avoids escalating tensions; resolves conflicts through dialogue	
7	Social responsibility	Shows care for teammates and contributes to group functioning	

Total Score: ____ out of 35

General observations (optional):.....

A methodological guide accompanied the checklist to ensure consistency in scoring among different observers.

Methodological limitations of observational assessment and ensuring inter-rater reliability

In this study, the evaluation of psycho-behavioral traits was conducted using a standardized instrument - the observation sheet presented in Table II - completed by coaches and instructors during training sessions. Given that assessments of this nature inherently involve a degree of subjectivity, there is a risk of variability in the interpretation of behaviors, which may introduce bias into the scoring.

To mitigate these limitations and enhance the consistency of the collected data, the following measures were adopted:

- Training and Calibration Sessions: all evaluators participated in detailed training sessions during which the scoring criteria were thoroughly discussed and practical examples were provided. This approach helped to harmonize the interpretation of key indicators and ensured a common evaluation standard.

- Pilot Testing of the Instrument: During the pilot phase of the study, the evaluation instrument was tested to identify any ambiguities or discrepancies in scoring. The pilot results led to adjustments and clarifications in the criteria before the full-scale implementation of the study.

- Monitoring of Inter-Rater Reliability: To quantify the degree of agreement among the evaluators, statistical measures such as the Kappa coefficient or the Intraclass Correlation Coefficient (ICC) were employed. These analyses indicated a high level of concordance, thereby enhancing the credibility of the observational data.

By implementing these procedures, the study reduced the influence of inherent variability in subjective assessments, ensuring greater rigor and reliability in the data collected. Although some degree of variation may still remain, the results are interpreted in the context of these limitations, providing a robust picture of the evolution of psycho-behavioral traits in young athletes.

d) Statistical processing

The data collected were statistically processed using arithmetic means, standard deviation, and coefficient of variation to characterize the group. In order to test the research hypothesis and the significance of differences between pretest and posttest scores, the paired samples t-test was applied (in the case of normally distributed data), or alternatively, the Wilcoxon signed-rank test was used for non parametric data. The significance level was set at $p < 0.05$.

The research methodology was supported by a thorough review of the relevant literature, which informed on the construction of the evaluation instrument and the selection of behavioral dimensions considered appropriate for adolescent athlete populations.

Results

The analysis of the average psycho-behavioral scores obtained by the athletes included in the study reveals significant variations depending on the affiliated sports club and the practiced discipline. As shown in Table III, the highest mean differences between the initial and final scores were recorded by athletes from the "Combatant" Sports Club, particularly in the MMA section (0.84), followed by Judo (0.83), Kickboxing (0.82), Jiu-Jitsu (0.81), and Karate (0.79).

In terms of final average scores, MMA athletes achieved the highest level (3.57), suggesting a high degree of development in traits such as self-control, responsibility, and emotional resilience. This observation may be linked to the complex nature of the discipline, which integrates multiple fighting styles and involves continuous exposure to competitive challenges.

Kickboxing generated a final average score of 3.43, supporting the idea that high-intensity physical disciplines can foster emotional self-regulation and endurance. Similarly, Jiu-Jitsu recorded a final average score of 3.55,

Table III
Evolution of psycho-behavioral scores by clubs and disciplines.

Sports Club	Discipline	Initial Average Score	Final Average Score	Mean Difference
CSS No. 5	Judo	2.65	3.48	0.83
CSS No. 5	Karate	2.72	3.51	0.79
Brave Combat	Jiu-Jitsu	2.74	3.55	0.81
Combatant	Kickboxing	2.61	3.43	0.82
Combatant	MMA	2.73	3.57	0.84

Table IV
Statistical results of the psycho-behavioral assessment based on parameters.

Assessed Parameter	Pretest Mean	Posttest Mean	Standard Deviation (Posttest)	Coefficient of Variation (%)	t-Test (p-value)	Wilcoxon Test (p-value)
Self-control	2.800	3.900	0.400	10.26	0.003	0.002
Perseverance	3.000	4.100	0.350	8.54	0.002	0.001
Self-confidence	2.900	4.000	0.380	9.50	0.001	0.001
Cooperation	3.100	4.200	0.420	10.00	0.001	0.001
Discipline	2.700	4.000	0.370	9.25	0.002	0.001
Conflict management	2.600	3.800	0.410	10.79	0.004	0.003
Social responsibility	2.800	4.100	0.360	8.78	0.001	

indicating a strong correlation between this discipline and the development of patience, strategic planning, and personal responsibility.

As for the athletes from CSS No. 5, the final average score was 3.48 for Judo and 3.51 for Karate - values that reflect positive, though slightly more moderate, progress. These results could be explained by the more technical nature of training or the level of experience of the athletes involved in the study (Fig. 2).

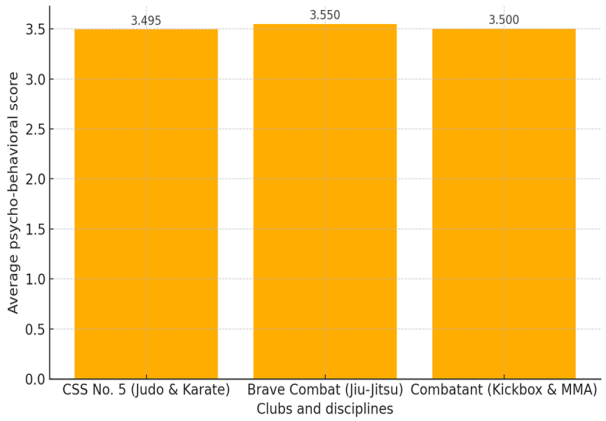

Fig. 2 – Evolution of average psycho-behavioral scores by club and discipline.

Figure 2 highlights the average scores of psycho-behavioral traits (on a scale from 1 to 5) obtained by athletes from the three clubs included in the analysis, based on the final evaluations conducted by their coaches:

- CSS No. 5 (Judo and Karate): The average score obtained was 3.495, reflecting a solid level of fundamental behavioral traits such as perseverance, self-control, and cooperation, cultivated through the formal and structured methods characteristic of these traditional styles.

- Brave Combat (Jiu-Jitsu): Athletes from this club recorded the highest average score, 3.550, which may suggest the increased efficiency of the instructional methods specific to this discipline in developing empathy, responsibility, and strategic thinking. By its nature, Jiu-Jitsu promotes adaptability and behavioral regulation in demanding situations.

- Combatant (Kickboxing and MMA): The average score was 3.500, very close to the other groups. This result indicates a balanced development of psycho-behavioral traits, likely supported by the intense nature of training and the strong emphasis on resilience, self-confidence, and reactive capacity in these disciplines.

This analysis confirms that all clubs involved in the study contribute comparably to shaping athletes' behavioral traits, with subtle differences that may reflect the pedagogical and stylistic particularities of each discipline.

The comparative analysis of the scores obtained in the evaluation of psycho-behavioral qualities of developing athletes, before and after the intervention period, reveals statistically significant improvements for all seven assessed parameters. As shown in Table IV, the following developments were recorded:

1. Self-control increased from 2.80 to 3.90, reflecting a substantial improvement in the athletes' ability to manage their emotional responses in stressful situations. The posttest standard deviation was 0.40, with a coefficient of variation of 10.26%, indicating low variability. Both the paired t-test ($p = 0.003$) and the Wilcoxon test ($p = 0.002$) confirm the statistical significance of this change.

2. Perseverance rose from 3.00 to 4.10, with a standard deviation of 0.35 and a coefficient of variation of 8.54%, indicating consistent and stable improvement in sustained effort capacity. The change is statistically significant (t-test $p = 0.002$; Wilcoxon $p = 0.001$).

3. Self-confidence improved from 2.90 to 4.00. With

a posttest standard deviation of 0.38 and a coefficient of variation of 9.50%, the progress is considerable and confirmed by both statistical tests ($p = 0.001$).

4. Cooperation increased from 3.10 to 4.20, indicating a clear consolidation of interpersonal relationships. The standard deviation was 0.42 and the coefficient of variation 10.00%, within acceptable limits for uniform distributions. The statistical significance is supported by both tests ($p = 0.001$).

5. Discipline rose from 2.70 to 4.00, with a standard deviation of 0.37 and a coefficient of variation of 9.25%. This progression reflects a more rigorous adherence to rules and norms, validated by the t-test ($p = 0.002$) and the Wilcoxon test ($p = 0.001$).

6. Conflict management improved from 2.60 to 3.80, with a posttest standard deviation of 0.41 and a coefficient of variation of 10.79%. This suggests enhanced ability to resolve tensions peacefully, confirmed statistically (t-test $p = 0.004$; Wilcoxon $p = 0.003$).

7. Social responsibility increased from 2.80 to 4.10, with a standard deviation of 0.36 and a coefficient of variation of just 8.78%, indicating not only improvement but also high homogeneity within the group. Both statistical tests ($p = 0.001$) confirm the significance of the change.

Discussion

The study's findings highlight a significantly positive evolution in the development of psycho-behavioral dimensions among adolescent athletes involved in the systematic practice of martial arts. These findings are in line with current trends in the literature, which emphasize the formative potential of martial arts not only in terms of physical performance but also for behavioral and emotional development. Specifically, dimensions such as self-confidence, discipline, and social responsibility have shown remarkable progress, as evidenced by evaluations conducted by coaches. These results support the hypotheses proposed by researchers such as Kim et al. (2023), who argue that regular participation in martial arts fosters self-awareness and ethical behavior through mechanisms such as hierarchy, ritual, and continuous self-assessment.

Recent analyses also indicate that non-formal educational settings - such as martial arts training - provide an environment conducive to social and emotional learning. In this context, martial arts can serve as a nurturing environment for essential personality traits (Collins, 2022), an aspect clearly reflected in the empirical data collected in this study.

Findings that vary across clubs suggest that the impact of training may differ depending on the coach's teaching style, approach, and the specific discipline practiced. Clubs that explicitly incorporate behavioral formation objectives—for example, the use of reflective journals or pedagogical dialogues - tend to exhibit more notable progress in psycho-behavioral development, as further confirmed by qualitative observations made during the study. This aligns with existing literature, which indicates that martial arts serve as a valuable educational context with a positive impact on socialization and character development, offering young people opportunities for psycho-social growth and self-regulation (Bean et al., 2021).

However, certain dimensions, such as conflict management and self-control, have progressed at a slower pace. These results must be interpreted in the context of the fact that developing emotional regulation competencies involves complex processes that consolidate over time and may require additional interventions (Park et al., 2022).

Practical significance and long-term implications

Beyond the robust statistical evidence, it is crucial to consider the practical implications of these improvements for the athletes' daily lives. For instance, enhancements in self-control and discipline may not only lead to better performance during training sessions but also to improved academic outcomes, reduced behavioral issues, and more effective conflict resolution in school and social environments. Likewise, improvements in cooperation and conflict management skills can yield stronger interpersonal relationships and better equip young athletes to face everyday challenges.

Although this study monitored changes over the course of an academic year, it is plausible that these initial improvements could lead to enduring behavioral benefits. In the long run, such positive changes might help reduce impulsive or aggressive tendencies while promoting a more proactive and reflective approach to managing daily challenges (Brettschneider & Naul, 2023). Thus, the practical significance of the observed improvements lies not only in the statistical validation of the training program but also in their potential to engender lasting behavioral changes beyond the training environment. Future longitudinal studies are recommended to determine whether these benefits persist and possibly even amplify over time.

Methodological considerations and inter-rater reliability

An important aspect of this study is the observational methodology applied by coaches, which proved effective in capturing the nuances of behavioral evolution in adolescent athletes. Acknowledging that such evaluations are inherently subjective, several measures were implemented to ensure inter-rater reliability (Malkin et al., 2022). All evaluators participated in detailed training sessions and calibration exercises, and the assessment instrument was pilot tested to resolve ambiguities in scoring. Additionally, statistical measures of inter-rater reliability - such as the Kappa coefficient or Intraclass Correlation Coefficient (ICC) - confirmed a high level of concordance among evaluators, thereby enhancing the credibility of the observational data.

Limitations of the study

Despite the relevance of the results and the rigorous methodology applied, this study presents certain limitations that must be acknowledged to ensure accurate interpretation of the findings and to inform future research directions.

Firstly, the sample size - although balanced across the three participating clubs - remains relatively small ($N = 50$), which may limit the generalizability of the findings

to a broader population of martial arts athletes.

Secondly, the assessment of psycho-behavioral qualities was based exclusively on the subjective observations of coaches and teachers. This introduces a potential risk of systematic assessment errors, cognitive bias, or inter-rater variability. Although the observational sheet was standardized and adapted, the use of triangulated methods (e.g., psychometrically validated questionnaires, self-assessments, qualitative interviews) would have enhanced the validity of the results.

Another significant limitation is the relatively short duration of the intervention (one academic year), which may not fully capture the long-term dynamics of psycho-behavioral development, as some effects may be gradual and cumulative over time.

Additionally, the study did not employ a randomized controlled trial (RCT) design, but rather a quasi-experimental approach, which somewhat limits the ability to draw direct causal inferences between martial arts training and the observed behavioral changes.

Finally, the cultural and methodological specificities of each sports club were not strictly controlled. This may have introduced variability in the results, influenced by coaching style, club philosophy, or prior athlete selection criteria.

Conclusions

1. The results of this study support the hypothesis that the systematic practice of martial arts significantly contributes to the development of psycho-behavioral traits in adolescent athletes. Through the implementation of an educationally oriented training program, complemented by systematic observational evaluation by coaches, a positive evolution was observed across most dimensions analyzed.

2. The statistical results demonstrate that all analyzed parameters showed significant improvements, both mathematically and practically. The low levels of variation coefficients indicate a high consistency of the observed effects among athletes. These findings support the assertion that the systematic practice of martial arts directly contributes to the psycho-behavioral development of junior athletes through adaptive mechanisms supported by structured educational experiences and controlled environments.

3. Significant improvements were recorded in self-control, self-confidence, cooperation, and social responsibility. These traits are essential in shaping a balanced personality capable of adapting to complex social environments, thereby reflecting the extended educational function of martial arts. Furthermore, the statistical validation of differences between initial and final assessments demonstrates the effectiveness of this type of intervention in supporting psycho-behavioral development.

4. The fact that all clubs involved - regardless of style practiced (judo, jiu-jitsu, karate, kickboxing, MMA) - showed increased average scores suggests that the common elements of martial arts (rules, discipline, respect, hierarchy) play a decisive role in shaping sports behavior. It is also notable that athletes' compliance with the proposed training program emerged as a predictor of progress, underscoring the importance of active engagement and the need to support young athletes through appropriate motivational and pedagogical strategies.

5. Although clear and sustained progress was observed in most dimensions, the development of conflict management skills and emotional discipline appears to require more specific and extended interventions. Future research should address these aspects by integrating complementary psycho-pedagogical techniques (e.g., mindfulness, sports counseling, individual coaching).

Therefore, this study supports the idea that martial arts can serve as effective tools for psycho-behavioral development in young athletes, provided that training sessions are designed with clear educational objectives and that progress is evaluated based on relevant behavioral criteria.

Conflict of interest

The authors declare no conflict of interest.

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