

INPLASY PROTOCOL

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None declared.

Effects of physical activity on social communication disorder in children with autism spectrum disorder : A meta-analysis

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Review question / Objective: Population: Subjects were ASD children, not limited to gender. Intervention: Experimental group intervention for sports. Comparator: Control group was intervened by other non-exercise interventions or routine activities. Outcomes: Outcome indicators were evaluated as social response series scales. Study design: Randomized controlled trial.

Condition being studied: Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder that typically manifests in early childhood and is primarily characterized by deficits in social communication, both verbal and nonverbal, as well as social interaction difficulties. It is imperative to conduct a meta-analysis to evaluate the impact of sports on social disorders in children with ASD. This will enable us to explore the effectiveness of sports intervention and determine the appropriate intervention time, cycle, and frequency. The findings of this study will provide new evidence and a practical basis for improving the scientific means of addressing social barriers in children with ASD.

INPLASY registration number: This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 01 June 2023 and was last updated on 01 June 2023 (registration number INPLASY202360001).

INTRODUCTION

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non-exercise interventions or routine activities. Outcomes: Outcome indicators were evaluated as social response series scales. Study design: Randomized controlled trial.

Rationale: Numerous studies have demonstrated the positive impact of sports on social barriers among children diagnosed with autism spectrum disorders. Despite positive impact, determining the optimal exercise regimen remains a point of contention. Thus, the aim of this paper is to conduct a systematic evaluation of sports and their efficacy in improving social disorders in children with ASD. Based on interventions for children with autism spectrum disorders, the best exercise prescription for future cases would involve a combination of aerobic exercise, strength training, and activities that improve motor skills and coordination. It is important to tailor the exercise program to the individual's needs and abilities, and to incorporate enjoyable activities to increase adherence. A multidisciplinary approach involving healthcare professionals, educators, and parents is recommended to ensure the best outcomes for individuals with autism spectrum disorders.

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METHODS

Search strategy: Pubmed: ("Exercise"[MeSH Terms] OR "Exercises"[Title/Abstract] OR "physical activity"[Title/Abstract] OR "activities physical"[Title/Abstract] OR "activity physical"[Title/Abstract] OR "physical activities"[Title/Abstract] OR "exercise physical"[Title/Abstract] OR "exercises

physical"[Title/Abstract] OR "physical exercise"[Title/Abstract] OR "physical exercises"[Title/Abstract] OR "acute exercise"[Title/Abstract] OR "acute exercises"[Title/Abstract] OR "exercise acute"[Title/Abstract] OR "exercises acute"[Title/Abstract] OR "exercise isometric"[Title/Abstract] OR "exercises isometric"[Title/Abstract] OR "isometric exercise"[Title/Abstract] OR "exercise aerobic"[Title/Abstract] OR "aerobic exercise"[Title/Abstract] OR "aerobic exercises"[Title/Abstract] OR "exercises aerobic"[Title/Abstract] OR "exercise training"[Title/Abstract] OR "exercise trainings"[Title/Abstract] OR "training exercise"[Title/Abstract] OR ("education"[MeSH Subheading] OR "education"[All Fields] OR "Training"[All Fields] OR "education"[MeSH Terms] OR "train"[All Fields] OR "train s"[All Fields] OR "trained"[All Fields] OR "training s"[All Fields] OR "Trainings"[All Fields] OR "trains"[All Fields]) AND "Exercise"[Title/Abstract])) AND ("Autism Spectrum Disorder"[MeSH Terms] OR ("Autism Spectrum Disorder"[MeSH Terms] OR ("autism"[All Fields] AND "spectrum"[All Fields] AND "disorder"[All Fields]) OR "Autism Spectrum Disorder"[All Fields] OR ("autism"[All Fields] AND "spectrum"[All Fields] AND "disorders"[All Fields]) OR "autism spectrum disorders"[All Fields]) OR ("child development disorders, pervasive"[MeSH Terms] OR ("child"[All Fields] AND "development"[All Fields] AND "disorders"[All Fields] AND "pervasive"[All Fields]) OR "pervasive child development disorders"[All Fields] OR ("autistic"[All Fields] AND "spectrum"[All Fields] AND "disorder"[All Fields]) OR "autistic spectrum disorder"[All Fields] OR "Autism Spectrum Disorder"[MeSH Terms] OR ("autism"[All Fields] AND "spectrum"[All Fields] OR "Autism Spectrum Disorder"[All Fields] OR ("autistic"[All Fields] AND "spectrum"[All Fields] AND "disorder"[All Fields])) OR ("Autism Spectrum Disorder"[MeSH Terms] OR ("autism"[All Fields] AND "spectrum"[All Fields] AND "disorder"[All Fields]) OR "Autism Spectrum Disorder"[All Fields] OR ("autistic"[All Fields] AND

"spectrum"[All Fields] AND "disorders"[All Fields]) OR "autistic spectrum disorders"[All Fields]) OR ("Autism Spectrum Disorder"[MeSH Terms] OR ("autism"[All Fields] AND "spectrum"[All Fields] AND "disorder"[All Fields]) OR "Autism Spectrum Disorder"[All Fields] OR ("disorder"[All Fields] AND "autistic"[All Fields] AND "spectrum"[All Fields]) OR "disorder autistic spectrum"[All Fields])) AND ("Social Communication Disorder"[MeSH Terms] OR ("Social Communication Disorder"[MeSH Terms] OR ("social"[All Fields] AND "communication"[All Fields] AND "disorder"[All Fields]) OR "Social Communication Disorder"[All Fields] OR ("communication"[All Fields] AND "disorder"[All Fields] AND "social"[All Fields])) OR ("Social Communication Disorder"[MeSH Terms] OR ("social"[All Fields] AND "communication"[All Fields] AND "disorder"[All Fields]) OR "Social Communication Disorder"[All Fields] OR ("communication"[All Fields] AND "disorders"[All Fields] AND "social"[All Fields]) OR "communication disorders social"[All Fields]) OR ("Social Communication Disorder"[MeSH Terms] OR ("social"[All Fields] AND "communication"[All Fields] AND "disorder"[All Fields]) OR "Social Communication Disorder"[All Fields] OR ("social"[All Fields] AND "communication"[All Fields] AND "disorders"[All Fields]) OR "social communication disorders"[All Fields]) OR ("Social Communication Disorder"[MeSH Terms] OR ("social"[All Fields] AND "communication"[All Fields] AND "disorder"[All Fields]) OR "Social Communication Disorder"[All Fields] OR ("pragmatic"[All Fields] AND "communication"[All Fields] AND "disorder"[All Fields]) OR "pragmatic communication disorder"[All Fields]) OR ("Social Communication Disorder"[MeSH Terms] OR ("social"[All Fields] AND "communication"[All Fields] AND "disorder"[All Fields]) OR "Social Communication Disorder"[All Fields] OR ("communication"[All Fields] AND "disorder"[All Fields] AND "pragmatic"[All Fields])) OR ("Social Communication

Disorder"[MeSH Terms] OR ("social"[All Fields] AND "communication"[All Fields] AND "disorder"[All Fields]) OR "Social Communication Disorder"[All Fields] OR ("communication"[All Fields] AND "disorders"[All Fields] AND "pragmatic"[All Fields])) OR ("Social Communication Disorder"[MeSH Terms] OR ("social"[All Fields] AND "communication"[All Fields] AND "disorder"[All Fields]) OR "Social Communication Disorder"[All Fields] OR ("disorders"[All Fields] AND "pragmatic"[All Fields] AND "communication"[All Fields])) OR ("Social Communication Disorder"[MeSH Terms] OR ("social"[All Fields] AND "communication"[All Fields] AND "disorder"[All Fields]) OR "Social Communication Disorder"[All Fields] OR ("pragmatic"[All Fields] AND "communication"[All Fields] AND "disorders"[All Fields]) OR "pragmatic communication disorders"[All Fields])).

Participant or population: In children with autism spectrum disorder.

Intervention: The experimental group received interventions through participation in various sports, while the control group received non-sports interventions.

Comparator: Regular sports interventions, conducted at least three times a week for a duration of 45-90 minutes and lasting for a period of more than 12 weeks, have been found to effectively improve the social skills of children with autism and reduce social barriers.

Study designs to be included: RCT.

Eligibility criteria: Exclusion Criteria: Subjects were non-autistic children. Experimental group intervention for non-sports means. Control group was intervened by other sports or other unconventional means. Literature results did not show the required indicators. Conference papers, review papers, non-randomized controlled trials.

Information sources: The authors searched searched databases in two languages,

Chinese and English, including China National Knowledge Infrastructure, VIP, and Wanfang Data Knowledge Service Platform, as well as English databases such as Web of Science, PubMed, Scopus, Cochrane Library, and eBSCO database.

Main outcome(s): Out of the 798 records identified, only 9 were eligible and all 9 randomized controlled trials (RCTs) were available for analysis. The data was found to have a low to moderate risk of overall bias. The meta-analysis results showed differences among studies in regards to overall social barriers with high statistical heterogeneity (I²=67%, P<0.01). The effect size of sports intervention on social barriers was found to be (SMD=-0.30, 95% CI: -0.65, 0.04) , indicating a medium-to-above effect and statistically significant.

Quality assessment / Risk of bias analysis: The quality of the literature was assessed using the Cochrane bias risk evaluation criteria, which includes factors such as random allocation method, allocation scheme hiding, blind method of subjects and experimenters, blind method of result evaluation, integrity of result data, selective reporting, and other sources of bias.

Strategy of data synthesis: Among the 9 studies included in this study, there are differences in the measurement dimensions of individual studies. In the process of extracting data, the information of each measurement dimension needs to be merged. Because its data presentation is a continuous variable, it needs to be converted according to publicity. The sample size of measurement method A is N₁, the mean is M₁, and the standard deviation is SD₁. The sample size of measurement method B is N₂, the mean is M₂, and the standard deviation is SD₂. Then the combined sample size N = N₁ + N₂, the mean $M = (N_1M_1 + N_2M_2) / (N_1 + N_2)$, If there are multiple dimensions of data that need to be merged, according to the above formula, first merge the data of two dimensions, and then merge the obtained data with the third dimension, and so on. In addition, this study used the Review

Manager 5.4 version to calculate the I² value of the heterogeneity test of the 9 articles. When the I² value is within the range of 0-40 %, the heterogeneity can be ignored. In the range of 40 % -60 %, there is moderate heterogeneity. In the range of 50 % -90 %, there is high heterogeneity. In the range of 75 % -100 %, there is extremely high heterogeneity [22], according to the heterogeneity test results of the literature, the effect model was selected to analyze the combined effect value Z, weighted mean difference (WMD) and confidence interval value (95 % CI) of the literature. If there is heterogeneity, subgroup or sensitivity analysis of heterogeneity sources is needed, and heterogeneity sources are analyzed to reduce heterogeneity. The publication bias of the literature was tested by forest plot.

Subgroup analysis: Subgroup analysis was performed based on intervention time, intervention frequency, and intervention cycle classification to obtain the following results :

1) Through the subgroup analysis of intervention time, it can be seen that 40-45 minutes of physical exercise intervention each time and 45-90 minutes of physical exercise intervention each time have an improvement effect on social dysfunction of ASD children, and 45-90 minutes of physical exercise intervention each time has no significant improvement effect on social dysfunction of ASD children (SMD = -0.49, P0.05).

2) Subgroup analysis of intervention frequency showed that sports with more than 3 times of intervention per week had no significant effect on the improvement of social dysfunction (SMD = -0.64, P0.05) in children with ASD.

3) Through the subgroup analysis of the intervention period, it can be seen that the sports intervention with the intervention period of 8-12 weeks and the sports intervention with the intervention period greater than 12 weeks have an improvement effect on the social disorder of ASD children, and the intervention period is greater than 12 weeks. The improvement effect of sports intervention

on social disorder (SMD = - 0.67, P0.05) of ASD children is not significant.

Sensitivity analysis: In order to explore whether the heterogeneity among studies is caused by a single study, this study conducted a sensitivity analysis on the intervention of highly heterogeneous exercise intervention on social disorders in children with ASD, and analyzed the combined effect by eliminating individual studies one by one. The results of the analysis are shown in Table 6. This study included 9 studies. After the exclusion of Ren's study (2018), the results of the remaining 8 studies were low heterogeneity (SMD = -0.64, 95 % CI : -0.69, -0.22, I² = 22 %). The processing results do not cause essential changes in the results of the meta-analysis, and the research results have certain reliability and stability.

Country(ies) involved: China AND Poland.

Keywords: autism spectrum disorder, social communication disorder, physical activity.

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