

**LITERATURE REVIEW:
Social and fitness results after martial art and JUDO
activities for children with autism spectrum disorder.**



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Introduction

Autism Spectrum Disorder (ASD) is a developmental disorder that involves deficits in social interaction, communication and behaviour. Many studies have pointed to the tendency for children with ASD to experience difficulties with motor and sensory skills in the early stages of their development. Research has also shown that those with ASD are at risk of physical inactivity due to social and behavioural problems (Bricout et al., 2018). In fact, studies have shown that people with ASD tend to spend less time on physical exercise (Healy et al., 2018) and to display poorer motor skills and physical conditioning than their peers who develop more typically (Pan, 2014; Tyler et al., 2014). It has been well established that physical activity is highly beneficial to people with ASD. In recent years, a number of researchers have attempted to quantify the effects of physical exercise on the motor skills of people with ASD and to sketch recommendations for professionals who work with this population (Sam et al., 2015; Sowa & Meulenbroek, 2012). Elsewhere, researchers have published meta-analyses and review articles confirming the potential for physical activity to enhance the social relations and communication skills of people with this disorder (Bremer et al., 2016; Healy et al., 2018; Howells et al., 2019). In general, this literature shows that physical exercise can lead to improvements in the everyday social interactions between children with ASD and their classmates, parents, siblings and teachers.

Despite the clear developmental benefits that people with ASD can gain from physical activity, many children with the disorder have a relatively sedentary lifestyle. Therefore, it seems clear that there is potential to expand the benefits of physical activity to a greater swath of this population. It is believed that in the long term this could reduce the group's levels of mortality and morbidity associated with chronic adult diseases such as cardiovascular dysfunction and obesity (Bricout et al., 2018; McCoy et al., 2016). In the shorter term, it is thought that increased physical exercise could lead to a decrease in functional difficulties, including behaviours like hyperactivity, aggression and self harm that are common in this population (Bricout et al., 2018). Unfortunately, though, individuals with ASD often face obstacles that make it difficult for them to engage in higher levels of physical activity under normal circumstances. The efforts of children with ASD to take part in sports are often cut short because of behavioural problems, motor skill deficits or a lack of trained instructors.



These complications increase the likelihood that people with ASD will continue to lead a sedentary lifestyle. In order to prevent this, it is critical to find research tools to gather information on successful experiences of physical activities for people with ASD and on how to promote the enjoyment of sports among this population. This would allow for the creation of physical fitness programmes that are better adapted to the needs of this group. In fact, there are already a number of such programmes aimed exclusively at people with ASD, including a range of physical activities and sports initiatives with the goal of enhancing the social skills and quality of life of this group. Zhao and Chen (2018) found significant benefits in terms of improved social and communication skills in children with ASD who had taken part in a structured adapted physical activity programme. Elsewhere, another therapeutic sports programme also led to significant improvements in social interaction and communication abilities (Duffy et al., 2017). Meanwhile, Najafabadi et al. (2018) found that participation in a selected group exercise regime known as Sports, Play and Active Recreation for Kids (SPARK) was beneficial for the motor and behavioural skills of children with ASD. Participation in a swimming programme was found to offer benefits in terms of improved social relations, and these improvements remained intact six months after the intervention (Zanobini & Solari, 2019). Yet another study suggests that the use of an entertainment programme based on golf helped enhance the scores of people with ASD on a whole range of measurements of communication, social, motor and self-regulation skills (Shanok et al., 2019).

A number of researchers have looked more specifically at the use of adapted martial arts activities for people with ASD. All have found positive benefit. This review has been conducted underlying the social and physical-fitness effects of Martial Art and Judo activities on individuals with ASD. The aim of this analysis is to describe the typology of the exercises and methodology used and the results obtained.

Method

This review examined the scientific studies that focused on Martial Art activities in general, and in Judo interventions in particular, designed to support children with ASD.

Search procedures

Searches were conducted in Pubmed electronic database, and data from the



bibliographic collections MEDLINE, SCOPUS, Web of Science. Publication year was not restricted, but search was limited to studies. The words in each string were associated with the Boolean operator “or”. The strings were interconnected by the Boolean operator “and”. The first set contained words and phrases related to intellectual disability and the like (“intellectual disability” or “mental retardation” or “learning disability” or “developmental disability” or “autism” or “mental illness” or “special needs” or “cerebral paralysis” or “brain injury”). The second set contained words and phrases related to judo and the like (“judo” or “adaptive judo” or “inclusion in sport” or “g-judo” or “judo for all” or “sport for all”). The keywords “Martial Art” “Combat Sport” and “Judo” were paired with “autism”, “Asperger”. This search procedure was conducted up to July 2020.

Selection criterion

For this review, we used two inclusion criteria: 1) the study had to contain at least one participant with ASD diagnosis 2) the physical exercise activity used to support the subject had to be Martial Art typology.

Results

The evidence shows that participating in these sports can be effective, especially when it comes to enhancing motor skills (Kim et al., 2016; Sarabzadeh et al., 2019), but also in terms of social behaviour. For example, a study of karate participants found they displayed significant improvements in stereotypical behaviour and social interaction (Bahrami et al., 2012; Movahedi et al., 2013). It seems that the stereotyped techniques (Kata) present in some Martial Art, like Karate, are very effective to decrease stereotypy in individuals with ASD (Bahrami et al. 2012). Martial arts may be especially appealing to people with ASD because of the repetitive structure of the exercises involved (Bell & Allen, 2016). Aikido has been found to reduce the symptoms of children with ASD associated with social relations, physical abilities and communication behaviours (Polak et al., 2019). Recent pilot programmes designed to study the effects of participation in judo on children with ASD have yielded initial results that point toward some psychosocial improvements (Burrell Jr, 2019). It is worth highlighting here that martial arts training involves moderate to high intensity physical exercise, coupled with a mental component (Garcia et al., 2019). These programmes also seem to represent an effective



way to promote moderate to high intensity physical activity among members of this population and to curb their tendency toward a sedentary lifestyle (Garcia et al., 2019). The high intensity exercise are beneficial to reduce more effectively than moderate intensity the stereotypic behaviours in individuals with autism (Levinson & Reid 1993). The literature shows that the primary objective of most sports programmes aimed at people with ASD is to reduce the prevalence of sedentary behaviour (Healy et al., 2017). This is necessary because the patterns of communication difficulties, anxiety and lack of social interaction that are typical of this population tend to be associated with low levels of participation in moderate to high intensity physical activities and with greater amounts of time spent engaging in sedentary behaviours (Srinivasan et al., 2014). Martial Art activities adapted to ASD people seem to be very effective to improve motor skills as balance (Kim et al 2016, Sarabzadeh et al 2019), motion coordination (Sarabzadeh 2019), and rhythm and breathing technique (Barhami 2015).

Conclusions

The literature review on inclusion in judo, inclusion of people with intellectual disabilities can be roughly divided into 3 subgroups.

The social perspective covers the importance of equal integration of judokas with various abilities in regular sports clubs and the possibility to use the results of research projects in the specific educational system for the disabled children and also the popularization of judo for all, integration and socialization of people with intellectual disabilities.

The medical and psychological aspect points to the impact of judo on certain psychophysical characteristics of people with autism disorder and ADHD and exposes the health promotion of people with special needs through judo.

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Author(s) (year)	Martial Art	Title	SAMPLE duration/ frequency	"General" Test	Training Protocol	Conclusion/Evidence of Benefit
Paul et al.(2011)	Aikido	Teaching Aikido to Children with Autism Spectrum Disorders.				
McKeenan et al. (2012)	Mixed Martial Art	The art of martial behavior: Using martial arts as a behavioral intervention for children with autistic spectrum disorders	2 boys; 8-15 years one year, once per week	Children Behavior Checklist; GARS-2	This type of training included but was not limited to Muay Thai, Taekwondo, wrestling, Judo, and Ju Jitsu martial arts based techniques. Cardiovascular workout. Each class began with a light cardiovascular workout which typically lasted 15 minutes and included several activities. Students began the class by running around the mat. Students were encouraged at least to jog. During the run the instructor asked the students to perform various exercises, such as side-to-side steps, crab walks, bear crawls, pushups, and sit-ups. The students were encouraged to do their best and participate during the activities. Striking exercises, majority of the activity: 1) Front kick, 2) low and high round kick, 3) Side kick 4) Back kick, 5) Jabs, 6) Cross, 7) Elbows, and 8) Spinning back fist. Special exercises: These included obstacle courses, breaking boards, and team play exercises such as tug of war.	There was indication of clear and significant improvement in all measured skills demonstrated by subject 1 (Alpha). Subject 2 (Bravo) did not demonstrate improvement in any of the measured skills over the six weeks of the course.



Barhami et al. (2012)	Karate	Kata techniques training consistently decreases stereotypy in children with autism spectrum disorder	30 (15 experimental 2F-13 M, 15 control 2F-13M), dai 5 ai 16. Asd severity da 18 a 85 14 weeks, 4/sett,	GARS-2 (pre-post, 1 month follow up)	15 trainers (20 hours of ASD training) to teach 4 time/week in one to one situations	Kata reduce stereotypies
Chan et al. (2013)	Nei Yang Gong	A Chinese mind-body exercise improves self-control of children with autism: A randomized controlled trial				
Movahedi et al. (2013)	Karate	Improvement in social dysfunction of children with autism spectrum disorder following long term Kata techniques training	31 (15 experimental 2F-13 M, 15 control 2F-13M), dai 5 ai 16. Asd severity da 18 a 85 15 weeks, 4/sett,	GARS-2 (pre-post, 1 month follow up)	16 trainers (20 hours of ASD training) to teach 4 time/week in one to one situations	Kata reduce stereotypies
Hefley et al. (2015)		Martial Arts as a Behavioral Treatment Modality for Children on the Autism Spectrum				



Bahrami et al. (2015)	Karate	The Effect of Karate Techniques Training on Communication Deficit of Children with Autism Spectrum Disorders	31 (15 experimental 2F-13 M, 15 control 2F-13M), dai 5 ai 16. Asd severity da 18 a 85 15 weeks, 4/sett,	GARS-2 (pre-post, 1 month follow up)	16 trainers (20 hours of ASD training) to teach 4 time/week in one to one situations	Kata reduce stereotypies
Kim et al. (2016)	Taekwondo	Effects of Taekwondo intervention on balance in children with autism spectrum disorder	14 ASD children; 8 male TKD groups 6 (5m, 1f) control , 6 to 14 years old 8 weeks, 2 times per week, 50 min	Antropometric		TKD improve balance
Bell et al. (2016)	Martial Art	Using Martial Art to address Social and Behavioral Functioning in Children and Adolescent with ASD				



<p>Tomey et al. (2017)</p>	<p>Judo</p>	<p>Effects of a Modified Judo Program on Psychosocial Factors in Typically Developing and Children with Autism Spectrum Disorder: a Mixed-Methods Study.</p>	<p>10 (5TD;5ASD); 8-11 yrs 5 weeks; 2 session per week</p>	<p>PA self efficacy; PA enjoyment; PA barriers</p>	<p>Each session occurred in 50-minute bouts and consisted of a warm-up and stretching session, followed by a series of solo and partner-oriented judo exercises of moderate to vigorous intensity. The study participants began their introduction to judo by learning formal opening/closing procedures (i.e.: bowing procedures), how to put on and care for their judo gi (uniform), and a variety of basic body weight exercises. As the participants advanced through the program they learned how to fall safely, move effectively with a partner, balancing/unbalancing strategies, and standing-based (foot sweeps) judo techniques. Each session closed with a cool-down and mind-body exercises to encourage self-regulation and reflection.</p>	<p>For pre and post psychosocial measures, no significant differences existed between PA self-efficacy, PA enjoyment , and barriers to PA (p=.27).</p>
<p>Polak et al. (2019)</p>	<p>Aikido</p>	<p>An Aikido-based intervention supporting the therapy of a child with autism spectrum disorder-a case study</p>	<p>1 boyASD high function, from 8 to 17 years old every year from 2013 to 2017: 10 days Aikido Camp</p>	<p>Likert scale</p>		<p>improvement in all areas</p>



Burrell (2019)	Judo	The Effects of an 8-week Judo Program on the Psychosocial Factors of Children Diagnosed with Autism Spectrum Disorder	33 (17M, 3F), 12.32 ± 3.04 8 weeks; 1 per week, 45 min	Demographic Information, health information and the child's diagnosis. Self-reported Physical Activity and Screen Time: Participants were given a P	Each judo session began with a formal opening and description of the class and closed with a few minutes of mindfulness to reflect on the practice. With the progression of the sessions, participants learned how to safely fall, move with partners, balancing/unbalancing strategies and other important judo techniques.	significant changes in PA enjoyment, exercise motivation and athletic self competency from baseline to following the 8-week program. There was a significant, positive correlation found between judo attendance and self-reported motivation to Additionally, there was a positive correlation found between judo attendance and the number of MVPA days per week
Garcia et al. (2019)	Judo	Brief Report: Preliminary Efficacy of a Judo Program to Promote Participation in Physical Activity in Youth with Autism Spectrum Disorder				
Phung et al. (2019)	Mixed Martial Art	Promoting Executive Functioning in Children with Autism Spectrum Disorder Through Mixed Martial Arts Training				



<p>Renziehausen (2019)</p>	<p>Judo</p>	<p>The Effects of a 10-week Judo Program on Cortisol and Stress in Children with Autism Spectrum Disorder</p>	<p>20 (15M, 5F), 12.8 ± 2.8 10-week judo program. Participants were offered the option to attend sessions once (N = 14) or twice (N = 6) a week for 45 minutes each.</p>	<p>Demographic;BMI;Accelerometer; Salivary Cortisol test;Stress Survey Schedule</p>	<p>Participants learned a variety of judo skills and techniques, focusing on self-awareness. Each session followed a similar structure and began with an appropriate warm-up, followed by both individual and partner-centered judo exercises, and then proper cool down.</p>	<p>A total of 15 participants were included in the baseline analysis. Negative correlations existed between sleep efficiency and the SSS subscales unpleasant stress and food-related stress. Similarly, total sleep time was negatively associated with changes , unpleasant stress , and food-related stress. Pre-Post Stress (SSS): A total of 14 participants were included in this analysis. There were no significant differences, however, trends existed for the subscales changes and unpleasant , with decreases observed post-intervention for both. Cortisol: A total of 12 participants were included in this analysis. Participants were split into age groups: younger (8-12 years) and older (13-17 years). No significant chronic × age interactions were noted. No significant acute × age interactions were noted, although a trend existed indicating that cortisol levels were decreased after one session of judo for older children. A large effect size is noted for acute.</p>
<p>Renziehausen 2019</p>	<p>Judo</p>	<p>Effects of a 10-week judo program on cortisol and stress in children with autism spectrum disorder</p>	<p>10-week judo program, 20 children with ASD, mixed-methods convenience sample of 11 adolescents and 9 children,</p>	<p>Stress Survey Schedule, Actigraph GT9X accelerometers</p>		<p>Acute changes in cortisol levels may be seen following one session of judo. Subscales of the parent-reported questionnaire may also show improvements following 10 weeks of participation in a judo program.</p>



<p>Sarabzadeh (2019)</p>	<p>Tai Chi</p>	<p>The effect of six weeks of Tai Chi Chuan training on motor skills of ASD children</p>	<p>18M (9 SG;9 CG); 6-12 years 6 weeks; 60min*3 times week</p>	<p>GARS 2</p>	<p>This protocol was designed to reinforce fundamental skills such as balance, physical fitness, body awareness, neural control, and proprioceptive coordination. Each training session consisted of a 10-min warm-up, 40 min practicing basic Tai Chi Chuan forms, and a 10-min cool-down. The control group did not carry out any regular exercise training during the study period.</p>	<p>A significant difference was observed in ball skills and balance variables between the groups; also, a noticeable difference was observed between pre-test and post-test scores of ball skills) and balance variables in the experimental group; whereas no significant difference was reported between pre-test and post-test scores in these variables in the control group. In regards to the manual dexterity variable, no considerable difference was seen between groups; likewise, there was no significant difference between pre-test and post-test scores in the experimental and control groups based on dependent t-test results. Finally, the total mean-based results interestingly represent a noticeable difference between pre-test and post-test in both experimental and control groups, which significantly show that control group results were in a negative direction and their motor skill disorders significantly increased in the post-test, compared to the pre-test stage.</p>
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Rivera (2020)	Judo	Effects of an 8-Week Judo Program on Behaviors in Children with Autism Spectrum Disorder: A Mixed-Methods Approach	33 children (ages 8-17) 8-week judo program (45 minutes, 1x week).	Questionnaires; measurement of sleep quality: actigraph GT9X accelerometers; a modified version of the Aberrant Behaviour Checklist (ABC).		A strong association between class attendance and lower ABC scores were observed, along with improvements in moderate to vigorous physical activity (MVPA) and sleep quality. Future studies should include larger samples of youth with ASD over a longer intervention period
Garcia et al. 2020	Judo	Efficacy of a judo program to promote physical activity in youth with autism spectrum disorder	14 youth (ages 8-17) with a formal diagnosis of ASD 8-week judo program (45 minutes, 1x week).	Demographic questionnaire; calibrated standard medical scale (439 Physician Scale; Detecto, Webb City, MO);	Two measures were used to assess the effects of the program on moderate-to-vigorous physical activity (MVPA) and sedentary behaviour (SB): (1) changes in objective measures of MVPA and SB and (2) continued participation in a second judo program (or similar program); physical activity and sedentary	Participants attended the majority of the judo sessions and 50% of the sample continued participation results showed favourable increases in MVPA
Greco (2020)	Karate	Effect of Karate training on social, emotional, and executive functioning in ASD children				