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| **School of Occupational Therapy** | **Touro University Nevada** |
| **OCCT 643 Systematic Reviews in Occupational Therapy**  **CRITICALLY APPRAISED TOPIC (CAT) WORKSHEET** | |

**Focused Question:**

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| Does exercise increase appropriate play behavior in children with autism (ASD)? |

**Prepared By:**

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**Date Review Completed:**

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**Clinical Scenario:**

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| Autism spectrum disorders (ASD) are a group of developmental disabilities that can cause significant social, communication, and behavioral challenges (CDC, 2013). The Centers for Disease Control and Prevention (CDC) estimates that about 1 in 88 children have been identified with an ASD (CDC, 2013). More people are being diagnosed than before but the reasons remain unknown, but are in part likely due to increased awareness. The CDC revised the ASD prevalence estimates from 1 in 150 children to 1 in 110 children (CDC, 2013). ASD is characterized, in varying degrees, by problems in social interaction, verbal and nonverbal communication, and repetitive behaviors (Autism Speaks, 2013). Children with ASD present unique challenges to the classroom teacher and the child’s inability to regulate his or her own behavior can often be the biggest struggle (Koenig, Buckley-Reen, & Garg, 2012). To date, several organizations promote and fund autism research however few have isolated specific intervention strategies to enhance engagement in occupation. Additionally, because ASD’s presentation in each child is so varied with symptoms ranging from mild to severe, “understanding the condition and finding the best therapies [can be] difficult” (U.S. Department of Health and Human Services, 2011, p. 1).  It is important then that OT practitioners work collaboratively with individuals on the autism spectrum, their families, their teachers and other health professionals to, “provide a range of needed resources and services that support the individuals’ ability to participate fully in life,” (AOTA, 2010, p. 1). Exercise as an intervention has become increasingly popular in the United States. The latest "Yoga in America" study released by Yoga Journal shows that 20.4 million Americans currently practice yoga (Yoga Journal, 2012). Exercise based activity has many benefits including stress reduction, increased flexibility and muscle tone, improved athletic performance, increased respiration and energy, and maintenance of a balanced metabolism (AOTA, 2013). Yoga is classified as a mind–body intervention by the National Center for Complementary and Alternative Medicine and can be used as a complementary approach in occupational therapy to enhance engagement in occupation (Koenig et al., 2012). Exercise based strategies are used as an intervention strategy in the classroom in order to increase attention, increase social skills, decrease maladaptive behavior, and increase functioning in children diagnosed with ASD. This review looks at the evidence behind children with ASD participating in exercise-based interventions to make positive behavioral changes. |

**Summary of Key Findings:**

Summary of Levels I, II and III:

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| Level I:  Research indicated that Kata techniques training is effective for consistently reducing social dysfunction in children with ASD. The results of the present investigation may help officials of autism institutions decide to establish strategic plans under which martial arts techniques will best be instructed to children with ASD. It also offers parents of children with ASD to encourage their autistic children to participate in Kata techniques training programs  (Movahedi, Bahrami, Marandi & Abedi, 2013, Level I).  Level II:  Research concluded that an individualized, high-intensity exercise program is an effective method for improving health and fitness, reducing negative behaviors, and in improving positive behaviors of children and adolescents with ASD. Results of pre- and post-intervention ratings by parents and guardians indicated that the frequency of problematic behaviors and how the behaviors interfere with daily life were significantly reduced following participation in an exercise program. The benefits of using exercise as an intervention include its cost-effectiveness and potentially preventative nature compared to other behavioral interventions (Magnusson, Cobham & McLeod, 2012, Level II).  The study’s findings are similar to the clinical scenario. The author of this study concluded that a school-based yoga program used with children with ASD decreases maladaptive behaviors such as non-compliance, hyperactivity, social withdrawal, lethargy, and irritability. Significant changes were found in maladaptive behavior in the experimental group compared to the control group. The outcome results are favorable to the use of the GRTL yoga program as an intervention with children with ASD (Koenig, Buckley-Reen & Garg, 2012, Level II).  Positive effects of physical activity were found to increase the duration attention spans and quality of life of children with ASD. These results extend the findings that physical activity enhances cognition of ASD children and support its consideration into early intervention programs (Tan, 2011, Level II).  Research concluded that the participants that received the integrated approach to yoga therapy (IAYT) had improved imitation skills, language skills, communication, joint attention, play, and increased alertness. The outcome results were favourable to the use of a IAYT program when used with children with ASD (Radhakrishna, Nagarathna & Nagendra, 2010, Level II).  Findings support the notion that an appropriate regular physical activity program will improve health behaviors for children with and without disabilities. It is concluded that an aquatic program is an effective intervention option for children with ASD and their siblings with a disability, and may be a fun alternative to land-based low-impact physical activity program for children with disabilities and their families. By providing a physical activity program that meets regularly, it is possible to positively impact the lifestyle and independence of individuals, especially for those with disabilities (Pan, 2010, Level II).  Level III:  The study showed that implementation of structured play and facilitated play models increased appropriate play and communication. The study found preliminary evidence that respondent and spontaneous play and communication interacts with the play format as well as the functioning level of the participants  (Kok, Kong & Bernard-Opitz, 2002, Level III).  The study’s findings are related to the clinical scenario. The author of this study concluded that the participants that received the IAYT had improved imitation skills, language skills, communication, joint attention, play, and increased alertness. The outcome results are favourable to the use of IAYT program when used with children with ASD. Since the specific data of the control group was not given, it is hard to know whether IAYT had a much greater effect than the ABA training (Rosenblatt, Gorantla, Torres, Yarmush, Rao, Park...Levine, 2011, Level III). |

Summary of Level IV and V:

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| Findings from the study revealed increased percentages of observed academic engagement for students participating in the physical activity intervention. Increases in academic engagement correlated with the level of participation in the physical activity such that the students who were more consistently running or walking subsequently displayed greater involvement in the classroom (Nicholson, Kehle, Bray & Heest, 2011, Level IV). |

**Contributions of Qualitative Studies:**

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| None included in review |

**Bottom Line for Occupational Therapy Practice:**

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| **The clinical and community-based practice of OT**: As the health risks of a sedentary lifestyle are more common among individuals with intellectual and developmental disabilities such as ASD compared to those without the developmental disabilities, finding ways to increase activity levels in this population is necessary to reduce the likelihood of negative health consequences (Magnusson, Cobham & McLeod, 2012, Level II). Evidence suggests that occupational therapists can bring evidence-based yoga programs to public school classrooms as a successful way to improve maladaptive behavior (Koenig, Buckley-Reen & Garg, 2012, Level II). It is also important to note social dysfunction as a main diagnostic feature of autism spectrum disorders. Deficits in socialization have been found to be a major source of impairment in social interaction for individuals with ASD; the results of a Kata technique intervention have proved to increase the social behaviors necessary to live a meaningful and productive life, (Movahedi, Bahrami, Marandi & Abedi, 2013, Level I). Specific physical activity interventions may increase academic engagement in high-functioning children diagnosed with an ASD (Nicholson et al., 2011, Level IV), as well as appropriate regular physical activity programs, such as an aquatics (Pan, 2010, Level II). Participants who received exercise-based interventions, specifically yoga-based represented with improved imitation skills, language skills, communication, joint attention, play, and increased alertness. It also proved to further calm the physical body, which in-turn helped the child become more focused and organized (Radhakrishna, Nagarathna & Nagendra, 2010, Level II). Results prove there is a positive impact utilizing multimodal relaxation programs on the behavioral and cognitive symptoms of children with ASD. Favorable results allow OT’s to use yoga programs in practice with children with ASD (Rosenblatt et al., 2011, Level III). Physical activity prior to any form of learning may be an effective stimulus in early intervention services to enhance learning; utilizing any form of physical activity proves to be suitable to children’s needs, attention span and social functioning when diagnosed with ASD (Tan, 2011, Level II). More concrete, specific, and replicable research is needed evaluating similar interventions that use like outcome measures in order to make a more solidified recommendation to practitioners about exercise-based interventions used in the clinic to benefit children with autism.  **Program development:** An exercise-based program promotes reduction in maladaptive behaviors, but also suggests that occupational therapists can bring evidence-based exercise programs to public school classrooms as a successful way to improve behavior (Koenig, Buckley-Reen & Garg, 2012, Level II). When looking at facilitated and structured play, treatment comparison studies could shed some light on optimizing play interventions. It is likely that clinical gains can be enhanced when treatment programs can strike a delicate balance between the motivation and ability of the child and the task structure (Kok, Kong & Bernard-Opitz, 2002, Level III). An individualized, high-intensity exercise program is an effective method for improving health and fitness, reducing negative behaviors, and in improving positive behaviors of children and adolescents with ASD (Magnusson, Cobham & McLeod, 2012, Level II).  All studies reported beneficial and temporary effects of exercise in decreasing maladaptive behaviors. Effects were greater with more intensive aerobic activity. However, the heterogeneity of the research designs and interventions makes it difficult to determine appropriate prescription of exercise for children with ASD. Different forms of exercise (e.g., jogging, yoga, kata techniques, structured play) and varying measures of exertion and intensity (e.g., flushed face, heart rate, appearance, no monitoring) further complicate the process of making precise recommendations regarding exercise prescription to reduce stereotypical, inappropriate behaviours in children with ASD.  Although the evidence is weak to moderately strong, the literature does suggest that exercise produces short-term decreases in maladaptive behaviours in this population. There is also supporting evidence that higher-intensity exercise is more effective than lower-intensity activity in decreasing self-stimulation. Clinicians working in pediatric practice should consider the above points when working with children with autism displaying non-compliance, social dysfunction and maladaptive behaviours. Although the heterogeneity of the research designs and interventions makes it difficult to determine specific prescription of exercise for children with ASD, the studies reviewed included various types and intensities of exercise that are clinically relevant for clinicians working with children with ASD who have different capabilities and tolerance levels for certain activities. Furthermore, benefits were not limited to these behaviours; several studies in this review found improvements in other areas (e.g., academic responses, on-task behaviours). In depth research utilizing more rigorous methods with greater numbers of participants is needed to determine specific exercise prescriptions within OT treatment for children with ASD. Despite these limitations, the literature does suggest that exercise has a beneficial, albeit short-term, impact in reducing maladaptive behaviours in children with ASD.    **Societal Needs:** As the number of children diagnosed with autism continues to grow, so too will the prevalence of children with autism seeking OT services. As such, there is a professional and societal need to identify and practice effective intervention techniques to meet said demands. As mentioned previously, many children with ASD experience deficits within social and communication skill realms that can interfere with engagement in daily life occupations and interactions with family members, friends, and peers in a purposeful manner. Provided their prevalent use already to aide in these areas, it is important to determine the effectiveness of exercise-based interventions that will increase appropriate social behaviors which in turn will help ensure that the profession is in compliance with evidence based practice by providing the most effective treatments available.  If it is found that exercise based therapy can effectively improve social skills and communication, children with autism who have been placed alternatively in school, may find themselves eligible for increased inclusion in least restrictive environments. Furthermore, it is possible that improved communication and social skills could help children be more self-sufficient and thus depend on others and community programs less.  Studies suggest that physical activity in the form of something as simple to implement as jogging may be efficacious in promoting academic achievement for students diagnosed with ASD (Nicholson, Kehle, Bray & Heest, 2011, Level IV). Study results showed changes in communication, language, play and joint attention when utilizing exercise-based interventions (Radhakrishna, Nagarathna & Nagendra, 2010, Level II). Evidence suggests that specific yoga programs help decrease maladaptive behaviors when used with children with ASD no matter how severe the diagnosis (Rosenblatt, Gorantla, Torres, Yarmush, Rao, Park...Levine, 2011, Level III). Several finding throughout this exhaustive literature review showed improvement of social functioning in the physical activity participants, further presenting with higher results in the PedsQL, reflecting exercise interventions to be effective (Tan, 2011, Level II).  **Healthcare delivery and policy:** Findings revealed increased percentages of observed academic engagement for students participating in the physical activity interventions. It also appeared that the increases in academic engagement correlated with the level of participation in the physical activity such that the students who were more consistently running or walking subsequently displayed greater involvement in the classroom. By providing a physical activity program that meets regularly, it is possible to positively impact the lifestyle and independence of individuals, especially for those with disabilities. Parents of each reviewed study all reported dramatic positive impacts on their children’s lives as a result of the specific exercise-based interventions. An increased sense of accomplishment and self-worth was also reported by the parent or guardian of each individual child. Results suggested that a yog-based program may help to increase behavior skills such as imitation, language, joint attention, communication, play, and alertness when used with children with ASD (Radhakrishna, Nagarathna & Nagendra, 2010, Level II). Evidence suggests that physical activity is capable of triggering the brain’s ability to change (Tan, 2011, Level II) The evaluation of exercise-based interventions especially given its increased integration into practice both clinically and within the health profession to treat a myriad of diagnoses and symptoms is critical within evidence-based practice. As the need for scientifically based educational interventions is outlined in the Individuals With Disabilities Education Improvement Act of 2004, research addressing the effectiveness of intervention to guide evidence-based practice is pivotal.  **Education and training of OT students:** Although many of the interventions within the relevant studies implemented assessments and outcome measures in which the individual effectuated the measure, had to be certified or trained within the realm of the assessment pertinent to the study, this was not the case for all reviewed literature. The clinical reasoning and creativity that is already part of entry-level education would allow for an introduction of the concept of each individual measure for a number of pertinent cases. Introduction to the concepts involved in many of the interventions however would enhance entry-level education and add to the skill set of entry-level practitioners. However, although many of the studies present as not needing further certification to conduct and implement, distinct training to perform specific yoga interventions would be useful to incorporate further knowledge and credibility while implementing yoga-based interventions (Radhakrishna, Nagarathna & Nagendra, 2010, Level II).  **Refinement, revision, and advancement of factual knowledge or theory**: Additional research is needed to better understand which specific physical activity interventions are most appropriate for specific children in various settings. Randomized control trials should be conducted in order to provide a higher level of evidence supporting the exercise-based interventions in order to further solidify structured, beneficial interventions. Future research should examine the effectiveness of the many programs already within research as well as new programs in relation to academic outcomes, performance-based executive function tasks that assess attention and focus among students with ASD as well as behavioral outcomes to see whether improved behavior affects educational and occupational performance.  Overall, the evidence suggests mixed results and thus an inconclusive review. Despite effective and partial effectiveness across several studies, the limitations found within the research aggregate require the results be evaluated and applied on a preliminary, experimental basis. Additional research is justified if not solely to either validate and close or refute and expand the findings of this exhaustive review. Homogenous groups, increased sample sizes, and valid and like outcome measures should be utilized in future studies to allow for the strongest and highest level of evidence when complete. It should also be noted that the focused question utilized in the making of this CAT encapsulated the spectrum of available exercise-based therapies. It would be beneficial in future reviews to complete separate reviews regarding modified and non-modified interventions. Once a technique’s effectiveness has been determined, then and only then can it be compared to and analyzed against another. While these studies provide a jumping off point, further research is required to determine exercise-based interventions’ position as a therapeutic intervention in the advancement of factual knowledge and theory of OT practice. |

**Review Process:**

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| The following process was undertaken to thoroughly and effectively evaluate the literature:  -In consultation with the course instructor, the focused question was developed and chosen out of personal interest regarding the practice as well as specific interventions implemented in an effort to target the ASD population.  -Search terms for applicable population, intervention, and outcome terms were developed and later verified by course instructor.  -Search terms were used to exhaust databases in search of abstracts and full text articles that contained each component.  -Abstracts that did not thoroughly identify inclusion of all components were further evaluated by reading the article in full text to determine presence or absence of necessary components.  -Twenty articles were submitted as a result of comprehensive literature search. As per the requirements of an Evidence-Based Literature Review, included articles had to be of evidence level IV and above. Course instructor along with students confirmed determined level of evidence when necessary.  -With assistance of course instructor, full-text articles of those identified in literature search were obtained. The articles were read and reviewed in reference to focused question. Full-text articles that did not meet identified population, intervention, and outcome were eliminated from further analysis.  -From the twenty, five free standing articles were analyzed within a systematic review and were thus, eliminated. High priority articles were then selected and reviewed based on level of evidence and publication date in a peer reviewed journal for the years 1992 through 2014 in an effort to provide a comprehensive review of the strongest and most recent evidence on the topic.  -Ten articles meeting population, intervention, and outcome standards as well as exclusionary criteria were selected for Evidence Table and appraised for significance.  -Course instructor reviewed appraisal of articles and provided feedback regarding revisions and article use approval for Critically Appraised Topic.  -Ten articles evaluated and approved were used to summarize key findings and clinical significance in this Critically Appraised Topic. |

**Procedures for the Selection and appraisal of articles:**

*Inclusion Criteria:*

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| Participants were children and adolescents with ASD under the age of 18; outcome measures were focused on behavior change; studies looked at the effects of exercise interventions; evidence 2002-present; quantitative studies |

*Exclusion Criteria:*

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| Studies that had outcome measures focused on something other than behavior; sample had children not diagnosed with ASD; evidence prior to 2002; qualitative studies; adult and geriatric population |

***Search Strategies:***

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| **Categories** | **Key Search Terms** |
| Patient/Client Population | ***Autism Spectrum Disorder, Adolescence, Pediatrics, Children, Asperger, Child Development Disorder, Pervasive Developmental Disorders*** |
| Intervention | ***Yoga, Exercise, Occupational Therapy, Behavior/play, Aquatics, Classroom, School*** |
| Outcomes | ***Positive behavior, Behavioral outcomes, Social skills, Appropriate response mechanisms*** |

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| **Databases and Sites Searched** |
| PubMed  EBSCO multisearch  CINAHL  Cochrane  Google Scholar  AJOT |

***Quality Control/Peer Review Process:***

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| -The focused question was consulted on and approved by course instructor.  -After initial development of key search terms, course instructor enhanced search terms and databases used to ensure exhaustive search of relevant databases was completed.  -The students conducted searches in multiple databases and with help from the course instructor, located and retrieved full-text articles of twenty studies identified in comprehensive literature search.  -The students read and reviewed all articles for inclusion/exclusion criteria. Upon establishing included articles, the course instructor helped ensure level of evidence of included articles was indeed appropriate for appraisal.  -The students appraised ten articles determined to fit population, intervention and outcome components while also meeting inclusion/exclusion criteria required to answer the focused question in an Evidence Table. The Evidence Table was reviewed and critiqued by course instructor.  -The students summarized the key findings and clinical significance of the reviewed articles from the Evidence Table while referencing instructor feedback to complete the Critically Appraised Topic. |

**Results of Search:**

***Summary of Study Designs of Articles Selected for Appraisal:***

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| **Level of Evidence** | **Study Design/Methodology of Selected Articles** | **Number of Articles Selected** |
| I | Randomized controlled-trial | 1 |
| II | Two groups, nonrandomized studies (e.g. cohort, case-control) | 5 |
| III | One group, nonrandomized studies (e.g. before and after, pre test, post test) | 2 |
| IV | Descriptive studies that include analysis of outcomes (e.g. single subject design, case series) | 1 |
| V | Case reports and expert opinions, which include narrative literature reviews and consensus statements | 0 |
|  | TOTAL: | 9 |

**Limitations of the Studies Appraised:**

Levels I, II, and III

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| Level I:  The small sample size and cultural bias was a limitation to this study (Movahedi, Bahrami, Marandi, Abedi, 2013, Level I).  Level II:  The sixteen week study prevented researchers from determining the long term effects and would require further investigation (Koenig, Buckley-Reen & Garg, 2012, Level II).  Small sample size, negative behavior reduction did not reach statistical significance (Magnusson, Cobham, McLeod, 2012, Level II)  The limitations of this study include the small sample size, small age range and single gender of participants (all male) limit generalization. Second, even though an attempt was made to obtain an equal size and type of ASDs in two groups of children with ASDs, differences in cognitive abilities and gross motor skills were not evaluated and might have influenced findings (Pan, 2010, Level II).  There is not a defined, representative sample of participants because there was no information given on the control group, which decreases the internal validity. The intervention was not clearly explained in the study. There were no psychometric properties given for any of the three outcome measures so the reliability and validity of these is unknown, which also decreases the internal validity. Because of the way the participants were chosen, there could have been selection bias in the study. Bias could have also been created because the ones implementing the intervention were the special educators and parents who know the children well (Radhakrishna, Nagarathna & Nagendra, 2010, Level II).  First, the current sample size is small thus must be considered a pilot study. Second, the unequal treatment time between the experimental and control group may have introduced certain bias to the nature of the results. Third, the confirmation of the ASD diagnosis including the type and severity was not carried out (Tan, 2010, Level II).  Level III:  Main limitations included the small sample size consisting of eight children with contrasting abilities. The use of more homogenous subgroups of children could contribute to the heated debate about ‘best treatment methods’ (Kok, Kong & Bernard-Opitz, 2002, Level III).  Limitations presented with this study was the lack of quantitative and qualitative data, and evidence should be obtained with caution. There was no follow up with the participants in the study so the long-term effects are unknown (Resenblatt et al., 2011, Level III). |

Levels IV and V

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| The small sample size, limited space to perform physical activities, and influence/motivation to participate may have affected the study (Nicholson, Kehle, Bray, Heest, 2011, Level IV). |

Other

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| N/A |

**Articles Selected for Appraisal:**

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| Koenig, K., Buckley-Reen, A., & Garg, S. (2012). Efficacy of the get ready to learn yoga program  among children with autism spectrum disorders: a pretest-posttest control group design. *The*  *American Journal of Occupational Therapy, (5)* 66, 538-546.  Kok, A. J., Kong, T. Y., & Bernard-opitz, V. (2002). A Comparison of the Effects of Structured  Play and Facilitated Play Approaches on Preschoolers with Autism A Case Study. *Autism,*  *6(2),* 181-196. doi: 10.1177/1362361302006002005  Magnusson, J. E., Cobham, C., & McLeod, R. (2012). Beneficial effects of clinical exercise  rehabilitation for children and adolescents with autism spectrum disorder (ASD). *Journal of*  *Exercise Physiology*, *15*(2), 71-79. Retrieved from  http://www.asep.org/asep/asep/JEPonlineApril2012Jane\_Magnusson.pdf  Movahedi, A., Bahrami, F., Marandi, S. M., & Abedi, A. (2013). Improvement in social  dysfunction of children with autism spectrum disorder following long term Kata techniques  training. *Research in Autism Spectrum Disorders*, *7*(9), 1054-1061. Retrieved from  http://www.sciencedirect.com/science/article/pii/S1750946713000834  Nicholson, H., Kehle, T. J., Bray, M. A., & Heest, J. V. (2011). The effects of antecedent physical  activity on the academic engagement of children with autism spectrum disorder. *Psychology in*  *the Schools*, *48*(2), 198-213.  Pan, C.-Y. (2011). The efficacy of an aquatic program on physical fitness and aquatic skills in  children with and without autism spectrum disorders. *Research in Autism Spectrum Disorders,*  *5*(1), 657-665. doi: http://dx.doi.org/10.1016/j.rasd.2010.08.001  Radhakrishna, S., Nagarathna, R., and Nagendra, H.R. (2010). Integrated approach to yoga  therapy and autism spectrum disorder. *Journal of Ayurveda & Integrative Medicine, (1)* 2,  120-124. doi: 10.4103/0975-9476.65089  Rosenblatt, L., Gorantla, S. Torres, J., Yarmush, R., Rao, S., Park, E.,…Levine, J. (2011)  Relaxation response based yoga improves functioning in young children with autism: a pilot  study. *Journal of Alternative and Complementary Medicine, (11) 17,* 1029-1035. DOI:  10.1089/acm.2010.0834  Tan, W. Z. B. (2011). Physical activity: its implication on attention span and quality of life in  children with Autism Spectrum Disorder. Retrieved from http://ro.ecu.edu.au/theses\_hons/20/ |

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