

# INPLASY PROTOCOL

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None declared.

## Effectiveness of exercise intervention on improving fundamental motor skills in children with autism spectrum disorder: A systematic review and Meta-analysis

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**Review question / Objective:** This systematic review and meta-analysis aimed to synthesize available randomized controlled trial studies concerning the effects of exercise interventions on fundamental motor skills in children with autism spectrum disorder.

**Condition being studied:** Autism Spectrum Disorder (ASD) is a complicated and highly prevalent neuro-developmental disorder characterized by deficits in social communication, restricted interests, and repetitive behaviors. The CDC reported that the prevalence of ASD was estimated to be 1 in 59 in the United States by 2020. Along with typical symptoms, a couple of studies have indicated that individuals with ASD encounter a variety of challenges, including sleep disturbance, obesity, executive function deficits, physical inactivity, and motor dysfunctions.

Fundamental motor skills (FMS) are the unnaturally occurring basic motor learning model of the human body, which are the building blocks for advanced specialized motor skills and for children and adolescents to participate in sports, games, or other context-specific physical activity. FMS falls into three different categories: (a) locomotor skills (e.g., running and hopping), (b) object control skills (e.g., catching and throwing), and balance or stability skills (e.g., balancing and twisting).

**INPLASY registration number:** This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 04 December 2022 and was last updated on 04 December 2022 (registration number INPLASY2022120013).

### INTRODUCTION

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## METHODS

**Search strategy:** ①autism OR autistic OR Asperger syndrome OR ASD OR PDD-NOS; ②Child\* OR adolescen\* OR youth\* OR teen\*; ③play\* OR “physical education\*” OR “endurance train\*” OR “aerob\* train\*” OR “weight train\*” OR “resistance train\*” OR “strength train\*” OR “physical fit\*” OR “physical activ\*” OR exercis\* OR sport\*; ④FMS OR “motor skill\*” OR “movement skill\*” OR “motor abilit\*” OR “motor competenc\*” OR “motor proficienc\*” OR “motor development” OR “motor performance” OR “motor function” OR “motor impairment” OR “motor fitness” OR “movement proficien\*” OR “locomotor” OR “gross motor” OR “object control” OR “manipulative skill\*” OR “manipulative control” OR “object manipulation” OR stability OR balance OR gait\* OR postur\* OR coordination.

**Participant or population:** children with autism spectrum disorder.

**Intervention:** Exercise intervention.

**Comparator:** Routine Rehabilitation.

**Study designs to be included:** randomized controlled trials.

**Eligibility criteria:** (1) participants included in the studies were children, and the definition and age classification of children were based on the CRC criteria, i.e., mean age  $\leq 18$  years. ASD was defined according to the criteria listed in the Diagnostic and Statistical Manual of Mental Disorders (DSM-4, or DSM-5) or other standardized diagnostic criteria, such as the Autism Diagnostic Interview-Revised(ADI-R), Autism Diagnostic Observation Schedule(ADOS-2); (2) the experimental group used any type of exercise for the intervention (e.g., motor skill-based, exergaming, Aquatic Training, Horseback Riding), control group used waiting list or routine care; (3) the study was randomized controlled trials; (4) studies had to measure fundamental motor skills with validated instruments such as Test of Gross Motor Development, Second Edition (TGMD-2) or Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2); (5) outcome indicators included quantitative data on fundamental motor skills (locomotor skills, object control skills, stability skills), with at least one outcome used to calculate the summary effect size.

**Information sources:** To ensure the comprehensiveness of the literature, a subject term search was conducted in the Web of Science, EBSCO, Scopus, PubMed, and Embase databases from inception through May 20, 2022 to identify all relevant published articles regarding the effect of exercise intervention on FMS in children with ASD.

**Main outcome(s):** Studies had to measure fundamental motor skills with validated instruments such as the Test of Gross Motor Development, Second Edition (TGMD-2) or the Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2). outcome indicators included quantitative data on fundamental motor

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**Quality assessment / Risk of bias analysis:** Study quality was assessed by the Physiotherapy Evidence Database (PEDro) scale. The PEDro scale has been found to be a reliable and valid tool for assessing the study quality of exercise intervention in children with ASD. Notably, one review stated that blinding may be unrealistic in exercise interventions. Thus, considering the limitations of exercise interventions, this item was ignored. The quality of the study can be divided into three categories: high quality $\geq 6$ , adequate quality=4-5, and low quality $< 4$ . Two authors independently assessed the study quality of the included studies based on PEDro, and any disagreements were resolved by a third author.

**Strategy of data synthesis:** Stata 14.0 software (Stata, Texas, USA) was used for data analysis. The included data were continuous variables, standardized mean difference (SMD) was selected as the effect sizes (ESs), and 95% confidence intervals (CI) for the ESs were calculated. As there are fewer than 20 articles, the magnitude of ESs was calculated by Hedges' g, taking 0.2, 0.5, and 0.8 as the respective thresholds for small, medium, and large effects. Heterogeneity was determined with the p-value (threshold point of 0.1) and I<sup>2</sup> statistic (25, 50, 75% representing the respective thresholds for small, medium, and large ratios of inter-study heterogeneity). If no statistical heterogeneity was found across studies (I<sup>2</sup> $\leq 50\%$ , p $> 0.1$ ), we applied the fixed-effect model—otherwise, the random-effects model was used.

**Subgroup analysis:** Given that overall ESs may be influenced by heterogeneity factors (FMS measurements, intervention type, intervention time, intervention frequency, and intervention duration), several subgroup analyses were conducted.

**Sensitivity analysis:** Analysis using the sensitivity analysis function of stata software

**Country(ies) involved:** China.

**Keywords:** fundamental motor skills; autism spectrum disorder; exercise intervention; systematic review.

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