

PHYSICAL ACTIVITY IN CHILDREN WITH AUTISM SPECTRUM DISORDERS: CONSIDERATIONS FOR EDUCATIONAL PROGRAM ADMINISTRATION

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Abstract. While diagnostic criteria for Autism Spectrum Disorders (ASD) is clear, misconceptions of ASD create barriers and challenges for children with ASD and their interaction in the educational environment around them.

The social model of disability states people with disabilities are more limited by social constraints than actual impairment (Llewellyn and Hogan 2000). In hopes to diminish these social constraints, continued education and progression of programs for children with Autism Spectrum Disorders is essential.

When observing the different teaching strategies educators used to assist children with ASD, no one educational strategy was deemed appropriate for use. Findings revealed there were no defined guidelines on how to interact with autistic children and left teachers to use their own teaching methods. Literature reflect a lack of educational strategies for children with Autism Spectrum Disorders in an academic setting; at the various grade levels. One of the newer strategies to be investigated is the role of physical activity in children with ASD.

Regular physical activity is highly beneficial towards the health of all children with or without disabilities. However, social and behavioral impairments leave little opportunity for children with Autism Spectrum Disorders to be successful in participating in physical activity; resulting in a possible higher risk of being inactive.

Exercise options such as martial arts, swimming and yoga programs have been shown to be successful for children with Autism Spectrum Disorders.

Key words: Children, Autism Spectrum Disorders, Physical Education

Purpose

The purpose of this review is to (1) provide information on Autism Spectrum Disorders (ASD) and impairments associated with ASD in children; (2) address common misconceptions of children diagnosed with ASD; (3) describe appropriate physical activity levels of children with ASD, compared to those without; and (4) provide insight into the most effective methods and practices of an exercise prescription enabling children with ASD to achieve the recommended amount of physical activity.

Introduction

Autism Spectrum Disorders were first brought to the public's attention in 1943 when Dr. Leo Kanner of Johns Hopkins University published the paper "Autistic Disturbances of Affective Contact" in the journal *Nervous Child*. Kanner based the word "autism" from the Greek word "auto," meaning "self." His observations were based on 11 children who had withdrawn from human contact. However, it was not until the 1960s that the general public first started to have an understanding of ASD (nimh.nih.gov 2008).

Autism Spectrum Disorders impair a child's social interactions and their interaction with the environment around them. The root causes for ASD remain unclear but have been ascertained as a neurological impairment of the frontal systems of the brain (Mundy and Markus 1997). A genetic link appears to exist, as often a family history depicts relatives diagnosed with ASD. However, there is a continual dispute of an environmental link to the cause of Autism Spectrum Disorders. While the causes of ASD have not yet been fully identified, diagnostic criteria for identifying ASD have been established. In 2000, the following criterion established by the American Psychiatric Association identifies ASD as:

A total of 6 (or) more items from 1, 2, and 3, with at least two from 1 and one each from 2 and 3:

1. Qualitative impairment in social interactions, as manifested by at least two of the following: (a) marked impairment in the use of multiple nonverbal behaviors such as eye-to-eye gaze, facial expressions, body postures, and gestures to regulate social interactions; (b) failure to develop peer relationships appropriate to developmental level; (c) lack of spontaneous seeking to share enjoyment, interests, or achievements with other people (e.g., by a lack of showing, bringing, or pointing out objects of interest); (d) lack of social or emotional reciprocity.

2. Qualitative impairment in communication as manifested by at least one of the following: (a) delay in, or total lack of, the development of spoken language (not accompanied by an attempt to compensate through alternative modes of communication such as gestures or mime); (b) in individuals with adequate speech, marked impairment in the ability to initiate or sustain a conversation with others; (c) stereotyped and repetitive use of language or idiosyncratic language; (d) lack of varied, spontaneous make-believe play or social imitative play appropriate to developmental level.

3. Restricted repetitive and stereotyped patterns of behavior, interests, and activities, as manifested by at least one of the following: (a) encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus; (b) apparently inflexible adherence to specific, nonfunctional routines or rituals; (c) stereotyped and repetitive motor mannerisms (e.g., hand or finger flapping or twisting, or complex whole-body movements); (d) persistent preoccupation with parts of objects.

Delays or abnormal functioning in at least one of the following areas, with onset prior to 3 years of age: social interaction, language as used in social communication, or symbolic or imaginative play (American Psychiatric Association 2000).

The above outlined criterion establishes standards of the diagnostics for children with ASD. The American Academy of Pediatrics now recommends that pediatricians screen for ASD at age 18 months and again at 24 months. Currently, the average age for diagnosing children with ASD in the United States is three to four years, and even later for children who live in socioeconomically depressed and rural areas in the United States (aap.org 2007).

Autism Spectrum Disorder (ASD) affects one in every 150 children in the United States and is becoming increasingly more diagnosed (Block, Block and Halliday 2006). According to the Center for Disease Control and

Prevention (CDC), "Autism Spectrum Disorders occur in all racial, ethnic, and socioeconomic groups and are four times more likely to occur in boys than in girls" (cdc.gov 2007). With the diagnosis of children with ASD increasing, it is important to understand ASD and how children with ASD interact with their environments to ensure positive youth development. While diagnostic criteria for Autism Spectrum Disorders have become clear, misconceptions of ASD have created barriers and challenges for children in relation to their surrounding environments.

ASD and Mental Illness

Findings have shown that many children with ASD also suffer from anxiety disorders and have anxiety due to phobias. With this being said, children with ASD suffer from phobias different than those observed in a child without ASD. Children with ASD tend to develop more situational fears (e.g., large crowds, dark rooms and closed places) rather than social fears (e.g., fear of failure or criticism) (Evans et al. 2005). Additionally, high anxiety from these phobias also can instigate behavioral problems for children with ASD. Children with ASD need an environment created that reduces their anxiety levels due to these phobias. As a result, an environment sensitive to these phobias can provide a highly beneficial learning atmosphere.

Few studies have been conducted investigating children with ASD and depression, but more research has been compiled on adults with ASD depression (Sterling et al. 2007) and mood disorders (Hellings 2000; Pine et al. 2008). Findings suggest a highly functioning person with ASD is more likely to have depression than a person who is less functioning (Sterling et al. 2007). In general, exercise can decrease depression levels as well as improve the mental well-being of a person, regardless of diagnosis. Increased physical activity also could improve the depressive symptoms of high functioning adults with ASD.

Common Misconceptions

Understanding common misconceptions of ASD helps bring attention to the barriers created for these children by contemporary society. Misconceptions become a major detriment to the success of integrating children with ASD into educational and social environments. Overcoming these misconceptions will help identify methods and promote resolutions to these barriers facing children with ASD as they come together within their environments.

Overall, misconceptions of ASD arise from the lack of general knowledge and understanding of the disorder. The social model of disability states people with disabilities are more limited by social constraints than actual impairment (Llewellyn and Hogan 2000). In hopes to diminish social constraints, continued education and progression of programs for children with ASD is essential. The most prominent misconception concerning ASD is its label as a mental retardation. Although mental retardation can often be found in children with ASD, they are two different disorders. This misconception often leads to society treating this population ineffectively, thus resulting in the strengthening of already existent social barriers of exclusion and lack of support facing children with ASD. In addition, society misconceives that children with ASD can adapt and participate in any environment. Although many common characteristics exist in children with ASD, many variations of ASD behaviors exist and no one suitable environment exists for any one child with ASD.

Common Treatments and Interventions

There is no one treatment currently used for children with ASD, but different methods are being employed to help with the variety of symptoms associated with ASD. Diet, pharmaceutical intervention, behavioral intervention, and physical activity are four main treatments currently utilized. However, these treatments have no clear defined prescription.

One study conducted within public schools observed the different strategies teachers used to work with children with ASD (Hess et al. 2007). Hess et al. (2007) created a survey instrument, with five categories, based on treatment strategies featured in Simpson and colleagues (2005). The investigators categorized these treatment strategies as: interpersonal relationships, skill-based, cognitive, physiological/biological/neurological, and "other" (music therapy, art therapy, integrated movement therapy, self injurious behavior inhibiting system, and interactive metronome). The treatment strategies were further divided based on effectiveness: "scientifically-based", "promising practice", "limited support", and "not recommended". Results reflected the lack of guidelines for strategies for children with ASD in an educational setting at the various grade levels. The survey presented no defined guidelines set by health care providers on how to implement treatments for children with ASD. Since teachers were not given guidelines on how to set up a productive educational environment for a child with autism, they were left to use their own methods. None of the treatments utilized were based on scientifically proven practices. This caused unsupported treatments to be used that resulted in wasted time, energy, and funds. Therefore, there is an increasing demand for health care providers and educational institutions to develop guidelines providing an effective educational setting for the ASD population (Hess et al. 2007).

The Role of Physical Activity

Many benefits, encompassing varied populations, come with exercise. The American Heart Association states, "Increased physical activity has been associated with an increased life expectancy and decreased risk of cardiovascular disease. Physical activity produces overall physical, psychological and social benefits" (heart.org 2013). Additionally, providing more physical activity time for students during the school year has yielded positive results such as increased grade-point averages and improved self-esteem (Trudeau and Shepard 2008). Yet, knowing physical activity benefits the general population; few studies conducted observed if children with ASD receive the daily recommended physical activity allowances.

Physical activity plays an essential role in the healthy development of all children with or without disabilities. Children are recommended to engage in more than 60 minutes of moderate to vigorous physical activity (MVPA) per day spanning 10 to 15 minutes in duration (Sandt and Frey, 2005). Kodish et al. (2006) stated, "Habits begin at an early age and will often transcend into adulthood." Establishing a habit of achieving the recommended daily physical activity level can positively affect the health of children for the rest of their lives. With the established recommended daily amount of physical activity and its importance, the level of physical activity of children with and without ASD should be evaluated and compared between different groups of children (i.e., those with and without ASD) and the established recommended physical activity level. Table 1 outlines physical activity studies conducted utilizing children diagnosed with ASD and their respective findings.

Table 1. Physical Activity Studies with Children Diagnosed with Autism Spectrum Disorders and Observed Findings

Study	Year	Findings/conclusions
Rosenthal-Malek A., Mitchell S. (1997). Brief Report: The Effects of Exercise on the Self-Stimulatory Behaviors and Positive Responding of Adolescents with Autism. <i>Journal of Autism and Developmental Disorders</i> , 27 (2), 193–202	1997	Shown exercise in children with ASD reduces self stimulatory behavior, increase academic performance and increased the number of tasks completed. Exercise proved to not create too much fatigue in the children
Yilmaz I., Yanardag M., Birkan B., Bumin G. (November 2003). Effects of swimming training on physical fitness and water orientation in autism. <i>Pediatrics International</i> , (46), 624–626.	2004	Aquatic programs help with flexibility, strengthen muscle, posture, and endurance
Scott S., Kozub M.F., Goto K. (2005). Tae Kwon Do for Children with Autism Spectrum Disorder. <i>Palaestra</i> , 21 (1), 40-43	2005	Martial Arts provided a good form of exercise for children with Autism
Evans D.W., Canavera K., Kleinpeter F.L., Maccubbi, E., Taga K (2005). The Fears, Phobias and Anxieties of Children with Autism Spectrum Disorders and Down Syndrome: Comparisons with Developmentally and Chronologically Age Matched Children [Electronic version]. <i>Child Psychiatry and Human Development</i> , 36 (Fall), 3–25. from Springer	2005	Found children with ASD experience different phobias than children without ASD
Pitetti K.H., Rendoff A.D., Grover T., Beets M.W. (2007). The Efficacy of a 9-Month Treadmill Walking Program on the Exercise Capacity and Weight Reduction for Adolescents with Severe Autism. <i>Spring Science & Business Media</i> , 997–1006	2006	Treadmill walking program increased in exercise capacity and calorie expenditure couple with decrease in body mass index (BMI)
Yuill N., Strieth S., Roake C., Aspden R., Todd B. (2007). Brief Report: Designing a Playground for Children with Autistic Spectrum Disorders – Effects on Playful Peer Interactions. <i>Springer Science & Business Media</i> , 1192–1196	2006	Playground designed that accommodates autistic children into recess play
Groft-Jones M., Block, M.E. (2006). Strategies for Teaching Children With Autism in Physical Education. <i>Teaching Elementary Physical Education</i> , (November): 25–28	2006	Outlined important structures to accommodate children with ASD into physical education
Hess K.L., Morrier M.J., Heflin J.L., Ivey M.L. (2007). Autism Treatment Survey: Services Received by Children with Autism Spectrum Disorders in Public School Classrooms [Electronic version]. <i>Autism Development Disorders</i> , 38, 961-971. from Springer	2007	Identified that ASD children in the public schools are not receiving physician recommended treatments
Pan C.-Y. (2007). Objectively Measured Physical Activity Between Children With Autism Spectrum Disorders and Children Without Disabilities During Inclusive Recess Settings in Taiwan. <i>Spring Science & Business Media</i>	2007	Children with ASD prefer to play alone often choosing activities during recess that require little social interaction and often result in little physical exertion

Physical Activity Studies and Children with Autism Spectrum Disorders

Although many studies have been conducted on physical activity in children, only two studies were found comparing physical activity levels between children with and without ASD. Both these studies evaluated the participants at recess time during school hours, physical education classes, and after school activities. The studies assessed the duration and intensity of the physical activities and compared them to recommended physical activity levels.

Sandt and Frey (2005) showed children with ASD were less active than children without ASD, but the difference in moderate to vigorous physical activity (MVPA) was not significant enough to conclude children with ASD are less active than children without ASD. Both groups of children spent more time in light physical activity than in MVPA during the day. In relation to grade level, children in elementary school had higher levels of physical

activity compared to the children in middle school and high school (Sandt and Frey 2005). This physical activity trend continues as age progresses and physical activity levels decrease for both children with and without ASD. With no significant difference between the two groups (i.e., children with and without ASD) and an overall trend of decreased physical activity levels over time, based from this study, increased physical activity can be assumed to be necessary and beneficial for all participants regardless of the existence of a disability.

Children tend to receive a generous portion of their daily physical activity during school recess time. Furthermore, it is speculated that because recess allows children to choose activities they enjoy, they are more likely to engage in MVPA. Pan (2007) compared moderate-to-vigorous physical activity (MVPA) time in school recess between children diagnosed with ASD and those without ASD (Pan 2007). Results of the study displayed children with ASD engaged in only 27 minutes of MVPA compared to children without ASD who engaged in 35 minutes of MVPA; children with ASD attained less physical activity than children without ASD. Pan (2007) concluded the reason for the lower MVPA during recess for children with ASD was children with ASD often preferred to play alone. Children with ASD often chose activities during recess that required little social interaction and often resulted in little physical exertion. Children without ASD often chose to play more intense physical activities such as ball games and contact sports. This enables them to attain more MVPA during recess than the children with ASD. However, without adult encouragement, the recess environment may not provide the optimal setting as a source of physical activity for children with ASD.

Reviewing the results of these two studies comparing physical activity of children with and without ASD few conclusions can be made concerning the daily physical activity level of these two groups. Also, the Pan (2007) study and Sandt and Frey (2005) study were limited due to sample size. Sandt and Frey (2005) showed no difference in physical activity levels between children with and without ASD and the Pan (2007) study suggested a decreased physical activity level in children with ASD. Evaluating the results of both the studies it can be generally concluded that children with ASD do not obtain as much physical activity as children without ASD, but results clearly show children with and without ASD do not get the recommended amount of daily physical activity (i.e., a minimum 60 minutes). With this conclusion, increased daily physical activity should be recommended for all children with or without a disability. To increase physical activity in children with ASD a specific physical activity design would have to be created to accommodate ASD characteristics.

Through research, many benefits have been discovered when physical activity is incorporated in children with ASD (Pitetti et al. 2007; Yilmaz et al. 2004; Huettig and Darden-Melton 2004; Scott et al. 2005). Overall, exercise in children with ASD helps to reduce self-stimulatory behavior, increase academic performance, and increase the number of tasks completed (Pitetti et al. 2007; Rosenthal-Malek and Mitchel 1997). Further research is needed to look at duration, intensity and types of exercise to find an exercise prescription effective for children with ASD.

To increase daily physical activity of children with ASD, appropriate exercise prescription implementation must be utilized to be effective. Social demands and interactions, environment, exercise methods and other possible detriments to successful programs require careful consideration and research when designing an exercise prescription for children with ASD (Groft-Jones and Block 2006; Rosenthal-Malek and Mitchell 1997; Pan and Frey 2005; Sandt and Frey 2005).

Many different variables can have significant impacts on the physical activity patterns in autistic children. Pan and Fray (2006) evaluated physical activity patterns and determinants in individuals with ASD utilizing a Manufacturing Technologies Inc. (MTI) (formally CSA) Actigraph 7164 uniaxial accelerometer, Physical Activity

Instrumentation (a protocol for using the physical activity instrument), a questionnaire, and a parent support scale. The study found age and sedentary pursuits were factors affecting physical activity levels in autistic youth. In the modern era of an abundance of technology-based activities, physical activity levels of most children have been greatly reduced. With regards to non-physical activities, children with ASD were found to typically watch less television than those children without ASD. The issue for autistic children is that they have fewer opportunities to be physically active, because society still does not provide full accommodations and support for youth with disabilities. The study also surprisingly found parental physical activity and support were not significant factors in the child's activity levels. However, not being a significant factor does not result in the conclusion parental support is not important in the child's physical activity regimen. The study questions the ability of parents to overcome a lack of societal acceptance that limits the autistic child to community and physical activities opportunities. Barriers are not only placed on the child with ASD but also placed on the parents (Pan and Frey 2006). Regardless of not knowing the true effectiveness, parents of autistic youth need to give encouragement and support to their physical activity endeavors (Pan and Frey 2005).

Specific Programmatic Conditions for Children with ASD

There are a variety of variables to instill a proper environment to promote physical activity in children with ASD. Pan (2007) describes five effective environment and exercise methods for autistic children: 1) It is important to promote individual or dual activities that often require few societal supports and few social demands. 2) Activities that have fewer people needed to participate, in relation to time and effort, are ideal. 3) Activities also should be more easily continued into adulthood with less reliance on others. 4) Physical activities that are rhythmic in nature are conducive to the repetitive traits often associated with ASD. 5) Physical activities with little to no team orientation that can be performed using family resources are also important to a successful exercise prescription for children with ASD (Pan 2007).

Additional conditions impacting the environment for physical activity for children with ASD also exist. One often overlooked detail is the physical layout of the learning environment. Children with ASD often experience oversensitivity to certain stimuli such as lights, sounds and touch (Reid et al. 2003). The acknowledgment and understanding of these environmental factors also is essential.

In helping children with autism attain the optimal amount of exercise is the creation of a 60 minute fitness circuit (Hovey 2011). A six-step process created by the investigator involving task selection, layout design, pretest of individual skill and fitness level, individualization, implementation, and evaluation for change (Hovey 2011) provides a means of achieving the recommended level of physical activity in children with ASD.

1. Selection: Select activities to use at each station taking in account the activities are developmentally appropriate, age appropriate, and maturity appropriate.
2. Layout Design: Look at the layout and experiment with a design that is most effective. It is recommended to label stations with names and directions. Use pictures of individuals performing the task on the label to help children who are visual learners making it as easy as possible for students to understand what to do in the time allotted.
3. Pre-Test of Individual Skills and Fitness Level: A motivator to individuals with autism to observe first-hand success. This task gives information and data necessary to individualize the appropriate activities and motivate the child.
4. Individualization: Create a physical activity station that fits each child's personality and interest.

5. Implement: Have the students attempt one cycle of the circuit.

6. Evaluation: After a few sessions evaluate the circuit, with input from the student, and make the necessary adjustments to the circuit for optimal results (Hovey 2011).

Several exercise options exist that may be appropriate an effective methods of increasing physical activity levels, in proper environmental settings, in children diagnosed with Autism Spectrum Disorders. Exercise options such as martial arts, swimming, yoga and treadmill walking programs have proven successful for children with ASD (Pitetti et al. 2007; Yilmaz et al. 2004; Huettig and Darden-Melton, 2004; Scott et al. 2005).

Martial Arts

Martial arts provide a variety of benefits and acclimate well with many common ASD traits. It provides a structured and systemized physical activity routine that is inviting to children with ASD. Traits of ASD that martial arts accommodate include difficulty processing information, tactile defensiveness and social problem solving (Davis 1990; Reid et al. 1991; Sherrill 1998). This form of exercise addresses these traits in ways children with ASD can relate and cope with – most movements are done independent of a partner without the instructor needing to touch the child, allows the child to watch instructions thus promoting positive social interaction, the development of balance, coordination, and flexibility, and helping to hone fine motor coordination. Sessions of 45 minutes in duration, with a one-on-one helper ratio, are recommended (Scott et al. 2005). This exercise option has proven to be an effective method of providing physical activity and developmental growth in common impairments of children with ASD (Scott et al. 2005).

Aquatics Programs

Aquatic programs have a proven history of success for children with ASD. Swimming provides an environment for children with ASD to respond to stimuli. It is believed that water activities help improve adaptive behavior, facilitate language development and self concept. Swimming also helps develop physical fitness and water orientation capabilities (Yilmaz et al. 2004). In a case study by Yilmaz et al. (2004), a nine year old subject with ASD, was evaluated by a physical fitness test which incorporated a six minute walking test, balance test, standing broad jump test, grip strength test, muscle strength test, and a speed test before beginning the 10 week aquatics program. The developed program was conducted over 10 weeks, meeting three times a week for 60 minutes a session. After 10 weeks, evaluative findings indicated the upper and lower body was strengthened along with hand grip. Furthermore, flexibility, cardiorespiratory endurance, balance, agility and power all increased over the span of the 10 week period. Also, individual spontaneous movement decreased and objection responses increased. Overall, aquatic programs have numerous physical benefits such as working the entire body, strengthening the muscles, posture, endurance and flexibility, teaching breathing skills, floating skills, full body movement skills, and mental benefits of relaxation and concentrating on the rhythm of a stroke making these types of programs ideal for children with ASD (Yilmaz et al. 2004).

Yoga

In one study, investigators looked at six children with ASD as they participated in a 10 month yoga program. The 10 month program was comprised of 45 minute sessions five times a week, with mothers accompanying each child, along with additional practice at home. Children used their own yoga mats, allowing the children to create

their own necessary boundaries. Yoga asanas (postures) and pranayama (breathing exercises) were adapted for this study to focus on issues related to imitation difficulties with ASD. Exercises used during integrated approach to yoga therapy (IAYT) were: warm up asanas, strengthening asanas, release of tension asanas, calming asanas, and breathing asanas. If the child did not imitate the therapist, the attending adult physically guided the child to complete the task. Over time, the child slowly learned that she/he was expected to imitate the model. After the 10 months all children showed increased vocal imitation. Children who displayed increased imitation skills during yoga therapy transferred these responses into play situations whenever engaged in symbolic play with others. In addition, parents also reported an increased sitting tolerance of the child during other activities (Radhakrishna 2010).

School Recess Programs

Although varying in amounts of frequency, activity and time, recess in elementary school has proven to be a major source of MVPA for both children with and without ASD. The benefits of such opportunities for physical activities cannot be overlooked. Sandt and Frey (2005) and Pan (2007) both noted the importance of recess. It was also noted teachers would remove children with ASD from recess early, reducing the child's recess time. Teachers do this to let the children with ASD start assignments early, not considering the potential negative impacts on their daily physical activity level. Since recess is a vital source of MVPA for children with ASD, it is recommended that they should not be pulled from recess early. Along with providing children with ASD adequate time for recess, playgrounds can be further designed for a more effective, efficient and beneficial use of recess time and space.

Yuill et al. (2006) investigated different playground designs for children with ASD. In this study, the playground was designed to accommodate the often unique behavioral characteristics of children with ASD by having the appropriate level of physical activity challenge and child engagement. To accomplish this, using object-oriented physical activity, the slide, climbing wall and towers were designed to be difficult enough for a child to conquer; while supporting imaginative play. Props were kept simple and stable so that there was opportunity for repetitive play to occur, structured movement through a self-contained circuit track, and a slide curved to send the user to the start of the next activity. Finally, observation points were installed in the towers so children with ASD could take breaks from social interaction and survey the playground. The playground implemented a design for repetitive behavior that allowed children with ASD to participate and interact more with the other children. This particular playground design and study both improved the child's opportunity for physical activity and provided methods to overcome those aspects of social impairment common with ASD.

School Physical Education Programs

School recess has proven to be one source of physical activity. School physical education has also been shown to be another opportunity to provide physical activity for children with ASD. Physical education classes not recognizing the need to set up the proper environment for children with ASD will result in an ineffective physical education program to accommodate children with this disability. Groft-Jones and Block (2006) provided an outline of important structures to accommodate children with ASD. The strategy outlines the importance of the physical layout, establishment of a routine, having a clear ending to the class, usual visual schedules and cues, using simple verbal directions and positive reinforcement to support positive behavior (Groft-Jones and Block 2006).

As with any child with a disability, the concern with physical activity in children with ASD is potential barriers to opportunities for normal daily physical activity. Social and behavioral impairments leave little opportunity for children with ASD to be successful in participating in physical activity thus, resulting in a possible higher risk of being inactive (Pan 2007). Previous studies have shown that children with mental retardation (Davies and Joughin 1993), physical disabilities (Van den Berg-Emons et al. 1995) and cystic fibrosis (Nixon et al. 2001) are less active than children without a disability.

The benefits of increasing physical activities in all children are clear. The methods used to help increase the physical activity levels of children, with or without disabilities, continue to be less clear and a potential barrier. With the many variables to consider, no one solution will increase the physical activity levels of all children.

Many forms of exercise and sources of physical activities exist. However, in children with ASD, the possibility of one exercise prescription suitable for all children with ASD does not exist. Continued research will have to be done to explore the most effective and successful methods of increasing physical activity for children with ASD.

Conclusions

The growing population of children diagnosed with ASD will continue to pose an issue for educational institutions and families. Acknowledging the variations in behaviors and appropriate environments for children with ASD, further research is needed to address behavioral and environmental obstacles towards healthily youth development in children with ASD. Currently, there is a need to address the effectiveness and importance of parental physical activity and support. Concerns focus on parents to address and overcome barriers facing both them and their child, such as society's failure to provide appropriate services and the lack of social acceptance and support, limiting their child's role in physical activity opportunities. Parental support may play an essential role in successful exercise prescription programs for children with ASD. Such a study may greatly benefit successful progression of ASD based exercise programs.

Overall, the compilation of studies and research on children with ASD and physical activity levels has provided a foundation towards a successful continuation of exercise implementations and methods that will enable children with ASD to achieve the recommended daily physical activity. Furthermore, successful examples and protocols of physical activity methods for children with ASD provide essential detail into what should be investigated further.

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