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Review Article

The Effectiveness of Martial Arts Interventions in Autism Spectrum Disorder: A Scoping Review

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Abstract

Background. Autism Spectrum Disorder (ASD) is a neurodevelopmental condition marked by social-communication difficulties, restricted interests, and motor coordination challenges. In recent years, structured physical activity programs — particularly martial arts — have gained attention as promising complementary interventions for youth with ASD.

Objectives. This scoping review aimed to map and synthesize empirical evidence on martial arts interventions for individuals aged 6–18 years with ASD.

Materials and Methods. A systematic search of PubMed, Scopus, and Web of Science databases was conducted between January and March 2025.

Results. After screening 89 records and applying rigorous eligibility filters (regarding study design, diagnosis, age range, and sample size ≥10), only two studies were included. Both studies reported statistically significant improvements in motor coordination and balance following structured martial arts programs, specifically karate kata (n = 30) and Tai Chi Chuan (n = 18). However, methodological limitations such as a lack of blinding and small sample sizes were noted. Broader literature supports additional benefits of martial arts on social engagement, executive function, emotional regulation, and parental outcomes, although the two included trials did not capture these effects.

Conclusions. Despite the limited number of eligible RCTs, current evidence suggests that martial arts interventions may offer meaningful benefits across multiple developmental domains in children and adolescents with ASD. Further well-designed and rigorous trials are needed to confirm and expand these findings.

Keywords: Autism Spectrum Disorder (ASD), martial arts, karate, Tai Chi, motor coordination, neurodevelopmental disorders (NDDs).

Introduction

Autism Spectrum Disorder (ASD) is a complex neurodevelopmental condition characterized by deficits in social interaction, communication, and repetitive behaviors (American Psychiatric Association, 2022).

In recent years, there has been growing interest in the use of structured physical activity interventions, particularly martial arts, as complementary therapeutic approaches for individuals with ASD.

Among various physical modalities, martial arts have emerged as a promising approach to enhance social and behavioral outcomes in this population. Recent research suggests that martial arts-based interventions not only support motor skill development but also promote improvements in behavioral self-regulation, communication abilities, and social participation (Bahrami et al., 2016; Rivera et al., 2020a). Additionally, empirical work by Pusponegoro et al. (2016) confirmed that children with ASD who exhibited lower gross motor skills also scored significantly lower in measures of socialization, reinforcing the rationale for motor-based interventions aimed at supporting broader developmental outcomes.

Children and adolescents with ASD engage in significantly less physical activity than their neurotypical peers, underscoring the need for structured and engaging interventions such as martial arts (Gehricke et al., 2020).

Martial arts programs offer an organized, repetitive, and highly structured environment, which may align with the sensory and behavioral needs of children and adolescents on the spectrum with documented benefits in reducing stereotyped behaviors (Bahrami et al., 2012).

Furthermore, the discipline and concentration required in martial arts may boost executive functions such as attention, inhibitory control, and cognitive flexibility (Amonkar et al., 2021).

A recent network meta-analysis verified the specific advantages of martial arts in enhancing inhibitory control among children with ASD (Hou et al., 2024).

These findings are especially important given the high rate of executive dysfunction in youth with ASD. Wang et al. (2025) analysed 23 randomised controlled trials to assess how physical exercise, including martial arts, affects social, motor, and behavioural outcomes in children with ASD. Their analysis showed notable improvements in motor coordination- particularly in younger children- behavioral regulation across different ages, and mixed but encouraging effects on social skills, emphasising the importance of tailored program design and implementation. Similarly, a recent systematic review and meta-analysis by Costanza et al. (2025) further supports the efficacy of structured physical activity programs in enhancing social communication, emotional regulation, and adaptive functioning in children with ADHD (Attention-Deficit/Hyperactivity Disorder), highlighting martial arts as a particularly promising modality within this broader category.

Given this background, the present review aims to synthesize recent empirical evidence on the impact of martial arts programs on motor, social, cognitive, and behavioral domains in children and adolescents with ASD. It also considers secondary outcomes, such as sleep quality and caregiver well-being, providing a comprehensive view of the therapeutic potential of martial arts in neurodevelopmental contexts.

Materials and Methods

This scoping review aimed to map the existing evidence on martial arts interventions for children and adolescents with Autism Spectrum Disorder (ASD). We conducted searches across three electronic databases—PubMed, Scopus, and Web of Science Core Collection—between January and March 2025. In each database, we employed parallel search strategies focusing on ASD and martial arts terms in titles, abstracts, and keywords. In PubMed, we specifically searched titles and abstracts using the string "autism spectrum disorder" OR "ASD" AND "martial arts" OR "karate" OR "taekwondo" OR "judo" OR "kung fu," with filters for human studies and articles in English. In Scopus, we employed an analogous advanced search query—TITLE-ABS-KEY ("autism spectrum disorder" OR ASD) AND TITLE-ABS-KEY ("martial arts" OR karate OR taekwondo OR judo OR "kung fu")—with additional filters for articles (DOCTYPE = "ar"), English language, and publication year after 2004. For the Web of Science Core Collection, we applied TS= ("autism spectrum disorder" OR ASD) AND TS= ("martial arts" OR karate OR taekwondo OR judo OR "kung fu"), limiting the results to articles published in English from 2005 to 2025.

All retrieved records were exported into a reference-management software, where duplicates were automatically identified and removed. Two reviewers (CC and VM) then independently screened the titles and abstracts of each record to determine eligibility according to our a priori criteria: (1) randomized controlled trials (RCTs) or quasi-experimental designs; (2) participants aged 6–18 years with a confirmed ASD diagnosis; (3) sample size of at least 10 participants; and (4) a structured martial arts program (for example, karate, taekwondo, judo, or kung fu). Discrepancies during screening were resolved through discussion until consensus was reached.

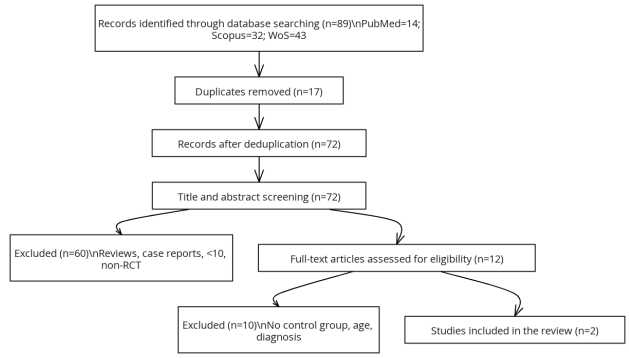

Fig. 1. Study selection flow

Full texts of studies deemed potentially eligible were retrieved and assessed in duplicate. We extracted key study characteristics into a standardized charting form, recording participant demographics, details of the martial arts intervention (frequency, duration, and specific techniques), comparator conditions (e.g., alternative exercise or no-treatment control), and outcome measures. To evaluate methodological rigor, we applied the CONSORT 2010 checklist, noting whether each trial reported on randomization procedures, allocation concealment,

Table 1. Characteristics and key outcomes of included controlled studies of martial arts in children with ASD

Study	Design	N	Age Range	Intervention	Comparator	Key Outcomes	Methodological Notes
Ansari et al. (2021)	RCT	30	6–18	10-week karate kata	Aquatic therapy & control	22% increase in balance (static & dynamic)	Trial registered, randomization clear, no blinding reported
Sarabzadeh et al. (2019)	Quasi-experimental	18	6–12	6-week Tai Chi Chuan	Control	18% improvement in balance subscales	Randomization described, no trial registration, no blinding

blinding, sample-size calculation, trial registration, and intention-to-treat analysis. Given the small number of fully eligible trials, we did not pursue a meta-analysis but instead offered a structured narrative synthesis of the findings.

Results

The database searches yielded a total of 89 records (PubMed: 14; Scopus: 32; Web of Science: 43). After removing 17 duplicates, 72 unique records remained for title and abstract screening. Of these, 60 were excluded (reviews, case reports, qualitative studies, protocols, and non-RCT/quasi-experimental designs with n < 10). Twelve full-text articles were then assessed for eligibility; 10 were excluded for failing to meet one or more inclusion criteria (no control group, unclear ASD diagnosis, age outside 6–18 years, or insufficient sample size). Ultimately, two studies satisfied all inclusion criteria and were included in this scoping review.

Summary of Findings

Only two controlled trials met our strict inclusion criteria. Both showed that structured martial arts training—karate kata in one RCT (n = 30) and Tai Chi Chuan in one quasi-RCT (n = 18) — produced statistically significant improvements in balance and motor coordination among children with ASD. Methodological limitations common to both studies (absence of blinding, small samples, incomplete registration) highlight the need for larger, more rigorous trials.

Discussion

Although only two studies met the inclusion criteria for this scoping review, their selection reflects the high level of methodological stringency we adopted. We aimed to synthesize the most reliable evidence available. Nonetheless, during full-text screening, we reviewed a total of twelve articles that examined martial arts interventions in youth with ASD.

In order to contextualize the findings of the two eligible trials within the broader empirical landscape, we also examined the additional ten full-text studies excluded from final inclusion. These studies explored various martial arts interventions and reported outcomes across five key domains: motor skills, social functioning, communication, cognitive/executive functioning, and secondary physiological or psychosocial effects. The following section summarizes the larger body of evidence, categorised by martial art type and outcome area.

Mixed martial arts (MMA), as a structured and socially engaging activity, has demonstrated notable benefits for children with ASD. Phung & Goldberg (2021) studies revealed substantial improvements in social skills and significant reductions in problem behaviors in boys, underscoring the potential of MMA to promote social adaptation and emotional self-regulation. Moreover Phung (2017) reported improvements in executive functioning and social communication following MMA participation, indicating broader cognitive and behavioral effects when martial arts are delivered in a consistent and inclusive setting.

Karate-based interventions have shown promising effects across multiple developmental domains in children with ASD.

Greco & Ronzi (2020) reported significant gains in emotional regulation, social engagement, and executive functioning, along with notable reductions in anxiety and sensory hypersensitivity. Similarly, (Ansari et al., 2021) demonstrated that kata techniques, characterized by their repetitive and focused motor sequences, enhanced both static and dynamic balance in children with ASD—highlighting their relevance for sensorimotor development. Further supporting these findings, Maussier et al. (2024) through the "KATAUTISM" inclusive school program, reported positive outcomes in social inclusion, gross motor coordination, and behavioral self-regulation following a 24-week karate and judo curriculum. Additionally, Bahrami et al. (2016) observed significant improvements in communication skills after 14 weeks of karate training, with effects that were maintained at one-month follow-up, suggesting the potential for sustained impact on core social communication deficits.

Taekwondo, a disciplined Korean martial art characterized by structured and dynamic movement patterns, has also yielded promising results for children with ASD.

Kim et al. (2024) reported significant improvements in balance and motor coordination following an 8-week Taekwondo program, with 92% adherence, suggesting both effectiveness and acceptability among participants. Mok et al. (2024) found that parents observed enhanced physical ability and social communication in children after a Taekwondo protocol was integrated with music therapy. Scamardella et al. (2025) highlighted how specific anthropometric traits, such as greater limb length and height, confer a biomechanical advantage in taekwondo, supporting its potential for tailored interventions in youth development contexts.

Several studies have explored the impact of judo programs on youth with ASD, highlighting both physical and psychosocial benefits. Garcia et al. (2020) demonstrated that an 8-week judo intervention not only doubled participants' physical activity levels but also improved social behaviors. Rivera et al. (2020b), using a mixed-method design, reported increased self-confidence, and reduced behavioral challenges.

Family-centred judo interventions were also associated with improved sleep quality, reducing sleep latency and night awakenings, as well as parental benefits, including better communication, bonding, and reduced stress (Garcia, Murray, et al., 2024). A parallel study by Garcia, Hahs-Vaughn, et al. (2024) noted reduced parenting stress and enhanced emotional connection, underscoring the role of co-participation. Pierantozzi et al. (2022) found that a six-month adapted judo program resulted in significant improvements in cardiorespiratory fitness and a reduction in the waist-to-height ratio. Morales et al. (2021) highlighted the need for continuity, noting that gains in social communication and emotional regulation diminished after program interruption during the COVID-19 lockdown.

Recent studies have explored novel adaptations of martial arts better to support the unique neurodevelopmental profiles of children with ASD.

In a complementary pilot study, Yip, 2019 piloted a rhythmic cueing protocol designed to enhance motor skills through synchronized auditory–motor training. The intervention, which combined traditional martial arts movements with rhythmic stimuli (e.g., metronome beats), and reported improvement in bilateral coordination and balance over four weeks. Supporting these findings, Amonkar et al. (2021) conducted a systematic review of creative movement therapies, including martial arts, and found moderate to significant effects on both social and cognitive outcomes.

Bittner et al., (2017) explored tech-assisted exercise using the ExerciseBuddy app and found enhanced physiological engagement during locomotor tasks, suggesting that tech-assisted learning tools may improve the effectiveness of motor interventions. This approach may also be extended to martial arts programs, enriching instruction with visual and interactive support.

Sarabzadeh et al. (2019) found that a six-week Tai Chi Chuan program significantly improved balance and ball skills in children with ASD, highlighting the potential of slow, structured movement practices to support sensorimotor integration.

To further synthesize the evidence, the following sections summarize the key findings within each of the five domains outlined above.

Motor Skill Development: Improvements in motor coordination and balance emerged as the most consistent outcome across interventions. Both included trials, as well as several excluded studies, demonstrated that structured martial arts programs—particularly those involving repetitive and controlled movements, such as kata or Tai Chi—can enhance postural stability, bilateral coordination, and sensorimotor integration. These gains are especially relevant given the high prevalence of gross and fine motor delays in children with ASD.

Social and Behavioral Outcomes: Numerous studies reported enhanced peer engagement, reductions in disruptive behaviors, and improved emotional self-regulation following martial arts participation. The inherently social and ritualized nature of these practices may foster prosocial behavior, cooperation, and self-control. Programs delivered in group settings appear particularly beneficial for reinforcing social reciprocity and reducing isolation.

Communication and Language Skills: Although less frequently addressed, communication outcomes showed encouraging trends. Improvements were noted in both expressive and receptive skills, especially when martial arts were integrated with other modalities such as music or visual supports. Structured instruction, imitation, and joint attention embedded in martial arts sessions may provide a naturalistic context for communication development.

Cognitive and Executive Function: Enhancements in attention, inhibitory control, and mental flexibility were reported across several studies, particularly those involving MMA and karate. Martial arts' cognitive demands—rule-following, sequential action, and goal-directed behavior—may support executive functioning through embodied learning processes. These effects are of clinical interest given the executive deficits often observed in ASD.

These findings align with emerging literature suggesting that motor and executive deficits often co-occur across neurodevelopmental disorders. The potential link between motor coordination difficulties and broader neurodevelopmental vulnerabilities has also been recently underscored in an editorial by Esposito et al. (2025), which discusses overlapping pathophysiological mechanisms in developmental coordination disorder (DCD) and epilepsy—highlighting shared deficits in motor and executive functioning as well as psychosocial outcomes.

Sleep and Psychosocial Functioning: Some studies have explored indirect outcomes, including sleep quality, caregiver stress, and family bonding. Interventions involving parental

Table 2. Summary of effects by martial-arts modality and outcome domains in children with ASD

Martial Art	Motor Skills	Social Functioning	Communication	Executive Function	Sleep / Psychosocial
Karate	✓✓ (Ansari, Maussier)	✓✓ (Greco, Maussier)	✓ (Bahrami)	✓✓ (Greco, Phung)	χ
Judo	✓ (Pierantozzi)	✓✓ (Garcia, Rivera)	χ	χ	✓✓ (Garcia, Morales)
Taekwondo	✓✓ (Kim, Mok)	✓ (Mok)	✓ (Mok)	χ	χ
Mixed Martial Arts (MMA)	χ	✓✓ (Phung)	✓ (Phung)	✓ (Phung)	χ
Tai Chi Chuan	✓ (Sarabzadeh)	χ	χ	χ	χ
Other/Innovative (e.g., rhythmic cueing, tech-assisted)	✓ (Yip, Bittner)	✓ (Amonkar)	✓ (Amonkar)	✓ (Amonkar)	χ

Legend: ✓ = improvement reported in at least one study; χ = no improvement reported or not assessed; ✓✓ = improvement reported in more than one study

co-participation (e.g., judo) were associated with improved sleep latency and emotional connectedness. These findings suggest that martial arts may offer broader psychosocial benefits, particularly when embedded in a family-centred or community-based approach.

Overall, the findings presented provide a compelling rationale for incorporating martial arts into ASD interventions. A more thorough understanding of long-term outcomes and underlying mechanisms, however, remains an important goal for future research.

Conclusions

This scoping review supports the growing view that martial arts represent a promising, multidimensional intervention for children and adolescents with Autism Spectrum Disorder (ASD). Across a range of structured programs, evidence indicates improvements in motor coordination, social interaction, communication, and executive functioning. Family-based interventions also appear to confer psychosocial benefits for caregivers, enhancing emotional connection and household cohesion.

The unique combination of physical engagement, behavioral structure, cognitive challenge, and social interaction embedded in martial arts may explain their wide-ranging effects. These findings support the integration of martial arts into educational, therapeutic, and recreational contexts as part of a holistic approach to neurodevelopmental care.

Nonetheless, methodological limitations—including small samples, heterogeneity in design, and limited longitudinal data—call for more rigorous, multisite trials. Future studies should aim to refine program protocols, explore neurobiological mechanisms, assess the sustainability of effects, and evaluate innovative delivery formats such as tech-assisted tools and video modelling. Martial arts should therefore be considered an evidence-informed, versatile strategy within multidisciplinary support frameworks for individuals with ASD.

Conflict of Interest

The authors declare no competing interests.

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Ефективність застосування інтервенцій із бойових мистецтв при розладах аутистичного спектра: Огляд предметного поля

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 7 с., 2 табл., 1 рис., 29 джерел.

Історія питання. Розлад аутистичного спектра (РАС) — це нейророзвитковий стан, що характеризується труднощами в соціальній комунікації, обмеженими інтересами та проблемами з руховою координацією. Останнім часом структуровані програми фізичної активності, зокрема бойові мистецтва, привертають увагу як перспективні додаткові інтервенції для молоді з РАС.

Мета дослідження. Мета представленого огляду предметного поля полягала у мапуванні та синтезі емпіричних даних щодо застосування інтервенцій із бойових мистецтв для осіб віком 6–18 років з РАС.

Матеріали та методи. Проведено систематичний пошук у наукометричних базах даних PubMed, Scopus та Web of Science у період з січня по березень 2025 року.

Результати. Після перегляду 89 записів та застосування ретельних критеріїв відповідності (щодо дизайну дослідження, діагнозу, вікового діапазону та розміру вибірки ≥10) до аналізу було включено лише два дослідження. В обох дослідженнях повідомлялося про статистично значуще поліпшення координації рухів та рівноваги після проходження структурованих програм із бойових мистецтв, зокрема карате ката (n = 30) і тайцзіцюань (n = 18). Однак було відзначено методологічні обмеження, як-от відсутність сліпого методу та невеликий розмір вибірки. Ширший літературний огляд підтверджує додаткові переваги бойових мистецтв щодо соціальної залученості, виконавчих функцій, емоційної регуляції та показників батьківського впливу, проте обидва включені дослідження не охоплювали зазначені чинники впливу.

Висновки. Незважаючи на обмежену кількість відповідних РКД, наявні дані свідчать про те, що застосування інтервенцій із бойових мистецтв може принести значну користь з точки зору розвитку дітей та підлітків з РАС у багатьох сферах. З метою підтвердження та розширення отриманих результатів необхідне проведення подальших добре розроблених та ретельних досліджень.

Ключові слова: розлад аутистичного спектра (РАС), бойові мистецтва, карате, тайцзі, рухова координація, нейророзвиткові розлади (НРР).

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