

Introduction

- Autism Spectrum Disorder (ASD) is a multisystem developmental disorder that affects cognitive, neurodevelopmental, social, and communication skills.¹
- Currently is one of the fastest growing developmental disorders in the United States; affects 1 in 59 children and 4x more common to appear in boys.²
- Children on the spectrum exhibit motor impairments: deficits in visual-motor and bilateral coordination, hypotonia, motor apraxia, toe walking, and/ or gross motor delays.
- Children with ASD have a high incidence of obesity (30.5%) due to the sedentary lifestyle they engage in.¹
 - Less physically active due to movement difficulties leading them to not participate in sports, activities in school, and other extracurricular activities for fear of exclusion by peers
- Physical activity for children on the spectrum pose a challenge due to poor motor functioning, low motivation, inability to understand complex motor skills, and trouble engaging in a team environment.
- Despite research that has shown physical activity to decrease social, behavioral, cognitive, motor impairments, and stereotypical behaviors in children with ASD, there is a lack of consensus on a standardized fitness model.¹

Patient History/Systems Review

- Four children, referred to as athletes, participated in Autism Fitness® sessions over a course of 7-8 weeks.

Athlete	Age	Ethnicity	Language	Prior Activity Level	Other Services	# of sessions total
SS	8	American Indian	English	High	OT	7
AN	10	Caucasian	English	Mod	OT	7
JF	8	Caucasian	English	Mod	OT, music, vision	8
TR	13	Hispanic	English & Spanish	Mod	OT, SLP	8

Examination

- Parents' reasons for having children participate in fitness was for them to become stronger, more coordinated, and to remove excess weight.
- During week 1, each athlete underwent a PAC Profile Initial Assessment to determine baseline ability.
- Each assessment exercise was scored: Correct with modeling; correct with physical prompt; incorrect with physical prompt; incorrect with physical and adaptive prompt

Athlete	Observations
SS	Low on the spectrum, non-verbal, repetitive body movements (arm flapping, body swaying, clapping, running back and forth), avoidance of eye contact, narrow interest in certain activities, maladaptive behavior (jumping on top of furniture, lying prone on the floor), fixation of lint on the floor
AN	Low on the spectrum, non-verbal, repetitive body movements (arm flapping, jumping), self-injurious behavior (head banging), attention deficits, lack of coordination, fixation on lights
JF	Required full attention to complete task, minimally verbal (able to express needs/wants), maladaptive behavior (hitting), repeated words/phrases but limited functional communication, loses focus with external distractions
TR	Echolalia, unusual and intense reaction to stimuli (breathing), preference for using certain colored equipment

Clinical Impression

- Each athlete required a different way of learning
 - Athlete SS: picture diagram and letter boards with adaptive and physical prompt
 - Athlete AN: written list with demonstration, adaptive, and physical prompt
 - Athlete JF: demonstration with adaptive and physical prompt
 - Athlete TR: demonstration and verbal cueing with adaptive prompt
- Athletes SS and AN performed better with music; athletes JF and TR were very distracted by music
- All athletes performed better without their parents in the room
- Frequent rest breaks (between every 2-3 sets) were required for each athlete or they would become overstimulated leading to breakdowns
- Problem List: decreased strength (specifically hip flexors and abductors), decreased coordination and balance, postural imbalances, poor biomechanics, delayed motor planning, hypotonia, toe walking (athlete AN)

Intervention

- Autism Fitness® has been studied over the past two decades as the most effective intervention strategy for those on the spectrum as it targets strength, stability, and motor planning
- Autism Fitness® is largely dependent upon the complexities and individual differences that are common to autism and allows carryover and generalization to other situations.
- Applied Behavioral Analysis (ABA) tactics utilized through use of the PAC profile (physical, adaptive, cognitive)
 - Physical:** the level to which the athlete can perform each exercise; progressions and regressions
 - Adaptive:** athlete's ability to tolerate new activities, delay secondary reinforcers, and engage in a challenging task
 - Increased and immediate positive reinforcement, appropriate break times, and prompting/ cueing
 - Behavior Specific Praise should be delivered immediately following the behavior that emphasizes what the athlete did correctly as focusing on what the athlete did incorrectly (while natural instinct) will result in confusion and increase the likelihood that the athlete will repeat the incorrect response
 - All behavior serves a function and often the function of the behavior is different from what the behavior looks like
 - Cognitive:** learning styles (visuals, demonstration/ kinesthetic cueing, daily set of written exercises), receptive language deficits, and short-term memory.
 - End goal is to allow the athlete to require less extrinsic feedback/prompting as the program progresses to independent mastery
- Autism Fitness® was applied over a course of 7-8 weeks for 60-minute sessions held either on Saturday or Sunday in the athlete's home
 - Equipment used included: hurdle steps, weighted medicine balls, spot markers, colored cones, sandbells, and resistance bands seen below:

Autism Fitness Exercises

Stand on Spot Markers/ Circles: Athlete will stand on a colored spot marker or circle for the allotted amount of time set by the fitness professional. (10 seconds-1 minute)

Hurdle Steps: Athlete will step over hurdles making sure to allow proper hip flexion and avoid hip internal rotation and circumduction

Cone Taps: Cones will be placed hip distance apart and the athlete will bend the knees and perform a hip-hinge movement to touch the cones with both hands

Dynamax Push Throw: Athlete will stand in a colored circle or next to a colored cone. Athlete will hold medicine ball with elbows tucked into side and perform a chest pass with the weighted medicine ball to fitness professional

Dynamx Overhead Throw: Athlete will stand in a colored circle or next to a colored cone. Athlete will hold medicine ball overhead, perform a triceps extension and upon release of triceps extension throw the ball to the fitness professional standing across

Dynamax Scoop Throw: Athlete should stand in a colored circle or next to a colored cone. Athlete will perform a mini-squat, move the medicine ball in between the legs and upon ascent throw the ball to the fitness professional standing across

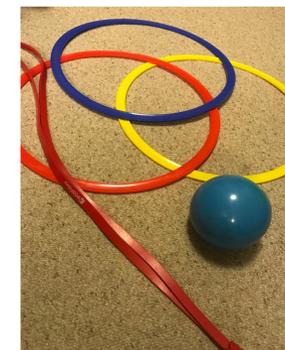
Squat: Athlete will perform a squat to a riser keeping the chest and head forward and feet hip distance apart

Sandbell Overhead Press: Athlete will hold a sandbell with both hands and perform a shoulder press and then slowly lower to chest level

Band Pull-Downs: Athlete will hold a resistance band shoulder width apart and pull down with elbows tucked into the side with the fitness professional also holding onto the band applying resistance

Sandbell Slams: Athlete will raise sandbell overhead with full arm extension and forcefully throw the sandbell to the ground

Standing Band Rows: Athlete will hold onto resistance band with both hands (thumbs pointing up), tuck in elbows, and pull band posteriorly keeping chest upright



Outcomes

- Autism Fitness® provided a standardized program across all four athletes and gave a baseline for most appropriate programming.
- Throughout the 7-8 weeks, every athlete, some more significant than others, demonstrated improvements in physical fitness and an overall decrease in maladaptive behavior.
- All athletes performed exercises with less prompting (physical, adaptive, cognitive) and/ or demonstration.
- The structure of Autism Fitness® programming with 12 core exercises gave the athletes time to master the exercise which led to faster skill acquisition.
- Each athlete presented differently and progressed on a separate timeline, even when following a standardized protocol.
- Feedback forms were given to the parents following the cessation of 7-8 weeks. Improvements noted within the athletes since the start of the program:
 - Athletes looking forward to fitness, being excited to perform more of the exercises, and having a greater desire to work out each week leading up to fitness sessions.
 - Athletes understanding of fitness as a part of everyday life: Athletes talking about weights, walking, hiking, and fitness, and wanting to go jogging following sessions.
 - Parent improvements/ recommendations for conducting with future athletes included: More structure, physical guidance, and a lot of follow through with energy and firmness; breaking down tasks with the right amount of challenge; enjoyed having you, traveling to us was huge.

Athlete	Weeks 1-2	Weeks 7-8
SS	0/10 exercises	3/10 exercises (spot marker, push throw, overhead press); displayed less arm flapping and pacing
AN	0/10 exercises	3/10 exercises (push throw, sandbell press, sandbell slam); decrease in head banging, crying, and increased attention to task
JF	2/10 exercises	10/12 exercises; improved squatting mechanics, no longer required demonstration, suggested exercises to perform, no hitting or crying
TR	8/12 exercises	11/12 exercises; no breakdowns due to frustration, increase in attention, improved strength/ squatting mechanics, increase in weight of equipment

Clinical Implications

- While Autism Fitness® produced gains in physical and behavioral components, there is limitations in generalizing this to all children diagnosed with ASD.
- Professionals need to learn of specific qualities of the athlete and understand a tactic for one child, may not work for the next.
- An athlete high on the spectrum and verbal was able to follow directions faster and easier than a child lower on the spectrum.
- Greater progress could have been made if the program was carried out for a period longer than 8 weeks and more than 1x/ week.
- Other factors that impacted outcomes:
 - Age, fitness ability, and weight
 - Prior activity level and interest in fitness
 - Concurrent occupational and/ or speech therapy services
 - Open vs. closed environment of fitness sessions
 - Participation in other gym/PE sessions
 - Sickness/ cancellations
- Further research is needed to:
 - Further support the need of fitness for the autism spectrum population
 - Determine a set frequency, intensity, and duration of fitness services
 - Compare Autism Fitness® to other standardized fitness protocols