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THE PSYCHOLOGICAL BENEFITS OF A REMOTE PHYSICAL ACTIVITY  
INTERVENTION IN INDIVIDUALS WITH AUTISM SPECTRUM DISORDER

by

MADISYN TAYLOR PELCHAT

A thesis submitted in partial fulfillment of the requirements  
for the Honors in the Major Program in Biomedical Sciences  
in the College of Medicine  
and in the Burnett Honors College  
at the University of Central Florida  
Orlando, Florida

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2021

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## **ABSTRACT**

Previous studies found that individuals with Autism Spectrum Disorder (ASD) tend to demonstrate poor health behaviors, including unhealthy nutrition habits and low physical activity (PA) levels. Growing research suggests the PA can improve ASD-related symptoms and attenuate the mental and physical adverse effects of the COVID-19 pandemic. Unfortunately, the stay-at-home order was put in place because of COVID-19, which negatively affected health behaviors in many individuals with ASD, including an increase in sedentary behavior and screen time and less PA participation. Prior research also has found that young adults with ASD are at a higher risk for obesity than their neurotypical counterparts. Therefore, the purpose of this study was to examine the effects of a 12-week online physical activity intervention on exercise self-efficacy, PA enjoyment, perceived stress, and depression in young adults with ASD. A total of 10 participants (mean age: 26.5, 70% male) completed the exercise intervention, which was accessed through the Zoom platform, and occurred twice a week for 45 minutes. Results revealed a significant decrease in depression levels following the exercise intervention ( $p=0.03$ ). Although not statistically significant, there was an increase in PA enjoyment following the exercise intervention ( $p=0.08$ ). There were no statistical differences for exercise self-efficacy or perceived stress. These findings indicate that the remote-based exercise program may help to alleviate depressive symptoms in young adults with ASD. Given that recent research has found that the COVID-19 pandemic has resulted in increased depressive symptoms in young adults with ASD, the use of a remote-based exercise program may have helped to attenuate these symptoms in this population. Future research should examine larger sample sizes and compare effects of in-person vs remote-based exercise interventions.

## **DEDICATIONS**

To my parents, Melissa, and Dylan Pelchat, thank you for being my biggest supporters and always believing in me; reminding me to push through obstacles and reach my goals. Your love, support, and pride in me keeps me going every day, and I am so appreciative to have such wonderful parents. I love you both dearly.

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## **CHAPTER ONE: INTRODUCTION**

Autism Spectrum Disorder (ASD) is distinguished by social communication impairments and restricted or repetitive behavior or interests (Sanders et al., 2015). It is a neurodevelopmental disorder that displays in the first three years of a child's life (Marshall et al., 2008). Several conditions fall under this spectrum, including Asperger's Syndrome (AS) and Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS). The main characteristics of ASD include impairments of reciprocal social interactions, restricted range of behaviors and interests, and difficulties with language and communication (Marshall et al., 2008). Males are approximately four times more likely to be diagnosed with ASD than females, and over the last two decades, the prevalence of ASD has steadily increased with up to 1 in 54 children (Sharma, Gonda, & Tarazi, 2018; "Center for Disease Control and Prevention", 2020). Although individuals with ASD face many difficulties in their lives, they also excel in math, science, music, art, the ability to learn things in detail, remember information for long periods, and are strong visual and auditory learners ("Autism Spectrum Disorder", 2018).

Prior research has demonstrated the benefits of physical activity (PA) on the ASD population. Similar to typically developing (TD) individuals, individuals with ASD who participate in PA tend to have higher levels of fitness, increased bone density, increased muscle mass, and a decreased risk of obesity. Interestingly, there are some additional benefits of PA that are unique to the ASD population, including language improvements, increased social skills, and decreased levels of anxiety. Unfortunately, the majority of individuals with ASD do not meet the recommended levels of PA (30 minutes or more on most days of the week). Therefore, it is

critical that interventions to improve PA levels, particularly in young adults with ASD, be developed/investigated/considered, and implemented.

At the beginning of March 2020, many businesses, schools and universities, and organizations were forced to close due to the COVID-19 pandemic, thus limiting the opportunity to participate in PA. As the COVID-19 pandemic may exacerbate feelings of stress and uncertainty in ASD populations, it is imperative to find programs that may help to attenuate negative emotions and enable individuals with ASD to engage in social interaction. This may be particularly important for young adults with ASD, who are often at an age where there are limited opportunities and services for them. Participation in PA may be an option as PA tends to decrease anxiety levels and improve mood in individuals with ASD. Recent research has found that during the mandatory stay-at-home order, PA levels have decreased (Garcia, Lawrence, Brazendale, Leahy, and Fukuda, 2020). In contrast, screen time usage has increased in many individuals, including young adults with ASD, who are already prone to inactivity. Additionally, as the pandemic is still ongoing, in-person programs continue to be discouraged in favor of remote-delivered programs for safety reasons. Prior research shows that the ASD population prefers remote-based programs due to their high levels of anxiety and difficulties with social interaction (Garcia, Lawrence, Brazendale, Leahy, and Fukuda, 2020). Therefore, the purpose of this study is to examine the psychological benefits of a remote-based PA program in young adults with ASD. It was hypothesized that there would be a significant increase in both exercise self-efficacy and enjoyment, and a significant decrease in both perceived stress and depression.

## **CHAPTER TWO: REVIEW OF LITERATURE**

### Introduction to Autism Spectrum Disorder

ASD is a developmental disability that can cause social, behavioral, and communication issues ("Center for Disease Control and Prevention", 2020). Additional symptoms of ASD are making little or inconsistent eye contact, the tendency to not look or listen to people, rarely showing enjoyment of pointing out objects, failing to respond to their name being called, having overly focused interests, getting anxious by slight alterations in routine, and hypersensitivity to sensory input ("Autism Spectrum Disorder", 2018). Often, there is no physical distinction between individuals with ASD that sets them apart from everyone else; however, some individuals with ASD may communicate or behave differently than most people.

Scientists are determined to identify biomarkers to achieve early diagnosis to enable more initial treatment and have found that biomarkers such as brain-derived neurotrophic factor and glutamate are sensitive markers for early diagnosis of ASD (Zheng et al., 2017). Unfortunately, there are still specific biomarkers needed that are relevant only to ASD. Generally, ASD begins in the early ages of a child's life and lasts throughout the lifespan. Since there is no cure for this disorder, the economic burden on both the family and society increases, causing the global public health problem (Zheng et al., 2017).

### Health Promotion Programs for Individuals With ASD

Individuals with ASD tend to demonstrate poor health behaviors, including unhealthy nutrition habits and low levels of PA (Garcia, Lawrence, Brazendale, Leahy, and Fukuda, 2020). Although all the reasons for these poor health behaviors, a significant symptom for individuals

with ASD is anxiety, especially around people, they do not know. While there is no single best treatment for ASD, it is believed that PA and exercise radiate positive effects on mood and anxiety, and there are a significant number of studies that describe the association of PA and general well-being, mood, and anxiety (Ströhle, 2009). Most individuals with ASD are not as likely to participate in PA on their own. There are many programs for individuals with ASD; however, most do not incorporate PA as one of the core elements. Motor skill deficiencies are associated with ASD, and studies have shown that PA reduces maladaptive behaviors in individuals with autism (Sefen et al., 2020). There are many skills that individuals learn through PA, such as social interactions and having relationships with peers.

#### Obesity: Prevalence and Health Correlation

Individuals diagnosed with ASD may be at an increased risk for overweight and obesity. Obesity and overweight are defined by the body mass index (BMI) and are recognized as the presence of excess body fat or adipose tissue (Curtin et al., 2014). Obesity can cause health issues such as hypertension, sleep-disordered breathing, type 2 diabetes, orthopedic problems, and dyslipidemia (Zheng et al., 2017). Children are more susceptible to bullying and isolation if they are overweight or obese, which causes severe social problems and becomes a significant influence on these individuals' quality of life and their ability to function independently (Zheng et al., 2017).

The studies' findings suggested that children with ASD are at the same or higher risk for obesity than TD children. In recent years, scientists reported that obesity and overweight are likely to be associated with psychiatric disorders in children, such as attention deficit, hyperactivity disorder, and ASD (Zheng et al., 2017). A few studies correlate obesity with ASD;

including, a Japanese study of 140 children with ASD between the ages of 7-18, which reported that the obesity prevalence in boys with ASD was 22% and was 11% in girls. After the results of this study, more studies began to appear. One study conducted a chart review of a sample of children with ASD and found that the prevalence of overweight was 35.7%, and obesity was 19.0% (Curtin et al., 2014). The National Study of Children's Health found that children with ASD were 40% more likely to be obese than children without the disorder (Curtin et al., 2014).

### COVID-19 Impact

The first COVID-19 case in the United States was reported on January 21, 2020 and was declared a pandemic on March 11, 2020 ("Center for Disease Control and Prevention", 2020). By mid-March, states began to issue Stay-At-Home-Orders to help stop the spread of the virus. During quarantine, businesses were shut down, people were out of jobs, children were home from school, and people could not pay their rent. Suicide and depression rates significantly increased during this time due to isolation and loneliness. There was nowhere for people to go other than outside.

Being a parent with children in school during quarantine was difficult because the children were home all day rather than school. For parents with children and adolescent adults with ASD, the problem was significantly greater. Many families that have children with ASD have special therapists who work with the individual for several hours a week (Narzisi, 2020). Such drastic changes likely caused stress and anxiety for individuals with ASD because they were used to their schedule and routine and were probably comfortable with who they surrounded. Once quarantine began, they lost that connection with their caregivers or teachers, which likely took a while to build. This resulted in individuals with ASD to become depressed

and anxious. Individuals with ASD have a concrete cognitive style, and some of them struggle with verbal communication and phenomenological perception (Narzisi, 2020). In the editorial written by Narzisi (2020) about handling individuals with ASD during COVID-19, it was stressed that parents should explain to their child with ASD what COVID-19 is and the reasoning for having to stay home, but simply and concretely (Narzisi, 2020). Adolescent adults with ASD excel in their daily lives by structure and routine, which was broken because of the pandemic. The families of these individuals were recommended to maintain a daily schedule and physically create a daily plan.

Growing research suggests that participation in PA can improve ASD-related symptoms and potentially attenuate the feelings of stress and anxiety caused by the COVID-19 pandemic (Garcia, Lawrence, Brazendale, Leahy, and Fukuda, 2020). Unfortunately, due to the stay-at-home order that was placed because of COVID-19, it negatively affects health behaviors in many individuals with ASD, serving as a possible barrier to participation in PA while increasing levels of stationary behavior and screen-time (Garcia, Lawrence, Brazendale, Leahy, and Fukuda, 2020). Research studies are still in progress but have shown that increased participation in PA decreases anxiety and improves language deficits and social encounters. Due to the stay-at-home orders set in place, there are not many activities that children and adolescent adults can participate in to stay busy, causing an increase in screen time. Creating an environment where individuals with ASD can participate in remote PA is detrimental to their psychological and physical health.

## Summary of Literature Review

The literature review intended to generate background knowledge and information on ASD and possible benefits to individuals affected by it. Included were three distinct areas regarding adolescent adults with ASD: 1) Health Promotion Programs for Individuals With ASD; 2) Obesity: Prevalence and Health Correlation; 3) COVID-19 Impact. With the literature review taken into consideration, there is much to learn regarding benefits that may impact an individual with ASD. An obstacle scientists face is that it is unknown the exact causes of ASD; however, research suggests that genes can collaborate with influences from the environment to affect development in leading ASD ("Autism Spectrum Disorder", 2018). Since scientists are unsure what causes the differentiation among individuals with ASD and those without, it is essential to continue research to find ways to benefit the lives of those affected by it. COVID-19 serves as a hindrance for individuals with ASD due to stay-at-home orders set in place, making this research paramount.

## **CHAPTER THREE: METHODOLOGY**

The current study was a quasi-experimental pretest-posttest design. The 12-week long study had participants attending remote exercise sessions twice a week for approximately 45 minutes. All procedures were administered remotely.

### Program Description

This study collaborated between the Department of Health Sciences and the Center for Autism and Related Disabilities (CARD). The 45-minute exercise sessions were taught by a certified exercise instructor who had specialized training for delivering exercise classes remotely. Classes consisted of a mixture of aerobic exercise and strength-training sessions. Participant attendance was taken at each session. Table 1 displays the various exercises taught during the 12-week program.

### *Recruitment of Participants for Current Study*

In order to recruit participants for the study, staff from CARD sent out an email announcement describing the study to all of the families affiliated with their organization. Individuals who were interested in attending contacted CARD and complete a survey to determine eligibility. Individuals who were eligible to participate were given a consent form to read over. These study procedures were part of a larger study approved by the University of Central Florida Institutional Review Board (IRB)



## *Measures*

All measures were administered to participants prior to the start of the program and immediately following the final session of the program unless otherwise stated.

### Demographic Survey

Participants were given a 6-item survey asking questions regarding their age, sex, race/ethnicity, age of diagnosis, any comorbidities, and medication status.

### PA-related Surveys

PA levels were measured using the Godin-Shepard Leisure-time Physical Activity Questionnaire (GSLTPAQ; Godin & Shepard, 1985). This questionnaire has been used in previous studies with young adults with ASD (Hillier, Buckingham, & Schena, 2020). This questionnaire asked participants to rate how many times they engaged in strenuous, moderate, and mild PA per week. To calculate a total PA score, the frequency of strenuous PA each week was multiplied by 9, the frequency of moderate PA each week was multiplied by 6, and the frequency of mild PA per week was multiplied by 3. This questionnaire was given to participants at baseline and post intervention.

Exercise Self-efficacy was measured with the Self-Efficacy for Exercise (SEE) Scale (Resnick & Jenkins, 2000). This 9-item scale asks how confident individuals feel they could exercise at least three times a week for 20 minutes, followed by a series of situations (e.g., the weather was bothering you). Response options range from 0 (Not confident) to 10 (Very confident). A higher score indicates higher exercise self-efficacy.

Enjoyment of PA was measured using the Physical Activity Enjoyment Scale (PACES) (Kendzierski & DeCarlo, 1991). This 18-item scale assessed the amount of enjoyment individuals' experiences during PA participation. Response options range from 1 (I hate it) to 7 (I enjoy it). A higher score indicated a higher amount of PA enjoyment.

### Psychological Surveys

#### *Depression*

Levels of depressive symptoms were measured using the Center for Epidemiological Studies Short Depression Scale (CESD-10) (Radloff 1977). The CESD-10 is a 10-item questionnaire that assessed how individuals felt during the past week (e.g., I was bothered by things that don't usually bother me). Response options ranged from "rarely or none of the time" (<1 day) to "all of the time" (5 to 7 days). A higher score indicated a higher level of depression.

#### *Stress*

Levels of perceived stress was measured by the Perceived Stress Scale (PSS) developed by Cohen (1995). This 10-item scale asked the individual about their thoughts and feelings in the past month (e.g., in the last month, how often you have been upset because of something that happened unexpectedly). Response options ranged from 0 (never) to 4 (very often), with a higher score indicating more significant perceived stress levels.

### Statistical Analysis

Means and frequencies were calculated for participant demographic variables, attendance, and psychosocial factors. Paired t-tests were conducted to examine differences in PA enjoyment, exercise self-efficacy, depression, and stress from baseline to post-intervention. All statistical tests were conducted using SAS version 9.4 with a significance level set at  $p < 0.05$ .

## CHAPTER FOUR: RESULTS

### Sample characteristics

A total of 14 participants were recruited to take part in the study and completed the pre- and post- surveys; however, 3 participants removed themselves from the exercise program and 1 participant did not complete all the surveys, leaving the sample size at 10. The mean attendance rate was 19.3 out of 24 sessions with 60% of the sample attending at least 80% of the sessions. Three participants attended all 24 sessions. The average age of participants was  $26.5 \pm 4.48$  years, and the majority of the participants were males (70%), White (80%), and currently lived with their family (80%). Table 2 displays the participant demographic characteristics.

### *Pre-Post Results for Total PA, PA Enjoyment, and Exercise Self-Efficacy (n=10)*

There was a significant increase in total PA scores from baseline to post-exercise intervention (16.5 vs. 38.7,  $p=0.006$ ). There were no significant differences in either PA enjoyment scores (33.1 vs 40.3;  $p=0.09$ ) or exercise self-efficacy (30.1 vs 26.8,  $p=0.51$ ) from baseline ( $M=33.1$ ) to post-exercise intervention. Table 3 provides the pre-post values.

### *Pre-Post Scores for Perceived Stress and Depressive Symptoms (n=10)*

There was a significant decrease in depressive symptoms from baseline to post-exercise intervention (23.7 vs. 16.9;  $p=0.03$ ). There were no significant differences in perceived stress scores from baseline to post-exercise intervention (40.8 vs. 37.4;  $p=0.35$ ). Pre-post values are displayed in Table 3.

## CHAPTER FIVE: DISCUSSION

The purpose of this study was to examine changes in exercise self-efficacy (SE), PA enjoyment, perceived stress, and depressive symptoms following a 12-week remote-based exercise intervention in young adults with ASD. It was hypothesized that there would be a significant increase in both exercise self-efficacy and enjoyment, and a significant decrease in both perceived stress and depression. Our hypothesis was partially upheld in that there was a significant decrease in depressive symptoms following the intervention, however, there were no significant differences in the other psychosocial factors following the exercise intervention.

The significant decrease in depressive symptoms following the exercise intervention may be particularly important for individuals with ASD who are at a higher risk of developing clinical depression (Chandrasekhar and Sikich, 2015). Many families that have young adults with ASD have special therapists who work with the individual for several hours a week (Narzisi, 2020). Such drastic changes, such as the COVID-19 pandemic, likely caused stress and anxiety for individuals with ASD because they were used to their schedule and routine and were probably comfortable with who they surrounded. Additionally, with the COVID-19 outbreak, the rates of depression in this population have increased substantially, and an exercise program that may help to alleviate symptoms of depression may be very beneficial during this time. Young adults with ASD may have experienced elevated levels of stress due to the disruptions in their daily routine (Fuld, 2018).

In contrast to our hypothesis, there were no differences in either PA enjoyment or exercise self-efficacy following the intervention. Interestingly, there appeared to be a slight decrease in self-efficacy at the end of the program. Although the results of this study cannot

determine the exact reason for this, it could be partly due to the varied nature of the exercise program. It was decided that the exercise instructor would teach a variety of exercises, and not focus specifically on any one exercise. Although this was to provide the participants with the opportunity to try out different types of exercises, it may have limited their ability to master any specific activity.

Participants demonstrated a significant increase in total PA levels from baseline to post-exercise interventions. A prior study that used the GSLTPAQ found that young adults with ASD had an average total PA score of 36 which is comparable to the post-intervention score of 38 in our sample (Hillier et al.,2020). Although these scores cannot be translated into actual minutes per day, it could be possible that the current sample had a very sedentary lifestyle at baseline, with a total PA score of 16.5. While objective measures of PA are more accurate than surveys, the COVID-19 pandemic limited our ability to utilize objective measures of PA. Nonetheless, it does appear that there was a relative increase in PA in our sample at the end of the exercise intervention. It would be important for future follow-ups with the current sample to determine whether this increase was sustained over time.

Remote-based instruction has been identified as an evidence-based practice in individuals with ASD (Sam, 2020), however, no research to date has examined the use of a remote-based exercise intervention in young adults with ASD. This could be a potential platform for young adults with ASD who may suffer from severe social anxiety or do not have accessibility to in-person programs. Further research should compare the benefits of in-person and remote-based exercise programs, and potentially consider using a combination of in-person and remote-based components in future programs.

### Strengths & Limitations

The current study had several strengths. First, the study focused on young adults with ASD, which is a population that tends to be overlooked in the literature (Howlin, 2021). Second, the study was able to be conducted during the COVID-19 pandemic, which has resulted in low levels of physical activity and high levels of screen time in this population (Garcia et al., 2020). Finally, the study was able to utilize an experienced exercise instructor who was certified to teach remote-based exercise in special populations.

There are several limitations of this study as well. First, the small sample size and lack of a control group are major limitations. The nature of the pandemic did not allow for in-person interaction which limited our ability to use certain assessment measures.

### Conclusion

The findings from this study indicate that a remote-based exercise intervention may help to alleviate symptoms of depression in young adults with ASD. With the COVID-19 pandemic still occurring, it is important for individuals with ASD to continue remote PA to relieve psychosocial factors that result from stay-at-home order. Further research is necessary to determine the effects of exercise interventions on young adults with ASD.

## LIST OF TABLES

Table 1: List of Exercises Taught During the Program

Categories	Exercise Classes
Aerobic	Cardio Variations Calisthenics
Strength Training	Bodyweight Strength Core Exercises
Flexibility	Yoga, Stretching, Meditation
Combination	Mini-Bootcamp: High Intensity Interval Training

Table 2: Participant Demographic Characteristics (n=10)

Variables	N (%)	Mean (SD)
Age	-	26.5 (4.48)
Males	7 (70%)	-
White	8 (80%)	-
Hispanic	4 (40%)	-
Lives at Home	8 (80%)	-
Employed	2 (20%)	-
Currently in School	1 (10%)	-
Session Attendance*	-	19.3 (5.06)

\*24 sessions total



Table 3: Comparison of Baseline & Post-program results (n=10)

Psychosocial Factors	Baseline M (SD)	Post-Program M (SD)	p-value
<b>Total PA Score</b>	<b>16.5 (24.53)</b>	<b>38.7 (25.83)</b>	<b>0.006</b>
Exercise Self-efficacy	30.1 (11.96)	26.8 (14.12)	0.51
PA Enjoyment	33.1 (8.88)	40.3 (10.87)	0.09
<b>Depression</b>	<b>23.7 (7.18)</b>	<b>16.9 (7.52)</b>	<b>0.03</b>
Perceived Stress	40.8 (9.92)	37.4 (8.1)	0.35

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