The Effects of Exercise Interventions on Stereotypic Behaviors of Children with Autism Spectrum Disorder

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Overview

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Purpose

To conduct a systematic review of studies examining the effect of exercise interventions on stereotypic behaviors of children with autism spectrum disorder (ASD)
Introduction

Autism Spectrum Disorder (ASD):

- refers to individuals with:
  - a specific autism diagnosis
  - Similar core deficits:
    - Pervasive Developmental Disorder–Not Otherwise Specified (PDD-NOS)
    - Asperger Syndrome
    - Childhood Disintegrative Disorder
    - Rett Syndrome
ASD:

- Increasing in prevalence\(^1\)
- Current prevalence: >1 in 200 \(^2\)
- Four times as many males as females affected\(^3\)
- More prevalent in the pediatric population than each of cancer, diabetes, spina bifida, or Down syndrome\(^4\)
ASD - Possible Causes$^5$

- Genetic
- Neuroanatomical differences
- Pre-natal factors
- Exposure to environmental toxins
- Viral infections
- Immune system deficiencies
Introduction

ASD – triad of features

- impairments in socialization
- impairments in verbal and nonverbal communication
- stereotypic and repetitive patterns of behaviours
Introduction

Interventions:
- Sensory integration therapy
- Sensory stimulation techniques
- Auditory and visual interventions
- Sensorimotor handling techniques
- Physical exercise

Goals:
- To treat the three features of ASD
- To facilitate the academic, leisure and self-care skills of children with autism
Introduction

Benefits of Exercise:

- Overall positive effects shown in adults with autism\(^8\)
- Few articles on exercise and stereotyped behaviors of children with autism
- Aerobic exercise may cause physiologically changes that modulate stereotyped behaviors in persons with autism\(^7\)
Introduction

**PICO:**

- **Population:** children under 19 years of age, with a diagnosis of autism or ASD
- **Intervention:** exercise interventions
- **Comparison:** N/A
- **Outcome:** reduction of stereotypic behaviours
Methods

Comprehensive Search Strategy:

- Searching electronic databases
- Hand-searching reference lists
- Communicating with experts in the fields of pediatric physical therapy and autism
Methods

Electronic databases searched:
- MEDLINE
- EMBASE
- PsycINFO
- PEDro
- ERIC
- CINAHL
- Cochrane Database of Systematic Reviews
- Cochrane Controlled Trials Register

Search terms:
- autism, autism spectrum disorder, exercise, physical activity and physical education
Methods

The Web of Science database was used to perform:

- author searches
- journal searches including:
  - Journal of Autism and Developmental Disorders
  - Pediatric Physical Therapy
  - Physical and Occupational Therapy in Pediatrics
  - Developmental Medicine and Child Neurology
  - European Academy of Childhood Disability
Methods

First Search / Papers First Index was searched to find published papers from:

- Congresses
- Symposiums
- Conferences
- Expositions
- workshops and meetings
Methods

Grey Literature:

- Hand-searching of relevant articles
- Contacting key individuals for assistance in finding relevant studies
Methods

Study Selection:

- **Search Limits**
  - English, Human Subjects

- **Title Screen**
  - Excluded if they were related to medications, genetics, cognition, memory, communication, or executive functioning
Methods

Study Selection (cont’d):

- Abstract Screen (reviewed by 2 authors)
- Excluded if did not adhere to the following criteria:
  - intervention study using either exercise or physical activity as the independent variable
  - frequency of stereotypic behaviours as the dependent variable
  - children under 19 years old
  - subjects stated to have autism or autism spectrum disorder
Methods

Study Selection (cont’d):

- Full-text Screen
  - Entire studies reviewed by two independent authors
  - Exclusion criteria same as abstracts
Methods

Data Extraction:

- An adapted version of the AACPDM Study Data Extraction Summary Form⁹ was used
- This form included analysis of:
  - evidence level
  - quality of the study
  - descriptive information about the study
  - outcome of interest
Methods

Levels of Evidence:

- The AACPDM Level of Evidence
- Harris Level of Evidence for Single Subject Designs (Adapted from AACPDM)
Methods

Study Quality Assessment:

Three scales were used for the analysis of study quality:

- **AACPDM Study Quality Scale**
- **The Clinical Relevance Tool for Case Studies**
  Modified from van Tulder
- **Quality, Rigour or Evaluative Criteria for Single Subject Research Designs**
Methods

Data Synthesis:

- Studies were classified into three tables to clearly depict:
  - study quality and design type
  - population characteristics
  - intervention type
  - outcome of interest
  - results
Results

- Preliminary studies $= 200$
- Seven relevant studies
Cochrane Database of Systematic Review (n=5)

MEDLINE (n=43)

Citations excluded after title screening (n=158)

Citations excluded after abstract screening (n=29)

Full articles retrieved for detailed review (n=13)

Studies excluded after full text review (n=6)

Relevant studies included in systematic review (n=7)

EMBASE (n=121)

CINAHL (n=9)

ERIC (n=20)

Cochrane Central Register of Controlled Trials (n=2)

Potentially relevant citations identified through electronic searches (n=200)

Abstracts retrieved for review (n=42)
Evidence Level and Quality of the seven studies

- **Quality:**
  - range 2 to 5 (out of 7), mean 3.9, mode 5
  - 42% moderate, 58% weak

- **Evidence:**
  - range II to V
  - 2 level II, 2 level IV, 3 level V
Brief summary of seven studies

- Study designs:
  - 4 single subject, 2 group designs, 1 case study
- Stereotypic behaviours:
  - As defined within each study
- Interventions:
  - 6 jogging, 1 hydrotherapy
- Subjects:
  - 26 total, male and female, age range 4 to 15
- Diagnosis of each subject:
  - ASD or autism, many stated to have high levels of stereotypic behaviours
Brief summary of seven studies

- Post-exercise stereotypic behaviours:
  - All studies measured using time sampling

- Results of exercise on stereotypic behaviours:
  - All studies reported a decrease in stereotypic behaviours
  - Three studies documented this effect over time
  - Effect was temporary

- Results of exercise on other simple cognitive/play tasks:
  - Mixed findings for improvement
Discussion

7 articles:

- 3: Exercise on stereotypic behaviour and academic performance
- 1: Hydrotherapy
- 3: Vigorous vs mild exercise
Exercise effects on stereotypic behaviours / academic performance

- Watters & Watters (1980)\(^{11}\)
  - Level IV, 5
  - IV: Effects of jogging, TV watching, academic classroom activities
  - No change in academic performance
  - Stereotypic behaviours decreased post-exercise
  - Jogging only IV affecting stereotypic behaviours

- Moderate evidence based on quality scale
- Higher Level of study design needed
Exercise effects on stereotypic behaviours / academic performance

  - Level IV, 5
  - IV: 20 minutes of jogging, academic precondition (classroom activity)
  - Exercise had significantly improved outcomes as compared to academic precondition
  - Jogging: decrease in stereotypic behaviour; increase in on-task behaviour; increase in academic performance

- **Moderate support**
- **Stronger Level of study design needed**
Exercise effects on stereotypic behaviours / academic performance

- Kern et al. (1982)\textsuperscript{13}
  - Level II,3
  - Intervention: Jogging (mildly strenuous); 5-10 min initially, 20 min by end of experiment
  - Decrease in stereotypic behaviour post-jogging
  - Increase in academic responding and ball playing frequency post-jogging

- Weak support, based on quality scale
Hydrotherapy Effect on Stereotypic Behaviours

- Bumin et al. (2003)$^{14}$
  - Level V, 2
  - Halliwick method of hydrotherapy
  - Decrease in stereotypic behaviours

- Weak support, based on quality scale
- Additional studies needed
Vigorous vs. Mild Exercise

- Kern et al. (1984)\textsuperscript{15}
  - Level II, 5
  - Jogging vs. ballplaying
    - Jogging decreased stereotypic behaviours; ballplaying no effect

- Moderate support
Vigorous vs. Mild Exercise

- Celiberti (1997)
  - Level V, 3
  - Jogging vs. walking
  - Jogging decreased stereotypic behaviours, walking no effect

- Weak support
- Stronger study design needed
Vigorous vs. Mild Exercise

- Levinson & Reid (1993)\(^{17}\)
  - Level V, 3
  - Jogging vs. walking
  - Jogging decreased stereotypic behaviours
  - Walking had no effect

- Weak support
- Stronger study design needed
Evidence Applied

- More intensive aerobic activity is of greater effect on stereotypic behaviours
- Difficult to develop exercise prescription due to:
  - Study design heterogeneity
  - Varied forms/monitoring of exercise
- Duration of decreased stereotypic behaviours post-exercise: up to 1.5 hrs
Literature Findings

- **Lack of Research in area:**
  - 7 articles examining exercise effects on stereotypic behaviours

- **Dates of Publication:**
  - 7 articles; 1980-2003
  - 23 year span, no timeline set as exclusion criteria

- **Poor study designs (evidence level II-V)**

- **Overall weak study qualities (mean quality score 3.9/7)**
Limitations of Systematic Review

- English language only
- Published articles only
Conclusion/Recommendations

- **Purpose:**
  - To assess the link between exercise and stereotypic behaviours in children with ASD.

- **The literature suggests:**
  - Exercise decreases stereotypic behaviours in this population.
  - Higher intensity exercise is more effective in decreasing self-stimulation than lower intensity activity.
Conclusion/Recommendations

- **Clinical implications for pediatric physiotherapists:**
  - Consider the literature
  - Difficult to determine specific prescription of exercise for children with ASD.

- **Further research required:**
  - Exercise prescription for children with ASD
  - Longer exercise interventions and long-term effects of exercise
  - Other physiotherapy treatments for children with ASD
  - Improved study design and study quality
?? Questions ??
References