

The University of Akron

IdeaExchange@UAkron

Williams Honors College, Honors Research
Projects

The Dr. Gary B. and Pamela S. Williams Honors
College

Spring 2023

The Effects of Exercise on Adolescents with Autism Spectrum Disorder

Julia Hofacker
jkh74@uakron.edu

Follow this and additional works at: https://ideaexchange.uakron.edu/honors_research_projects



Part of the [Speech Pathology and Audiology Commons](#)

Please take a moment to share how this work helps you [through this survey](#). Your feedback will be important as we plan further development of our repository.

Recommended Citation

Hofacker, Julia, "The Effects of Exercise on Adolescents with Autism Spectrum Disorder" (2023). *Williams Honors College, Honors Research Projects*. 1649.

https://ideaexchange.uakron.edu/honors_research_projects/1649

This Dissertation/Thesis is brought to you for free and open access by The Dr. Gary B. and Pamela S. Williams Honors College at IdeaExchange@UAkron, the institutional repository of The University of Akron in Akron, Ohio, USA. It has been accepted for inclusion in Williams Honors College, Honors Research Projects by an authorized administrator of IdeaExchange@UAkron. For more information, please contact mjon@uakron.edu, uapress@uakron.edu.

“The Effects of Exercise on Adolescents with Autism Spectrum Disorder”

Honors Research Project

Author: Julia Hofacker

Sponsor: Dr. Scott Palasik, PhD, CCC-SLP

April 21, 2023

Table of Contents

Abstract	3
The Effects of Exercise on Adolescents with Autism Spectrum Disorder	4
Comparison of Adolescents with Autism to Typically Developing Peers	4
Barriers to Physical Activity for Adolescents with Autism	5
Autism Spectrum Disorder and Swimming	6
Autism Spectrum Disorder and Surfing	7
Autism Spectrum Disorder and Aikido	8
Autism Spectrum Disorder and Yoga	9
Autism Spectrum Disorder and Golf	10
Autism Spectrum Disorder and Running	11
Autism Spectrum Disorder and Basketball	12
Proposed Exercise Therapy Plan	14
Discussion	14
Future Research with Proposed Therapy Plan	16
Conclusion	20
Acknowledgements	20
References	22

Abstract

This Honors Research Project will look at the impact of various types of exercise on the speech, language, and behavior of adolescents with autism spectrum disorder. The goal of this research project is to determine how exercise can be implemented into speech and therapy programs in order to better improve the communication skills of adolescents with autism spectrum disorder. To accomplish this, recent studies and publications will be analyzed to compare traditional therapy methods and therapy methods that include exercise. These studies will provide data on how various types of exercise impacted adolescents with autism spectrum disorder speech, language, behavior, and communication. Along with this, information on the common characteristics about the diagnosis, how many people are affected, and how it impacts speech and language development, and behavior will be provided. Based on this research, a speech and language therapy program will be created. The newly developed therapy program will include traditional methods of therapy along with exercise that has been proven to benefit adolescents with autism.

The Effects of Exercise on Adolescents with Autism Spectrum Disorder

Autism spectrum disorder (ASD) is a developmental disability that affects about 1 in 36 children, and has an impact on the way individuals communicate, learn, interact with other people (Prevalence and Characteristics of Autism Spectrum Disorder, 2023). Based on the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), the Centers for Disease Control (CDC) stated the deficits that must be present in all three areas of social communication and interaction to diagnose a child with ASD (Diagnostic Criteria Autism Spectrum Disorder, 2022). These include deficits in social-emotional reciprocity, deficits in nonverbal communicative behaviors, and deficits in developing, maintaining, and understanding relationships. Examples of these deficits based on the DSM-5 criteria according to this article include reduced sharing of interests or emotions, abnormalities in use of eye contact and body language, and absence of interest in peers. Additionally, for an ASD diagnosis based on the DSM-5 the Center for Disease Control (CDC) stated that the child must demonstrate a minimum of two of the four restricted, repetitive behaviors. These behaviors are stereotyped or repetitive motor movements, insistence on sameness, fixated interests that are of an abnormal intensity, and hyper or hypoactivity to sensory input. Further, the CDC explained that based on the DSM-5 these symptoms must be present in the early developmental period, these symptoms cause a clinically significant impairment in functioning, and these symptoms are not better explained by an intellectual disability (Diagnostic Criteria Autism Spectrum Disorder, 2022).

Literature Review

Comparison of Adolescents with Autism to Typically Developing Adolescents

The Effects of Exercise on Adolescents with ASD

Physical activity is an essential component of a healthy lifestyle. The CDC states that adolescents should engage in 60 minutes of physical activity every day (McCoy et al., 2016). Further, the authors wrote that the U.S. Department of Health and Human Services stated that as children age, their time spent participating in physical activity declines, and their time spent engaged in sedentary behaviors, such as watching television, increases. They also found from the National Health and Nutrition Examination Survey 2003-2004, only 8% of children 12-15 years old met the physical activity guidelines for children.

The authors further suggested there are far less opportunities for adolescents with ASD to participate in physical activity due to their difficulties engaging in social interactions, building, and maintaining relationships. When compared to their typically developing peers, adolescents with ASD are 74% less likely to have participated in a sport in the past 12 months, as seen in the survey conducted by McCoy et al. Along with this, despite the similar amount of screen time per day, adolescents with ASD were 27% more likely to be overweight, and 72% more likely to be obese compared to typically developing adolescents (McCoy et al., 2016).

Barriers to Physical Activity for Adolescents with Autism

Adolescents with ASD often do not engage in physical activity because of the many barriers they face. Past observations and interviews with adolescents with ASD and caregivers have provided insight into the difficulties surrounding physical activity. Hickingbotham et al. (2021) suggested a barrier that prevents those with ASD from participating in physical activity is their difficulties engaging in social interactions. Many activities that typically developing adolescents partake in are group or team oriented. According to this article, those with ASD tend to socially isolate themselves, and their peers may exclude them due to the fact that they do not understand their disabilities. When in school, adolescents have the opportunity to attend a

The Effects of Exercise on Adolescents with ASD

physical education class at least one time a week. The authors further suggested that this can be difficult for those with ASD due to sensory overstimulation. For example, there is a lot of movement and loud sounds that may echo in a gymnasium, which can be overwhelming for any individual with ASD. Lastly, they also suggested that many caregivers, teachers, and staff are not properly trained on how to work with those that have ASD. In the United States, 38 of the 50 states do not require more than one class on the topic of teaching physical education to students with disabilities (Piletic & Davis, 2010). Only 20% of the physical education teachers included in a survey conducted by Piletic & Davis considered themselves very competent in the Adapted Physical Education National Standards (APENS), which is used to educate those with disabilities.

In a study by Müller et al. (2008), the researchers were able to interview individuals that had either ASD or a form of Asperger syndrome (AS). The purpose of this study was to analyze these individual's past social experiences and get their perspective on how to improve social connectedness for those with ASD and AS. The authors suggested that one of the major barriers that was reported among the interviewees was isolation and difficulty initiating socialization. These feelings began when they were young as they watched other children play together, but could not understand how to join in. These feelings continued through adolescence and adulthood as they still struggled to initiate conversations and knew that they were different from other people. Another common barrier seen in the study was their difficulty understanding emotional inferences, gestures, and tone of voice. The authors concluded that this made communicating with classmates, peers, and larger groups a dreadful experience.

Autism Spectrum Disorder and Swimming

The Effects of Exercise on Adolescents with ASD

According to Pan (2010), aquatic-based activities can be improve social skills and motor performance. The author researched the effects of a water exercise swimming program (WESP) on adolescents with ASD. In this study, there were 16 male participants with ASD that were randomly assigned to either Group A or Group B. This study was conducted in two phases, with each phase lasting 10 weeks. For the first phase, Group A participated in a WESP while Group B did not. In the second phase, Group B participated in the WESP while Group A did not. Between phase one and phase two, there was one week for transition. To implement the WESP, there was one instructor for every two children with ASD. The program began with 20 minutes of floor activities, 40 minutes of one-to-two instruction, 20 minutes of group activities, and ended with 10 minutes of cool down activities. To evaluate the effectiveness of the WESP, the author collected data prior to beginning the program to serve as a baseline, after phase one, and after phase two. The School Social Behaviors Scales (SBBS-2) was used to assess the participants' social skills. Based on the data collected in this study, Group A had significantly lower scores in irritable, disruptive, and hostile behaviors after completing the WESP. The author reported that disruptive, hostile, and irritable behaviors decreased by seven points following the WESP. However, there was not a statistically significant increase in social competence behaviors following the WESP. These same differences were seen in Group B after completing the WESP in phase two of the study. It was also noted by the author that there was no significant change seen in the participants' social skills following the phase they did not participate in the WESP. This indicated that the WESP intervention provided sustainability for at least 10 weeks for individuals with ASD. Having decreased disruptive and hostile behaviors can make it easier to participate in group events or activities, promoting interaction with more peers (Pan, 2010).

Autism Spectrum Disorder and Surfing

The Effects of Exercise on Adolescents with ASD

A study conducted by Clapham et al. (2018) examined the effects of surfing on an 8-year-old male that had ASD. The surfing program occurred for eight weeks in the summer for six years. Prior to the study, the participant could follow directives, had a low attention span to activities he was not interested in, and had limited communication and social skills. Despite the lack of social communication skills, the participant had an excellent vocabulary, and excelled academically. Physically, the participant had low muscle tone and hyper flexibility. This study paired adolescents with a swim instructor for each of the surfing lessons. The instructor made lesson plans for each session designed for specific goals such as paddling, balancing on a surfboard, or catching a wave. After each year of completing the surfing program, the mother of the participant answered questions pertaining to the program's effectiveness on her son's behavior. The mother noted an improvement in her son's confidence as he went through the program. These behavioral changes have encouraged him to participate in other school and group physical activities, such as the Special Olympics. Surfing was also calming for the participant as the ocean provided white noise and is a repetitive activity which prevented the participant from being overstimulated (Clapham et al., 2018). The changes in these behaviors were significant because as seen in the DSM-5, individuals with ASD experience an absence of interest in peers and hypo or hyperactivity to sensory input (Diagnostic Criteria Autism Spectrum Disorder, 2022). By participating in an activity that decreased these deficits, individuals with ASD can begin to work on communication in group settings.

Autism Spectrum Disorder and Aikido

A study conducted by Polak et al. (2019), looked at the effects of an aikido program on a 16-year-old male that was diagnosed with ASD. The aikido program was a 10-day camp that consisted of two 90-minute classes each day. The participant began attending these camps when

The Effects of Exercise on Adolescents with ASD

he was 12-years old and attend the camps from 2013-2017. When starting the camp, the participant had communication deficits. It was difficult for the participant to interact with peers in group and tended to display stereotypical behaviors when in stressful situations. These behaviors included screaming, crouching, swinging, and waving his arms. He also had deficits in his balance and coordination. Each class followed the same structure, which began with a moment for the students to close their eyes and calm their thoughts. Then, the class spent 30 minutes imitating the teacher practicing individual gymnastics, 30 minutes practicing the basic elements of aikido, and 30 minutes practicing aikido techniques with a wooden stick. To evaluate the participants' progress, the authors used a 5-point scale to rank the boy's symptoms that were present when he began the program. A rank of 1 on the scale meant that the symptoms was displayed with a significant intensity, and a rank of 5 meant that there was a significant reduction in symptom that was previously displayed. After completing the aikido camps, it was observed that the participant became more comfortable and found it easier to participate in his peer group. The participant's parents and researchers observed the boy's ability to better express his emotions, accept changes to his environment, and a slight improvement in reading body language. Polak et al. (2019) suggested that this meant that there was a decrease in stereotypical behaviors seen, especially in social situations (Polak et al., 2019). Although individuals with ASD may experience deficits in nonverbal communication, sensory input, and sharing of emotions according to the DM-5 as seen in Diagnostic Criteria Autism Spectrum Disorder (2022), reducing the severity of these symptoms may make it easier for individuals with ASD to engage with other children. Individuals with ASD may be more likely to be accepted by their peers, improving their ability to build make friends and form relationships (Polak et al., 2019).

Autism Spectrum Disorder and Yoga

The Effects of Exercise on Adolescents with ASD

According to the American Osteopathic Association, yoga is a physical activity that has been shown to improve emotion control, attention, and resistance to the effects of stress (The Benefits of Yoga, 2021). Sotoodeh et al. (2017) set out to study the effects of a yoga training program on the communication, sociability, awareness, and behavior of adolescents with ASD. There were 29 participants in this study between the ages of 7 and 15. Along with this, there was a control group that did not participate in the program, but rather normal daily activities. The yoga program lasted 8 weeks, for a total of 24 sessions, with each session lasting 30 minutes. Three trainers that were certified to work with children with ASD conducted the yoga sessions. Each trainer would demonstrate a pose, and then have the children perform the pose. The Autism Treatment Evaluation Checklist (ATEC) was used to collect baseline data, and follow-up data after the program. The higher the score is on this scale; the more severe an individual's ASD is. This checklist was completed by the parents, teachers, or primary caretakers of the child. The researchers determined the results were not statistically significant for speech and language; however, the results were statistically significant for sociability, awareness, and behavior. Specifically for sociability, the experimental group had a 13% decrease in sociability scores on the ATEC compared to a 0.8% decrease in the control group (Sotoodeh et al., 2017). Individuals with ASD struggle to use eye contact, body language, or show interest in their peers (Diagnostic Criteria Autism Spectrum Disorder, 2022). Participating in yoga may aid adolescents with ASD relate to their peers and help them communicate better with their peers.

Autism Spectrum Disorder and Golf

Shanok et al. (2019) conducted a study through the Ernie Els #GameON Autism Golf Program. This program had 12 group lessons that lasted for 45 minutes each. The purpose of this program was to not only teach individuals with ASD the game of golf, but to also include

The Effects of Exercise on Adolescents with ASD

learning objectives into each lesson. These learning objectives included communication skills, regulatory skills, social skills, motor skills, asking for help, patience, sharing, responding, and following directions. Along with this, one golf objective was covered in each lesson, such as small swings, full swings, chipping, putting, ball control, aiming, and taking practice swings. In this study, each golf lesson began with a warmup, followed by reviewing the schedule, reviewing the learning objectives, taking a water break, going to the golf stations, and ending with a team meeting. To evaluate the progress made by the participants, the authors administered the same test before and after the program to evaluate their receptive, expressive, social, regulatory, and motor skills. The scores for this test were based on a 1-5 scale, lowest to highest, respectively. The scores for each category were calculated by averaging the scores of tasks that relate to each category. Improvements were seen in all categories that were tested. Specifically, the participants' social skills increased by 1.91. The researchers evaluated whether the participants waited their turn, shared equipment, maintained personal space while interacting with peers, and demonstrated sportsmanship with their peers. In addition to this testing, the researchers sent a questionnaire to the participants' teachers to see if they noticed a change in their student's behavior after completing the program. The teachers that completed the survey noted that the program had a positive impact on the individual. Specifically, the teachers noted the children's improved ability to focus, to wait, and some noted improved turn taking ability. Those with ASD struggle with developing and maintain relationships (Diagnostic Criteria Autism Spectrum Disorder, 2022). By having those with ASD participate in an activity that improves turn taking and focus, they may be able to better build rapport and understanding with their peers.

Autism Spectrum Disorder and Running

The Effects of Exercise on Adolescents with ASD

At Washington University, Marggraff & Constantino (2018) conducted a study that included adolescents with ASD, their neurotypical developing siblings, and student volunteers from the university. The participants met every Sunday for one hour eight weeks in the fall and spring seasons. In this study, each session began with stretches, followed by running, and ending with games. The child with ASD and their sibling were paired with one volunteer for the entire 8-week season to help the child with ASD build a relationship with the volunteer. Prior to beginning the study, each of the volunteers were trained on therapy techniques, characteristics of ASD, and interaction methods. To begin the 8-week season, the children with ASD ran a 400-meter timed race. This was compared to their time at the end of the season and used to track their progress. From this, the volunteers could help the participants practice setting goals. To evaluate the effectiveness of this program, the researchers sent surveys to the parents of the participants. The parents noted that this program helped to offset their child's social isolation and provided an opportunity for their child with ASD and their neurotypical developing children to bond. For many of the children with ASD, this was their only social activity besides school. The parents noticed that the participants looked forward to engaging in this group physical activity, and observed a positive change in their self-esteem as they progressed through each session. The participants were able to be engaged with their siblings and the volunteer from the university. This gave the individual with ASD experience building and maintaining relationships, which is a core deficit seen in those with ASD (Marggraff & Constantino, 2018).

Autism Spectrum Disorder and Basketball

Authors, Alp & Akin (2019), researched how adapted basketball exercises effect the development of nonverbal communication skills in children with ASD. For this study, there were two participants that were 10 years of age with mild ASD. The study was a total of 17 weeks, 1

The Effects of Exercise on Adolescents with ASD

week of observation, and 16 weeks of a basketball program. To conduct the basketball program, basketball specific skills were taught to the participants. These skills included dribbling with their left and right hands, various types of passes, smash throwing, and ball holding. In addition to this, nonverbal skills including extending their hand to another person, shaking hands with the other person, and making a handshake with the other person were selected to be taught to the participants through the program. These skills were selected for this study through observations, classroom teachers, and psychologists. To evaluate the effectiveness of the program on the development of these nonverbal communication skills, the researchers used event recording to accurately observe the number of times a behavior occurred. The numbers were then used to represent the frequency of a behavior. Never exhibiting a behavior was 0, occasionally exhibiting a behavior was 1, and always exhibiting a behavior was 2. The researchers stated that positive results were seen from the adapted basketball program. Between week 2 and week 3, both participants made a positive change of never extending their hand to the other person, to occasionally extending their hand to the other person. Between week 7 and week 8 of the program, both participants were seen always extending their hand to the other person. The participants began occasionally shaking hands with the other person between week 5 and week 6, however, they did not always shake hands with the other person consistently until week 12 and week 13. Lastly, the participants began to occasionally make handshakes with the other person between week 5 and week 6. It was not until week 11 and week 12 that the participants made handshakes with the other person consistently (Alp & Akin, 2019). Based on the DSM-5, nonverbal communication deficits must be present in order to be diagnosed with ASD (Diagnostic Criteria Autism Spectrum Disorder, 2022). Participation in an activity that lessens

The Effects of Exercise on Adolescents with ASD

the severity of the individual's nonverbal deficits can lead to improved communication and friendship building.

Proposed Exercise Therapy Plan

The table below depicts a weekly outline of an exercise therapy plan that can be utilized for an adolescent with ASD in order to improve specific social skills. This weekly therapy plan can then be repeated for a set number of weeks, or even months. This provides an adolescent with ASD an opportunity to exercise individually, and with peers to improve relationship building, sharing of emotions, understanding of body language, and initiating interactions with peers.

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Activity	Running 30 minutes with family	Yoga 60 minutes with peers and an instructor	Basketball 60 minutes with peers	Rest Day	Aikido 60 minutes with peers and an instructor	Golf 45 minutes with peers	Swimming 90 minutes with peers and an instructor
Focus of the Session	Relationship building and social communication	Nonverbal communication	Initiating interactions		Regulatory skills and emotions	Turn taking and relationship building	Regulatory skills
Research Referenced	Marggraff & Constantino (2018)	Sotoodeh et al. (2017)	Alp & Akin (2019)	N/A	Polak et al. (2019)	Shanok et al. (2019)	Pan (2010)

Discussion

In the exercise therapy plan above, certain exercises were selected because they have been shown to improve areas of social communication that individuals with ASD have difficulty with. One of the key identifiers for an ASD diagnosis is poor pragmatic skills. The exercises

The Effects of Exercise on Adolescents with ASD

used in the therapy plan have shown positive benefits on this communication area in past research. The therapy plan begins with running. As seen in the study by Marggraff & Constantino (2018), running lead to a decrease in social isolation in individuals with ASD. Running can be done with peers or family members, which can also aid in building relationships. The relationship the individuals with ASD have maintained with their sibling, and the new relationship they have built with their volunteer running partner provide them experience with relationship building they can use with peers.

Yoga was selected because it showed improvements in nonverbal communication and sociability Sotoodeh et al., (2017). The improvement in understanding body language, using eye contact, and simply showing interest in their peers can be helpful when interacting with peer groups or initiating an interaction. These nonverbal communication skills can aid those with ASD in relating to their peers and developing friendships.

Basketball was selected for the proposed program because in the study by Alp & Akin (2019), those with ASD that participated in a basketball program showed an improvement in initiating communication with another individual. By including basketball in the therapy plan, those with ASD can not only work on their pragmatic skills. This is an activity that can lessen the severity of nonverbal deficits and can be done in groups, reinforcing the idea of building relationships.

Aikido was selected for the therapy plan because as seen in the study by Polak et al. (2019), there was a significant improvement seen in self-regulatory behaviors and emotional regulation. By having improved self-regulation, adolescents with ASD can decrease their sensitivity to sensory input making it easier for them to participate in peer groups and new

The Effects of Exercise on Adolescents with ASD

environments. Additionally, by having a greater ability to share their emotions, individuals with ASD can better relate to their peers helping in building relationships.

Golf was included in the proposed therapy plan due to its benefits in turn taking skills and relationship building as seen in the study by Shanok et al. (2019). Improving skills such as turn taking can be beneficial for adolescents with ASD. This skill teaches adolescents with ASD how to share items and interact with peers. By being able to turn take, children with ASD may find it easier to play with peers in a group setting.

Lastly, swimming was selected for the proposed program above as there was a significant improvement seen in self-regulatory behaviors such as irritable, disruptive, and hostile behaviors as cited in the study conducted by Pan (2010). By being able to better self-regulate disruptive or hostile behaviors, individuals with ASD may be able to better participate in group activities with more peers. This in turn promotes relationship building and can foster the growth of communication skills.

Future Research with Proposed Exercise Plan

One research study that could be conducted using the proposed exercise program above. could include 60 participants between the ages of 8-18 years old with an ASD diagnosis. The exercise program would be implemented for a total of 16 weeks. Prior to implementing the program, a baseline test would be given to evaluate the participant's social skills. The test administered would be the Autism Treatment Evaluation Checklist (ATEC). After the program is completed, the same test would be given to the participants in order to look at the overall effectiveness of the program in these areas. In addition to this, the parents, caregivers, or teachers would complete a weekly survey to evaluate how these areas have changed at home or in the

The Effects of Exercise on Adolescents with ASD

classroom. These survey questions would address the participant's social skills. The survey would use a 1-5 ranking scale with 1 representing very poor, and 5 representing very good.

Examples of these survey questions could be:

- How does your child react to a change in schedule or environment?
- How does your child respond to loud environments?
- How well does your child follow directions at home or in the classroom?
- How well does your child initiate communication with another person?
- How well does your child maintain communication with another person?
- How well does your child respond to simple questions?
- How well does your child maintain personal space?

When implementing the exercise program, there are key points that could be emphasized throughout each session in order to maintain the focus of the session. When the participants are running with their families, it is important that the families talk and engage with their child. It is important for it to be a group or partner activity rather than the child with ASD running alone. This way, the focuses of the session, relationship building and communication, are emphasized throughout the activity.

During the yoga sessions, the instructor could demonstrate a pose and have the participants replicate the pose. The instructor would be certified to work with individuals with ASD. After working on awareness skills with individual poses, the participants could do simple partner yoga poses to encourage sociability and relationship building among their peers. As the program continues, and the participants' skills improve, the poses could gradually get more challenging. Being that the focus of the session is nonverbal communication, the instructor could

The Effects of Exercise on Adolescents with ASD

frequently remind the participants about the movement of their body in space, and use gestures when speaking to the participants in order to encourage them to use gestures.

Every week, basketball would be played with the participant's peers. This activity could be done anywhere space is available, for example, in a gym on a basketball court, or outside. The participants would work on individual basketball skills to begin the session, such as dribbling, passing, and shooting. Throughout the session and following the session, the instructor could have the participants practice initiating an interaction with one another. This could either be through the use of words, or through nonverbal communication. For example, the participants may practice waving to one another or reaching their hand out to a peer.

Similarly, to yoga, there would also be an instructor certified to work with individuals that have ASD leading the aikido sessions. The instructor would demonstrate aikido movements, and the participants could perform each movement. A large majority of these sessions would focus on individual aikido movements increasing in difficulty as the program advances, however there could still be an allotted time of each session for group or partner aikido activities. To focus on self-regulatory skills and controlling and expressing emotions, the instructor could again bring attention to breathing strategies. In addition to this, while doing the aikido activities, the instructor could talk about appropriate ways to express emotions to the participants.

The weekly golf session could take place at a local driving range. The instructor could work on various golf skills at each session such as driving, chipping, and putting. In order to emphasize the focus of the session, turn taking and relationship building, the participants could work in a group and practice sharing equipment throughout the session. Being in a small group could also encourage the participants to interact and build a relationship with their peers.

The Effects of Exercise on Adolescents with ASD

The weekly swimming session would be led by an instructor certified to teach individuals with ASD. The session could begin by allowing time for the participants to get used to going into the water. After this, time could be spent working on individual swimming skills. These will include floating, treading water, kicking, and using their arms. Following this, the instructor can practice different swimming styles with the participants. To focus on self-regulatory aspect of the session, group activities and games can be played in the water. Being in and around water aids in their emotional behavior as water is calming, and they can feel weightless through their movements.

A benefit of this proposed future study could be that not only would the participants interact with their peers, but their families would also be involved. Two of the days of exercise, running and basketball, would allow for family members to participate in the activity with their child or sibling. This could help foster a better relationship between the participants and their family members. From this proposed future study, it is hypothesized that the participants may demonstrate better self-regulatory skills, and less disruptive and hostile behaviors related to ASD. In addition to this, there is expected to be an improvement in the participant's receptive and expressive communication. The individuals with ASD may be able to better understand and follow directions. Along with this, they may be able to better engage and initiate conversations with others and regulate their emotions in stressful situations. Besides these language and behavioral benefits, this therapy program may also aid in improving the participants' physical health. Many individuals with ASD do not meet the suggested amount of physical activity per week (McCoy et al., 2016). This program could improve their cardiovascular health and support an increase in muscle mass.

The Effects of Exercise on Adolescents with ASD

To aid in the success of the program, the therapy plan could be the same weekly schedule. In addition to this, to make the individuals with ASD comfortable with participating, each exercise could follow the same routine every week. This way the individuals know what to expect from day to day. This exercise therapy plan encourages both individual and group exercise, which provides an emphasis on both social skills and relationship building.

Although this proposed future therapy plan includes only physical activity exercises, another study could be done looking into the effects of music and art therapy on the behavior and communication skills of those with ASD. Along with this, more research needs to be done on how early exercise therapies could be implemented, and the benefits of starting at a younger age.

Conclusion

In conclusion, adolescents with ASD do not have the same opportunity as typically developing adolescents to participate in physical activity. Individuals with ASD tend to struggle with their pragmatics, or social skills, making it more difficult for them to participate in group activities and communicate with others. By using an exercise therapy plan, schools, parents, and other therapy programs can use various forms of physical activity to target the behavior, awareness, sociability, emotions, attention, and language of individuals with ASD. This not only encourages those with ASD to participate in physical activity, but also provides these individuals with an opportunity to improve their communication and language skills while building relationships with others in the group.

Acknowledgements

The hard work and dedication of many people went into this research project. I would first like to thank my research sponsor, Dr. Scott Palasik. He was supportive and encouraging

The Effects of Exercise on Adolescents with ASD

throughout the entire research process. His guidance, and knowledge in the field of speech-language pathology helped me to write my first research project. The skills I have learned from Dr. Scott Palasik will be valuable as I begin graduate school and my career as a speech-language pathologist.

I would then like to thank Dr. Charles Carlin and Mrs. Jenna Day for being readers for my research project. They have been supportive of my research, and through their experience as speech-language pathologists, have given me feedback to improve my project.

Lastly, I would like to thank the Williams Honors College at the University of Akron. I am grateful for the opportunity to conduct a research project as an undergraduate knowing that this experience will help me succeed in my future studies and career as a speech-language pathologist.

References

- Alp, H., & Akin, S. (2019). The Effect of Adapted Basketball Exercises on the Development of Non-Oral Communication Skills of Autistic Children. *Journal of Education and Training Studies*, 7(10), 123-130. <https://files.eric.ed.gov/fulltext/EJ1289069.pdf>.
- Clapham, E.D., Minsuk Shim, Lamont, L.S., & Armitano, C. (2018). A Case Report Illustrating the Implementation of a Therapeutic Surfing Intervention for an Adolescent with Autism. *Palaestra*, 32(2), 49-53.
search.ebscohost.com/login.aspx?direct=true&db=c9h&AN=130206303&site=ehost-live.
- Diagnostic Criteria Autism Spectrum Disorder (2022). *Center for Disease Control and Prevention*. <https://www.cdc.gov/ncbddd/autism/hcp-dsm.html>.
- Harris, A., & Williams, J. (2017). The Impact of a Horse Riding Program Intervention on the Social Functioning of Children with Autism Spectrum Disorder. *International Journal of Environmental Research and Public Health*, 14(7), 776.
<http://dx.doi.org/10.3390/ijerph14070776>.
- Hickingbotham, M. R., Wong, C. J., Bowling, A. B. (2021). Barriers and Facilitators to Physical Education, Sport, and Physical Activity Program Participation Among Children and Adolescents with Psychiatric Disorders: A Systematic Review, *Translational Behavioral Medicine*, 11(9), 1739-1750. <https://doi.org/10.1093/tbm/ibab085>.
- Marggraff, A., & Constantino, J.N. (2018). Physical and Psychosocial Impact of a University-Based, Volunteer Student-Led Running Program for Children with Autism Spectrum

The Effects of Exercise on Adolescents with ASD

Disorder. *Journal of the American Academy of Child and Adolescent Psychiatry*, 57(12), 974-977. <https://doi-org.ezproxy.uakron.edu:2443/10.1016/j.jaac.2018.06.028>

McCoy, S.M., Jakicic, J.M., & Gibbs, B.B. Comparison of Obesity, Physical Activity, and Sedentary Behaviors Between Adolescents with Autism Spectrum Disorders and Without. (2016). *J Autism Dev Discord* 46, 2317-2326. <https://doi.org/10.1007/s10803-016-2762-0>.

Müller, E., Schuler, A., & Yates, G. B. (2008). Social challenges and supports from the perspective of individuals with Asperger syndrome and other autism spectrum disabilities. *Autism*, 12(2), 173–190. <https://doi.org/10.1177/1362361307086664>

Pan, C.Y. (2010). Effects of Water Exercise Swimming Program on Aquatic Skills and Social Behaviors in Children with Autism Spectrum Disorders. *Autism*, 14(1), 9-28. <https://doi.org/10.1177/1362361309339496>.

Piletic, C. K., & Davis, R. (2010). A Profile of the Introduction to Adapted Physical Education Course within Undergraduate Physical Education Teacher Education Programs. *ICHPER-SD Journal Of Research*, 5(2), 26-32. <https://files.eric.ed.gov/fulltext/EJ913329.pdf>.

Polak, E., Sikora, J., & Rachwal, M. (2019). An Aikido-Based Intervention Supporting the Therapy of a Child with Autism Spectrum Disorders – A Case Study. *Ido Movement for Culture Journal of Martial Arts Anthropology*, 19, 67-76. search.ebscohost.com/login.aspx?direct=true&db=s3h&AN=135515540&site=ehost-live.

Prevalence and Characteristics of Autism Spectrum Disorder Among Children Ages 8 Years – Autism and Developmental Disabilities Monitoring Network, 11 Sites, United States,

The Effects of Exercise on Adolescents with ASD

2020. (2023). *Centers for Disease Control and Prevention.*

https://www.cdc.gov/mmwr/volumes/72/ss/ss7202a1.htm?s_cid=ss7202a1_w.

Shanok, N.A., Sotelo, M., & Hong, J. (2019). Brief Report: The Utility of a Golf Training Program for Individuals with Autism Spectrum Disorder. *Journal of Autism and Developmental Disorders*, 49(11), 4691-4697. <https://doi-org.ezproxy.uakron.edu:2443/10.1007/s10803-019-04164-0>

Sotoodeh, M.S., Arabameri, E., Panahibakhsh, M., Kheiroddin, F., Mirdoozandeh, H., & Ghanizadeh, A. (2017). Effectiveness of Yoga Training Program on the Severity of Autism. *Complement Therapies in Clinical Practice*, 28, 47-53. <https://doi-org.ezproxy.uakron.edu:2443/10.1016/j.ctcp.2017.05.001>.

The Benefits of Yoga (2021). American Osteopathic Association. *American Osteopathic Association*. <https://osteopathic.org/what-is-osteopathic-medicine/benefits-of-yoga/>.