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## Effectiveness of Exercise or Other Leisure Activities in Reducing Anxiety in Children with Autism Spectrum Disorders

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### CLINICAL SCENARIO:

When helping children with Autism Spectrum Disorders (ASD) cope with anxiety, "heavy work" exercises (i.e. pushing, pulling, lifting, carrying, etc.), are often recommended by occupational therapists (Baranek, 2002; Kranowitz, 1998; Yack et al., 1998). These kinds of activities provide proprioception, which can be defined as information from muscles, joints, ligaments and receptors (Ayres, 1972), about body movements or position (Kranowitz, 1998). Proprioception thus enables us to have a sense of where our bodies are in space, and contributes to a sense of security. Children with poor proprioceptive awareness may accidentally bump into objects and people, have decreased postural stability, difficulty planning and controlling motor movements, in addition to experiencing anxiety (Kranowitz, 1998). Even for those with normally functioning proprioception, "heavy work" exercise can be calming and organizing when over stimulation is experienced (Barthel, 2004).

In professional practice, many children with ASD who experience anxiety appear to enjoy proprioceptive activities and the sense of calm these activities produce. After engaging in exercise, these children appear more relaxed, as evidenced by normal pupil dilation, slower breathing, lower heart rate, and other signs of parasympathetic nervous system activation (Snell, 1997).

However, some children with ASD avoid exercise, and prefer other leisure activities (e.g. building with Lego, drawing, etc.). These children may actually become distressed when asked to engage in proprioceptive activities. It can be unclear whether to continue to recommend exercise for these children when they become anxious. It may be reasoned that their distress is related to resisting a change in routine and they will adjust given time and support. However, this is unclear, and perhaps they should simply be encouraged to engage in preferred leisure activities when they show signs of anxiety.

### FOCUSED CLINICAL QUESTION:

Is engaging in exercise more effective than engaging in other leisure activities for decreasing stress in elementary school children age 5-12 with ASD?

**SUMMARY of Search, 'Best' Evidence' Appraised, and Key Findings:**

Studies have documented the effects of exercise on typical children and children with developmental and psychiatric disorders (Harsha, 1995; Tomporowski, 2003), but few have looked at the effects of exercise on children with ASD. Furthermore, no studies have used reliable and valid outcome measures to investigate the effects of exercise on this population's anxiety levels (Petrus et al., 2008).

Existing studies have looked at the effects of exercise on stereotypic (i.e. repetitive) behaviours (Bumin et al., 2003; Celiberti et al., 1997; Rosenthal-Malek & Mitchell, 1997). Jootsen and colleagues (2008) reason that intrinsic and extrinsic motivation exists for stereotypic behaviours, and that anxiety may be an intrinsic motivator for stereotypic behaviours. This being said, it appears that weak to moderately strong evidence supports the use of higher-intensity exercise (i.e. jogging or hydrotherapy) in decreasing stereotypic movements (Petrus et al., 2008). It may be reasoned that a decrease in stereotypic movements may equate to a decrease in anxiety.

A thorough literature review found no evidence on the effects of other leisure activities on anxiety levels of children with ASD. However, Garcia-Villamizar and Dattilo (2010) designed a Randomized Controlled Trial to explore the effects of a variety of leisure activities on stress levels and quality of life of adults with ASD. Critical appraisal of this study suggests that quality of life (in areas of satisfaction and competency/productivity) improves for this population through participation in an intensive, voluntary and individualized leisure program. The use of an outcome measure for stress levels with questionable reliability and validity weakens this study's claim that stress levels of adults with ASD decrease through leisure program participation.

**CLINICAL BOTTOM LINE:**

While more research is required, engaging in high-intensity aerobic activities may result in some reduction in anxiety for children with ASD (as measured by a decrease in stereotypic movements). There is little evidence to support a link between leisure activities and a decrease in stress levels for children with ASD.

**Limitation of this Critically Appraised Topic (CAT):** This critically appraised paper was prepared for a graduate course assignment and has not been peer-reviewed by one other independent person/an instructor.

**SEARCH STRATEGY:****Terms used to guide Search Strategy:**

- **P**atient/Client Group: Elementary school children with ASD age 5-12
- **I**ntervention (or Assessment): Exercise (i.e. proprioceptive activity)
- **C**omparison: Other leisure activity
- **O**utcome(s): Decreased anxiety

<b>Databases and Sites Searched</b>	<b>Search Terms</b>	<b>Limits Used</b>
Medline OvidSP, PubMed & EMBASE OvidSP	exp Child/ or child*.mp. AND exp Child Development Disorders, Pervasive/ or autis*.mp. AND exercis*.mp. or Exercise/ AND exp Proprioception/ or exp Movement/ or exp Physical Exertion/ or propriocept*.mp.	Humans, English
CINAHL	(MH "Child+") or "Child*" AND (MH "Child Development Disorders, Pervasive+") or "Autis*" AND (MH "Exercise+") or "Exercis*"	Humans, English
EBM Reviews (Cochrane Database of Systematic Reviews, ACP Journal Club, Database of Abstracts of Reviews of Effects, Cochrane Central Register of Controlled Trials, Cochrane Methodology Register, Health Technology Assessment, NHS Economic Evaluation Database)	child*.mp. AND child develop* disorder*.mp. or autis*.mp. AND exercis*.mp.	Humans, English
OTseeker	Autis* AND Exercise*  Autis* AND Sensor**	none

## **INCLUSION and EXCLUSION CRITERIA**

- Inclusion:
  - Diagnosis of ASD: autistic disorder, Asperger syndrome, pervasive developmental disorder - not otherwise specified, child disintegrative disorder and Rett syndrome.
  - Children or adults
  - Independent variable: Exercise (i.e. physical activity) or leisure activity
  - Dependent variable: Anxiety (i.e. stress), or stereotypic (i.e. repetitive) behaviour
  - Peer reviewed studies
  
- Exclusion:
  - Individuals without ASD
  - Studies focused on genetics, medications, massage, acupuncture, or cognitive-behavioural approaches to treating ASD.
  - Letters or editorials

## RESULTS OF SEARCH

Five relevant studies were located and categorised as shown in Table 1, and four of these studies, including one systematic review, are summarized in Table 2. The study which was identified as providing the “best” evidence is critically appraised in Table 3.

**Table 1:** Summary of Study Designs of Articles Retrieved

Study Design/ Methodology of Articles Retrieved	Level*	Number Located	Author (Year)
<b>Systematic Review</b>	1	1	(Petrus et al., 2008)
<b>Repeated Measures Design (Randomized Controlled Trial)</b>	2	1	(Garcia-Villamizar & Dattilo, 2010)
<b>Single Case Design (One-group, repeated measures)</b>	4	1	(Rosenthal-Malek & Mitchell, 1997)
<b>Single Case Design (One subject, repeated measures)</b>	4	1	(Bumin et al., 2003)
<b>Single Case Design (Replication reversal design)</b>	4	1	(Celiberti, Bobo, Kelly, Harris, & Handleman, 1997)

\*Levels of evidence are based on The 2011 Oxford Levels of Evidence (Howick et al., 2011).

**Table 2:** Summary of Studies

	(Petrus et al., 2008)	(Rosenthal-Malek & Mitchell, 1997)	(Bumin et al., 2003)	(Celiberti et al., 1997)
Sample/ Population (SR)	Children under 19 with ASD	N = 5 boys between 14 and 16 years old with autism.	N = 1 eleven-year-old girl with Rett syndrome	N = 1 five-year-old boy with autism.
Outcomes/ Search Strategy and Selection Criteria (SR)	Extensive search and clear selection criteria described.	Frequency of self-stimulatory behaviours, correct academic responding and tasks completed during workshops.	Frequency of stereotypic movements; informal assessment of hand function, balance, gait, activity level, social engagement and communication.	Frequency of physical and visual stereotypic movements, and out of seat episodes.
Intervention/ Data Extraction and Synthesis (SR)	Levels of evidence provided; results displayed in table format.	Academics or jogging followed by academics or workshop tasks.	Hydrotherapy: Halliwick method twice weekly, for eight weeks.	Jogging or slow-paced walking, followed by 40 minutes in the classroom
Results	7 articles met inclusion criteria.	Data analysed through two-tailed, paired <i>t</i> tests.	No data provided.	Data expressed as percentages and means.
Conclusions	Weak to moderately strong evidence	Jogging decreases self-stimulatory	Hydrotherapy may result in functional	Jogging decreased physical self-

	supports the use of higher-intensity exercise in decreasing stereotypic movements.	behaviours and improves productivity of adolescents with ASD.	improvements, decreased anxiety and decreased stereotypic movements in children with Rett syndrome.	stimulatory behaviour in one boy with ASD.
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### **BEST EVIDENCE**

The Randomized Controlled Trial by Garcia-Villamizar and Dattilo (2010) was identified as the 'best' evidence and selected for critical appraisal. Reasons for selecting this study were:

- All PICO elements of this CAT's clinical question are at least partially addressed: Stress levels (Outcome) of individuals with ASD (approximate Population) are measured following engagement in exercise (Intervention) or other leisure activities (Comparison).
- High level of evidence (i.e. Randomized Controlled Trial).

## SUMMARY OF BEST EVIDENCE

**Table 2:** Description and appraisal of Effects of a leisure programme on quality of life and stress of individuals with ASD by (Garcia-Villamisar & Dattilo, 2010).

**Aim/Objective of the Study:** "...to examine effects of a leisure program on quality of life and stress of individuals with ASD" (Garcia-Villamisar & Dattilo, 2010, p. 613).

**Study Design:** "...a pre-test, post-test control group experimental design" (Garcia-Villamisar & Dattilo, 2010, p. 613), which is also known as a Randomized Controlled Trial.

**Setting:** Group recreation sessions were held at the Nuevo Horizonte Association's learning centre, or in the local community in Madrid, Spain.

**Participants:** N = 71 individuals between 17 and 39 years old with clinically diagnosed ASD who attended a day program. Informed consent was obtained, from the participants or their guardians. While the majority of participants were randomly assigned to groups, two participants with Asperger's syndrome were divided between the treatment (program) and control (waitlist) groups. Individuals with comorbid psychiatric illnesses were excluded from the study. Participants' genders are provided. Mean chronological ages, and mental ages based on *Test of Leiter* scores are provided in Table 1.

**Intervention:** Study participants either received one year of individualized leisure programs in a group setting, or were assigned to a wait list. Program participants attended from 17:00-19:00, five days per week, and engaged in activities from the following categories: media, exercise, games and crafts, events and other recreation. Learning centre staff ensured that participants were able to choose between preferred activities within each broader category. Activities were understandable, engaging, and changed frequently. Staff supported participation at different skill levels and flexibility in programming was emphasized: "Participants were not coerced or required to participate in any particular activity. All participants were eligible to engage in all programme activities; however their choices and associated skills guided their engagement" (Garcia-Villamisar & Dattilo, 2010, p. 615).

**Outcome Measures:**

Outcomes were measured both at baseline, and twelve months later, by a therapist blind to the purposes of the study.

Quality of life was measured by the *Quality of Life Questionnaire – Spanish version (QLQ)*. The QLQ is a Level B test, and can be administered to individuals over 18 years old. Five major domains are measured by the QLQ: General Well-Being, Organizational Activity, Occupational Activity, Interpersonal Relations, and Leisure and Recreational Activity. Reliability and validity have been established (MHS Psychological Assessments and Services, 2011).

Stress was measured by *The Stress Survey Schedule for Persons with Autism and Other Pervasive Developmental Disabilities (SSS)*. This survey asks 49 general questions related to common stressful experiences of individuals with ASD, followed by 6 questions related to fears, and 7 questions related to life stressors. Responses are provided on a scale of 1-5. This measure has not established reliability or validity (Matson & Sturmey, 2011).

**Main Findings:** "Simple effects tests using pooled variance estimates" (Garcia-Villamizar & Dattilo, 2010, p. 616), determined no difference in Stress Total Scores and Quality of Life Total Scores between the leisure program and waiting list groups at baseline. ANOVA showed a significant decrease in stress and a significant increase in quality of life (in areas of satisfaction and productivity) for leisure program participants at the end of one year.

Stress	Condition	Baseline		Final Program		ANOVA
		Mean	SD	Mean	SD	
Total score	LP*	114.03	19.90	103.19	19.27	$F_{1,69} = 22.42^{**}$
	WL*	116.94	18.61	117.67	16.25	
Quality of Life						
Empowerment/ independence	LP*	12.13	1.18	13.24	1.88	$F_{1,69} = 0.04$ ; n.s.
	WL*	13.06	1.81	14.26	1.60	
Satisfaction	LP*	15.29	2.32	22.03	2.92	$F_{1,69} = 134.86^{**}$
	WL*	16.23	1.21	15.03	0.93	
Competence/ productivity	LP*	7.62	1.08	11.35	4.08	$F_{1,69} = 22.43^{**}$
	WL*	7.64	0.73	7.82	7.33	
Social/ integration	LP*	15.54	2.06	17.00	2.40	$F_{1,69} = 0.62$ ; n.s.
	WL*	17.23	2.04	18.17	2.11	
Total score	LP*	50.59	2.93	63.62	8.99	$F_{1,69} = 44.14^{**}$
	WL*	54.17	2.90	55.29	3.45	

\*LP = Leisure program; \*WL = Waiting list

\*\*  $P < 0.001$

### Original Authors' Conclusions:

Engagement in leisure activities positively reduces stress and improves quality of life for individuals with ASD. These leisure activities are similar to activities enjoyed by those without disabilities.

Because independence and social integration are often significantly impaired in those with ASD, longer and more directed intervention may be needed to make improvements in these areas.

Studies on the meanings and perceptions of engagement in leisure activities for individuals with ASD are recommended.

### Critical Appraisal:

#### Validity:

Attention bias: More attention may have been paid to leisure program participants than to wait list participants.

Measurement bias: The SSS is an assessment tool for which only internal constancy has been determined. Reliability and validity have not been established (Matson & Sturmey, 2011).

Intervention bias: Contamination is unlikely considering the study results, but should have been addressed as it is unclear whether the wait list group continued to receive alternate day program services. Co-intervention may be an issue as individuals with ASD are often prescribed anti-anxiety medications.

#### Additional Considerations:

Dropouts are not mentioned.

Participants' socioeconomic backgrounds are not discussed.

The study was implemented in Spain.

**Interpretation of Results:**

Transferability is favourable.

The results appear statistically significant (although this is debatable for results of the SSS, given its unproven validity and reliability); ANOVA is appropriate when more than three sets of observations are made on one sample (Greenhalgh, 1997.)

Because a cross-cultural research team (from Spain and the USA) was involved in the design, the leisure activities described are familiar to North American cultures.

**Summary/Conclusion:**

Study results related to improvements in quality of life appear to have clinical significance for adults with ASD. Results suggesting that leisure activities reduce stress in adults with ASD warrant further study.

**IMPLICATIONS FOR PRACTICE, EDUCATION and FUTURE RESEARCH**

- Limitations include a failure to fully address potential attention bias, measurement bias and intervention bias. Although the SSS does not have proven reliability and validity, because the study's methods are otherwise sound, and its measure of quality of life is reliable and valid, these results have some clinical significance.
- Day programs in British Columbia offer similar kinds of leisure activities for adults with developmental disabilities, including ASD.
- In practice, clinicians should ensure that individuals with ASD are exposed to new activities at their levels of ability. In addition, leisure activities should be chosen by participants (and not coerced.)
- It would be valuable to know whether leisure activities need to be provided five times per week (for 2 hours at a time) to be effective in improving quality of life (and possibly reducing stress.) For example, would participating for 15 minutes several times daily suffice?
- Further study on how leisure activities affect stress levels in individuals with ASD is warranted. In particular, conducting a similar study with children with ASD would be valuable to clinicians.

**REFERENCES**

- Ayres, A. J. (1972). *Sensory integration and learning disorders*. Los Angeles, Calif: Western Psychological Services.
- Baranek, G. T. (2002). Efficacy of sensory and motor interventions for children with autism. *Journal of Autism and Developmental Disorders*, 32, 397-420.
- Barthel, K. (2004). *Evidence and Art: Merging Forces in Pediatric Therapy*. Victoria, BC: Labyrinth Therapies.
- Bumin, G., Uyanik, M., Yilmaz, I., Kayihan, H. & Topçu, M. (2003). Hydrotherapy for Rett syndrome. *Journal of Rehabilitation Medicine*, 35, 44-45.
- Celiberti, D. A., Bobo, H. E., Kelly, K. S., Harris, S. L., & Handleman, J. S. (1997). The differential and temporal effects of antecedent exercise on the self-stimulatory behavior of a child with autism. *Research in Developmental Disabilities*, 18(2), 139-150.
- Garcia-Villamizar, D., & Dattilo, J. (2010). Effects of a leisure programme on quality of life and stress of individuals with ASD. *Journal of Intellectual Disability Research: JIDR*, 54(7), 611-619.
- Greenhalgh, T. (1997). Statistics for the non-statistician. I: Different types of data need different statistical tests. *British Medical Journal*, 315, 364-366.
- Harsha, D.W. (1995). The benefits of physical activity in childhood. *The American Journal of the Medical Sciences*, 310 (Suppl. 1): 109-13.
- Howick, J., Chalmers, I., Glasziou, P., Greenhalgh, T., Heneghan, C., Liberati, A., . . . Hodgkinson, M. (2011). *The Oxford 2011 levels of evidence*. Retrieved from Oxford Centre for Evidence-Based Medicine website: <http://www.cebm.net/index.aspx?o=5653>
- Jootsen, A.V., Bundy, A.C. & Einfeld, S.L. (2009). Intrinsic and extrinsic motivation for stereotypic and repetitive behavior. *Journal of Autism and Developmental Disorders*, 39, 521-531.
- Kranowitz, C. S. (1998). *The out-of-sync child: Recognizing and coping with sensory integration dysfunction* (1<sup>st</sup> ed.). New York: Perigee Book.
- Matson, J.L. & Sturmey, P. (Eds.). (2011). *International handbook of autism and pervasive developmental disorders*. New York: Springer.
- MHS Psychological Assessments and Services. (2011). *QLQ™ Quality of Life Questionnaire*. Retrieved from <http://www.mhs.com/product.aspx?gr=cli&prod=qlq&id=overview#scales>
- Petrus, C., Adamson, S. R., Block, L., Einarson, S. J., Sharifnejad, M., & Harris, S. R. (2008). Effects of exercise interventions on stereotypic behaviours in children with autism spectrum disorder. *Physiotherapy Canada*, 60(2), 134-145.
- Rosenthal-Malek, A., & Mitchell, S. (1997). Brief report: The effects of exercise on the self-stimulatory behaviors and positive responding of adolescents with autism. *Journal of Autism & Developmental Disorders*, 27(2), 193-202.

Snell, R. S. (1997). *Clinical Neuroanatomy for Medical Students* (4<sup>th</sup> ed.). Philadelphia: Lippincott-Raven.

Tomporowski, P.D. (2003). Cognitive and behavioural responses to acute exercise in youths: a review. *Pediatric Exercise Science*, 15: 348-359.

Yack, E., Sutton, S. & Aquila, P. (1998). *Building Bridges through Sensory Integration*. Weston, ON: Building Bridges Through Sensory Integration.