

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

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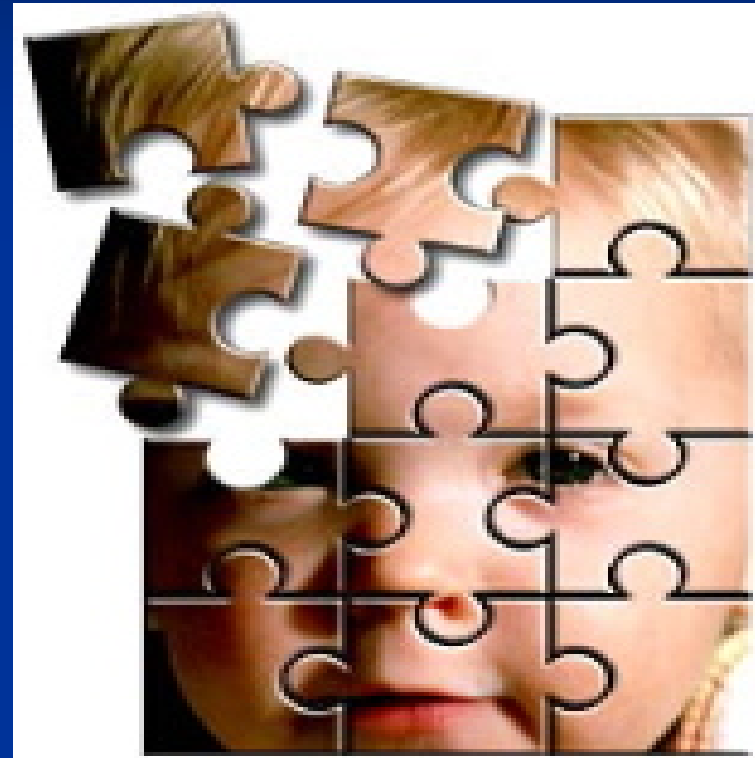


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# Overview

- Purpose
- Introduction
- Methods
- Results
- Discussion
- Conclusion
- Limitations
- Recommendations



# 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):

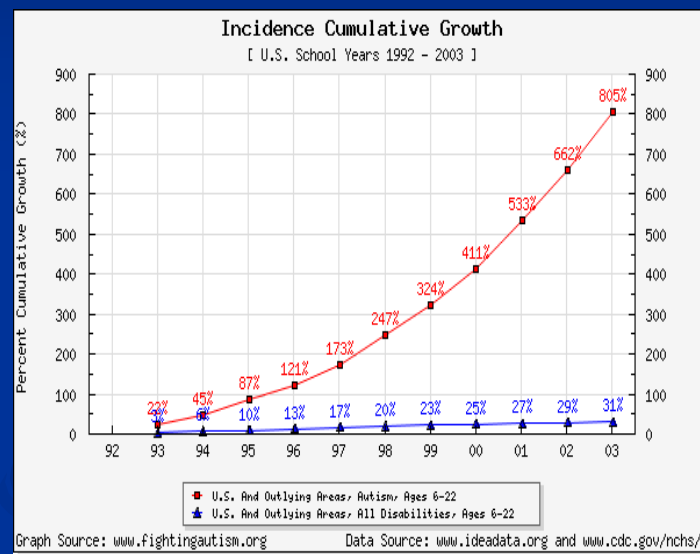
- refers to individuals with:
  - a specific autism diagnosis
  - Similar core deficits:
    - Pervasive Developmental Disorder–Not Otherwise Specified (PDD-NOS)
    - Asperger Syndrome
    - Childhood Disintegrative Disorder
    - Rett Syndrome



# Introduction

## ASD:

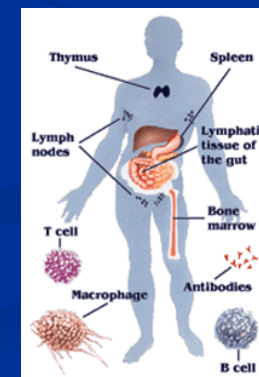
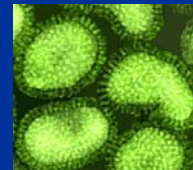
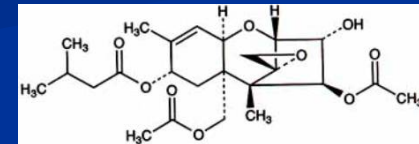
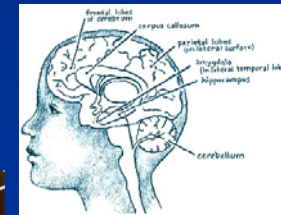
- Increasing in prevalence<sup>1</sup>
- Current prevalence: >1 in 200<sup>2</sup>
- Four times as many males as females affected<sup>3</sup>
- More prevalent in the pediatric population than each of cancer, diabetes, spina bifida, or Down syndrome<sup>4</sup>



# Introduction

## ASD - Possible Causes<sup>5</sup>

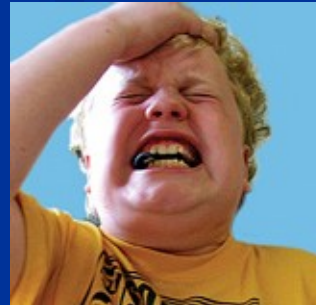
- Genetic
- Neuroanatomical differences
- Pre-natal factors
- Exposure to environmental toxins
- Viral infections
- Immune system deficiencies



# Introduction

## ASD – triad of features<sup>6</sup>

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



# Introduction

## Interventions<sup>7</sup>:

- 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<sup>8</sup>
- Few articles on exercise and stereotypic behaviours of children with autism
- Aerobic exercise may cause physiologically changes that modulate stereotypic behaviours in persons with autism<sup>7</sup>

# 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 AACPD<sup>M</sup> Study Data Extraction Summary Form<sup>9</sup> 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 AACPD<sup>M</sup> Level of Evidence<sup>9</sup>
- Harris Level of Evidence for Single Subject Designs (Adapted from AACPD<sup>M</sup>)

# Methods

## Study Quality Assessment:

Three scales were used for the analysis of study quality:

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

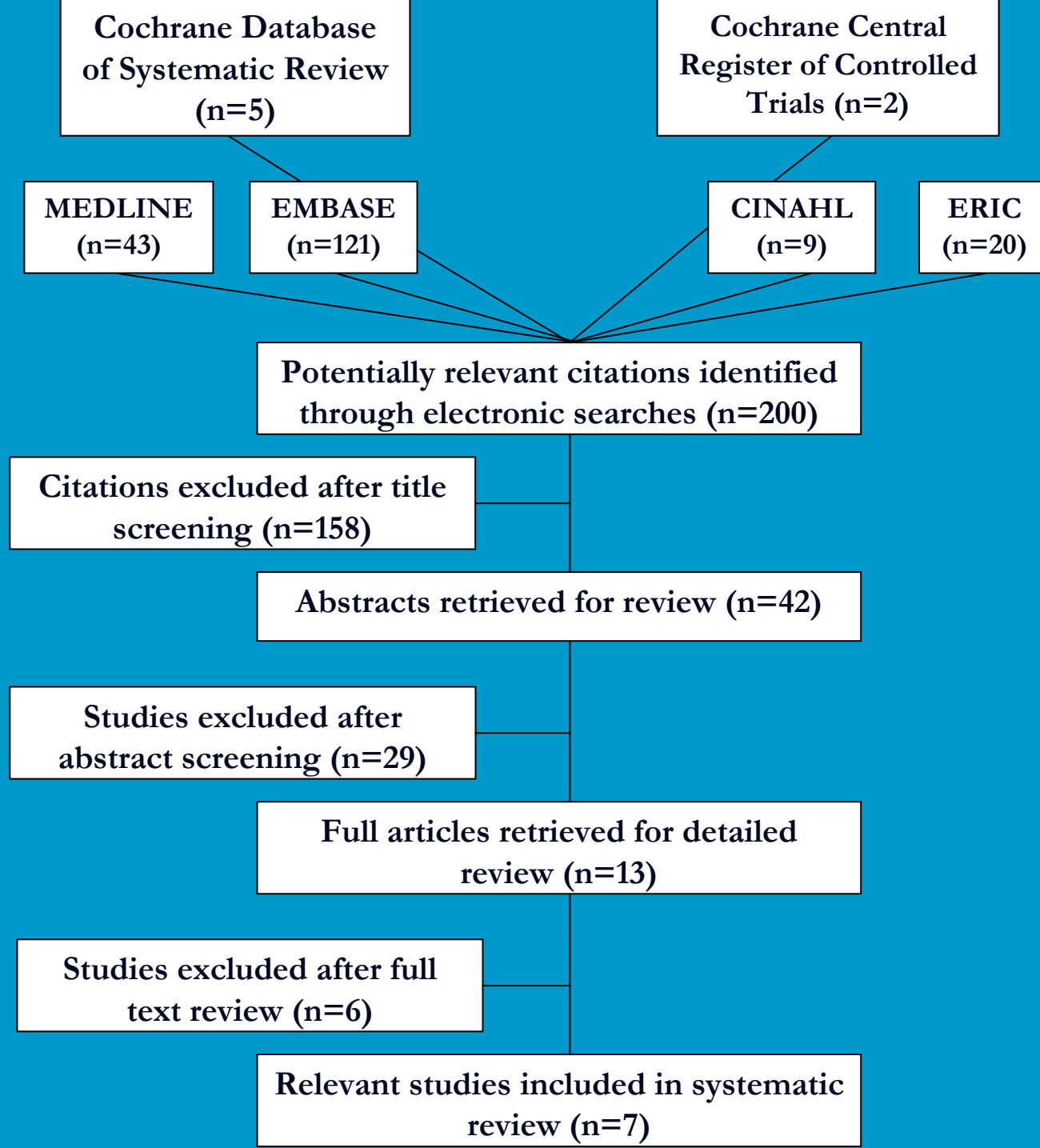
# Methods

## 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





# 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)<sup>11</sup>**
  - 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

- Rosenthal-Malek (1997)<sup>12</sup>
  - 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)<sup>13</sup>
  - 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)<sup>14</sup>
  - 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)<sup>15</sup>
  - Level II, 5
  - Jogging vs. ballplaying
  - Jogging decreased stereotypic behaviours; ballplaying no effect
- Moderate support

# Vigorous vs. Mild Exercise

- Celiberti (1997)<sup>16</sup>
  - 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)<sup>17</sup>
  - 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:

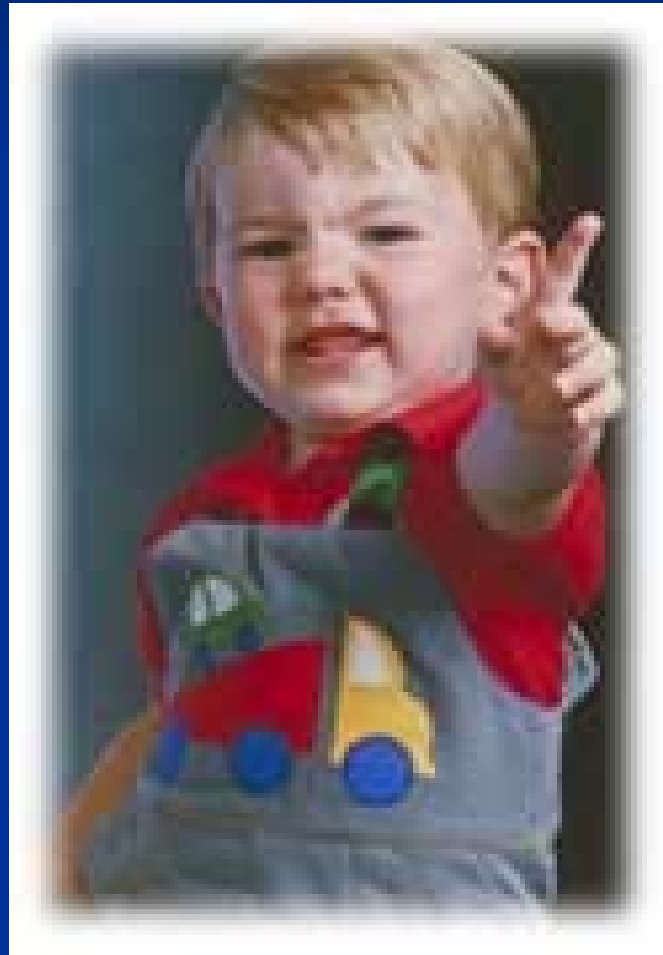
- exercise decreases stereotypic behaviours in this population.
- higher intensity exercise is more effective in decreasing self stimulation than lower intensity activity

# 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 ??



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