

A Meta-Analysis on the Effects of Physical Activity on the Social Skills of Individuals with Disabilities

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Abstract

This study examined the overall impact of physical activity on the social skills of individuals with disabilities and investigated the moderating influence of associated variables. A meta-analysis was conducted based on 18 empirical studies selected according to the PICOS framework outlined in the PRISMA guidelines. The findings are as follows: First, physical activity demonstrated a moderate overall effect size on the enhancement of social skills in individuals with disabilities ($ES = 0.87$). Second, the heterogeneity of the overall effect size was moderate ($I^2 = 64.9\%$, $Q = 105.32$, $df = 37$, $p < .10$). Third, moderator analysis identified the number of intervention sessions and the type of intervention as significant factors contributing to the observed heterogeneity. Fourth, an assessment of publication bias revealed minimal bias, supporting the robustness of the findings. Taken together, these results suggest that participation in more than 30 sessions of multi-component physical activity interventions may lead to the most substantial improvements in the social skills of individuals with disabilities.

Keywords: *Physical Activity, Individuals with disabilities, Social Skills, Meta-analysis, Convergence Technologies.*

Introduction

The World Health Organization (WHO) defines disability as a multifaceted concept resulting from the interaction between an individual's health condition and various personal and environmental factors, leading to impairments, activity limitations, and restrictions in participation [1]. Similarly, the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) describes disability as a condition in which individuals with physical or mental impairments encounter barriers to full and effective participation in society [2]. Both definitions align with the social model of disability, which views disability not as an inherent personal deficit, but as the product of social and environmental contexts, underscoring the importance of promoting full social participation for persons with disabilities.

Despite these definitions and perspectives, many individuals with disabilities struggle to form meaningful peer relationships due to limited social skills [3]. As a result, they are often perceived as having lower social competence and social status than their non-disabled peers, and they tend to face greater challenges in resolving social conflicts [4]. Consequently, there is increasing recognition of the need to foster and strengthen social skills among individuals with disabilities.

Social skills are defined as an individual's ability to understand others' expectations in various social contexts, select appropriate behaviors accordingly, and respond effectively [5]. These skills are not merely personal attributes, but represent a multidimensional system of abilities encompassing interaction, communication, participation, and emotional competencies. As such, social skills are considered essential for effective interpersonal interaction and for functioning harmoniously within a social environment [5]. Deficits in social skills can arise at any stage of development, and persistent deficits may impede the formation of interpersonal relationships. Such difficulties not only result in unstable social experiences, but also constrain the acquisition of new skills. Therefore, enhancing social skills is considered an essential competency for effective functioning in social contexts [6].

From this perspective, participation in physical activity is widely recognized as an effective means of fostering both social skills and social engagement among individuals with disabilities [7]. Physical

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activity provides physiological, emotional, cognitive, and social benefits, while also helping to prevent diseases and secondary health conditions [8]. It is therefore particularly valuable for improving the quality of life and daily functional abilities of individuals with disabilities compared with their non-disabled peers [8]. Moreover, physical activity supports psychomotor development and nurtures social responsibility as well as appropriate social skills [7]. Activities such as team sports and cooperative exercises promote social integration, strengthen interpersonal bonds, and foster friendships. They also offer emotional benefits, including enjoyment, and help alleviate negative emotions [8].

Accordingly, numerous studies—particularly in international contexts—have examined the relationship between physical activity and the development of social skills in individuals with disabilities [7, 9–13]. In addition, meta-analyses synthesizing these individual studies to determine effect sizes have been conducted, categorized by disability type and intervention characteristics [14–17]. Findings from these international studies indicate that the impact of physical activity extends beyond psychomotor health, serving as a valuable means of promoting social adaptation and participation among individuals with disabilities. However, research conducted in Korea has largely been limited to experimental or case studies, with few meta-analyses systematically examining effect sizes. This lack of empirical research on the effects of physical activity on the social development of individuals with disabilities within educational and environmental contexts may hinder the formulation of educational policies grounded in domestic realities.

Therefore, the purpose of this study was to systematically collect and analyze research conducted in Korea on the effects of physical activity on the social skills of individuals with disabilities, to estimate the overall effect size, and to identify moderating variables influencing these effects. The findings are intended to provide empirical evidence to guide the development of physical activity and sports policies for individuals with disabilities, and to serve as a foundation for initiatives aimed at improving their social skills.

Method

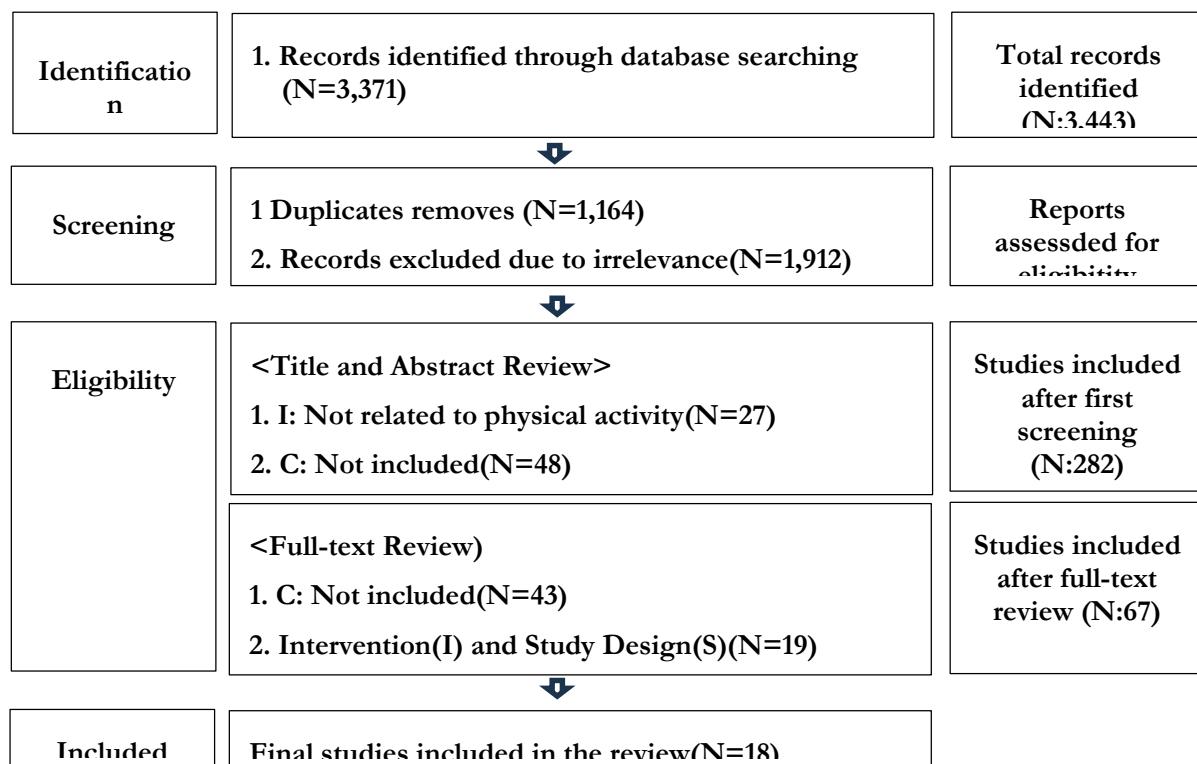
Literature Search and Selection Criteria

This study sought to estimate the overall effect size of physical activity on the social skills of individuals with disabilities and to identify moderating variables influencing this relationship. Electronic searches were conducted via the Research Information Sharing Service (RISS) and Google Scholar, supplemented by manual searches of reference lists from relevant studies. Search terms were developed based on the conceptual definitions of “disability,” “physical activity,” and “social skills,” and included related terms such as “interpersonal skills,” “peer relationships,” “empathy,” and “prosocial behavior.”

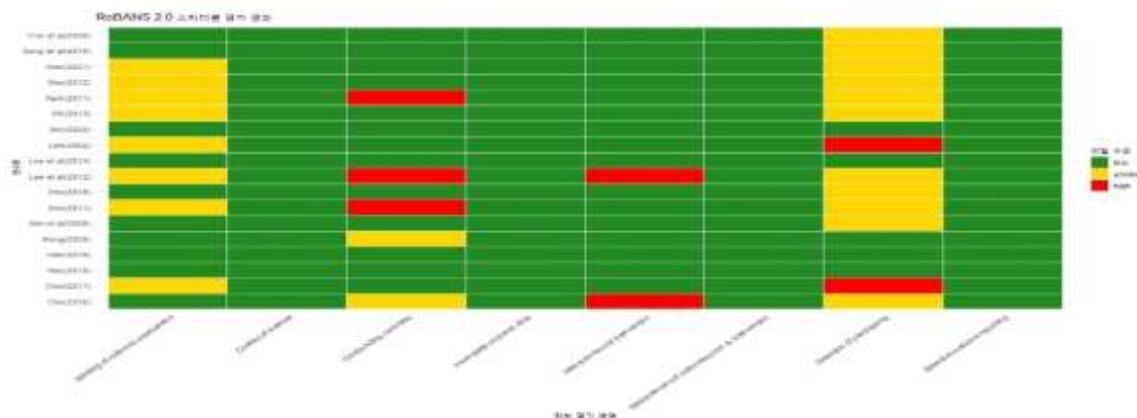
Study selection followed the PICOS criteria (Population, Intervention, Comparison, Outcome, and Study Design) in accordance with the PRISMA 2020 guidelines [18]. The Population included individuals with disabilities, including those eligible for special education services. The Intervention involved physical activity, and eligible studies were required to include a comparison group to enable between-group analyses. The Outcome was social skills, and only experimental studies were included. Studies were excluded if they did not report statistical results, were not intervention-based experimental studies, or did not include a control group.

Literature Selection

This meta-analysis systematically reviewed theses and peer-reviewed journal articles, including both indexed and candidate journals, published between January 2000 and January 2025. The initial search identified 3,443 records. After applying the PICOS eligibility criteria, 18 studies were deemed eligible and included in the final analysis. The selection process is illustrated in Figure 1, in accordance with the PRISMA 2020 flow diagram.

**Figure 1. PRISMA flow diagram****Quality Assessment of Studies**

The methodological quality of the 18 included studies was assessed in this meta-analysis. Evaluating study quality is critical, as it affects the validity of the included research and can substantially influence meta-analytic findings [19]. Because several included studies were non-randomized, quality appraisal was conducted using the Risk of Bias Assessment Tool for Non-randomized Studies (RoBANS 2.0). Assessment results were visualized with the robvis tool [20] and are presented in Figure 2.

**Figure 2. Risk of Bias Assessment for Individual Studies****Expert Panel Discussion**

To enhance the objectivity and reliability of this meta-analysis, expert consultations and consensus-building procedures were implemented at each stage. Key steps—including the operational definition of sociality, literature selection, quality appraisal, and classification of moderator variables—were finalized through cross-review and expert agreement.

The expert panel consisted of four members: one professor specializing in adapted physical education, one Ph.D. in adapted physical education, one Ph.D. in sports pedagogy, and the lead

researcher. Following the framework proposed in [5], the construct of sociality was defined to include not only social skills but also interpersonal skills, peer relationships, empathy, and prosocial behavior. For literature selection, titles and abstracts were first screened, followed by full-text reviews to confirm final eligibility. Among the reviewed studies, all four panelists agreed to include 14 studies, while two reviewers considered four additional studies eligible. Final inclusion decisions for these cases were made through group discussion, resulting in an overall agreement rate of 77.8%. During quality assessment, each of the eight domains and 144 items in the RoBANS 2.0 tool was independently evaluated. Agreement was reached on 126 items, producing an inter-rater agreement rate of 87.5%. This systematic consensus process ensured a high level of reliability [21].

Following this process, data were coded for effect size calculation and moderator analysis based on the 18 included studies. The primary moderator variables identified were type of intervention, total number of sessions, duration per session, frequency per week, number of instructors, and number of participants. Age was excluded from the moderator analysis due to missing information in several studies. The final coded data are presented in Table 1, and the moderator variables, developed through expert consensus, are shown in Table 2.

Table1. Final Coded Data

study	Disability	Freq/wk	Time(min)	Age	Sess.	Interventions	N
Hong(2020)	I.D, AUT	1	100	4-6	12	Dance	11
Lee et al(2014)	I.D.	2	30	7-12	16	THR	15
Lee et al(2012)	I.D.	2	80	9-12	40	Swim	9
Kim et al(2008)	L.D	5	60	16	50	Peer-assisted	10
Yun et al(2020)	I.D, AUT	3	60	10-11	36	Rhythm TKD	10
Song et al(2010)	I.D.	2	90	14	24	Soccer	9
Han(2010)	I.D.	3	40	10-13	30	GB-IPE	9
Han(2018)	I.D, L.D, AUT	2	45	14	16	GD-IPE	8
Kim(2011)	I.D.	2	90	14-16	10	APE	6
Park(2011)	I.D.	2	40	11-16	12	DMT	5
Shin(2021)	AUT	3	60	12	48	Comb. ex	15
Kim(2016)	I.D.	1	40	18-20	12	DMT	7
Seo(2012)	I.D.	3	90	-	12	Soccer	10
Choi(2011)	I.D.	3	60	26-28	10	Aquarobics	15
Cho(2016)	I.D.	2	40	6	24	Incl. aqua	20
Oh(2013)	I.D.	2	50	8-13	24	MGL Ex	5
Min(2020)	I.D., AUT, BL	1	150	13	12	Group Ex	15
Lee(2002)	AUT	2	90	7-8	48	Aquatic Act	10

Table 2. Categorization of Moderator Variables

Moderator Variable	Classification
Type of Disability	I.D / Autism / Multiple & Other
Frequency per Week	≤ 2 times/week / ≥ 3 times/week
Session Times	≤ 40 minutes / ≥ 60 minutes / > 60 minutes
Number of Sessions	≤ 15 sessions / ≤ 30 sessions / > 30 sessions
Intervention	Single Activity/ Peer-Related / Multiple
Number of Participants	≤ 8 participants / $\leq 9-11$ participants / ≥ 12 participants

Statistical Analysis

All statistical analyses were performed using R software. Study quality was evaluated according to the RoBANS 2.0 criteria. Standardized mean differences (Cohen's d) were calculated from pre- and

post-intervention means (M) and standard deviations (SD) reported in each study. Effect sizes were interpreted following the guidelines of [22]. Statistical heterogeneity was assessed using the Q statistic and the I^2 index. Publication bias was examined through funnel plots, Egger's regression test, the trim-and-fill procedure, and the fail-safe N method.

Results

The Overall effect size of Physical Activity on the Social skills of Individuals with Disabilities

The overall effect size (ES, Cohen's d) of physical activity on the sociality of individuals with disabilities is summarized in Table 3. The pooled ES was 0.76, indicating a moderate magnitude according to the guidelines of [22]. This effect was statistically significant, as the 95% confidence interval (CI) did not include zero. Heterogeneity was moderate, with an I^2 of 64.9% ($Q = 105.32$, $df = 37$, $p < .10$), indicating statistically significant variability among studies.

Table 3. Overall Effect Size(Cohen's D)

Model	K	ES	L	H	Q(df)	I^2	p
Random	38	0.76	0.51	1.01	105.32(37)	64.9	.0001

Figure 3 presents the forest plot showing the overall effect size of physical activity on the sociality of individuals with disabilities, along with the effect sizes of the individual studies.

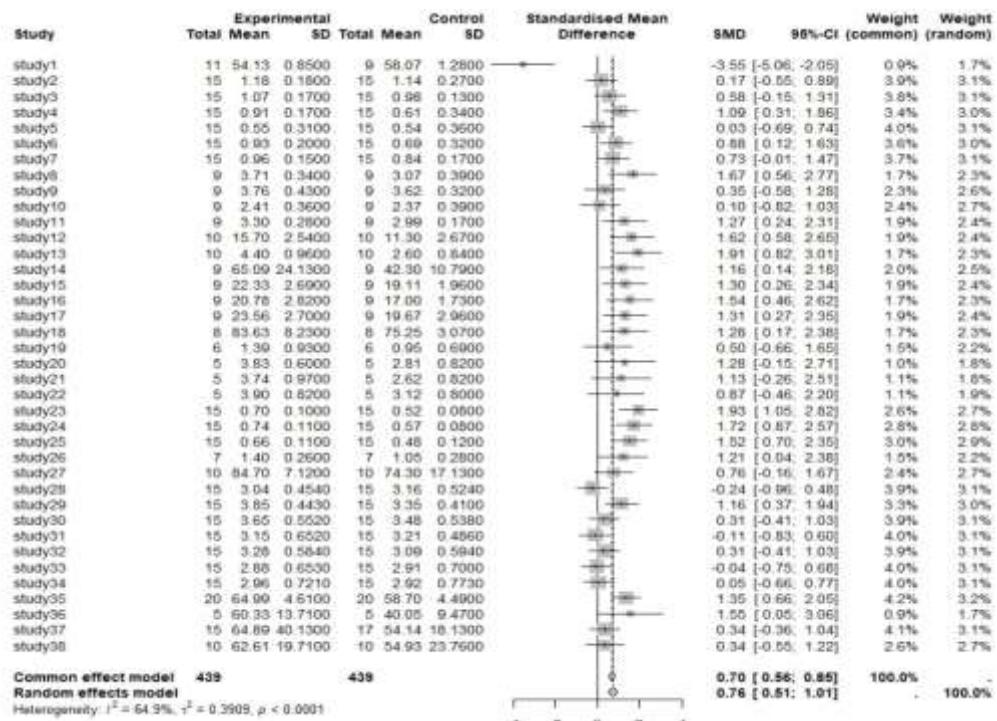


Figure 3. Forest plot

Moderator Analysis

The moderator analysis showed a moderate level of heterogeneity in the overall ES (Cohen's d) ($I^2 = 64.9\%$, $Q=105.23$, $df=37$, $p<.10$). Subgroup analyses were conducted to explore potential sources of this heterogeneity, and the results are presented in Table 4. The total number of sessions significantly moderated the effect ($Q_b = 6.55$, $df = 2$, $p < .10$), with the largest ES observed for interventions exceeding 30 sessions (ES = 1.18). Intervention type was also a significant moderator ($Q_b = 10.17$, $df = 2$, $p < .10$), with combined exercise producing the highest ES (ES = 1.24). This result should be interpreted with caution due to the limited number of cases (fewer than ten) involving combined exercise.

No significant moderating effects were found for type of disability ($Q_b = 3.92$, $df = 2$, $p>.10$), frequency per week ($Q_b=0.66$, $df=1$, $p>.10$), session duration ($Q_b=1.55$, $df = 2$, $p>.10$), or number of participants ($Q_b=2.52$, $df=2$, $p>.10$). Overall, these findings indicate that multi-component physical activity programs

with more than 30 sessions may be the most effective for improving social skills in individuals with disabilities.

Table 4. Analysis of Moderating Effects

Moderator Variable	Classification	K	ES	95% CI		Q_b (df)	p
				L	H		
Type of Disability	I.D	29	0.67	0.45	0.88	3.92(2)	0.1412
	Autism	4	1.38	0.69	2.07		
	Muliple and Other	5	0.37	-1.52	2.25		
Frequency per Week	≤2times/week	22	0.67	0.34	0.10	0.66(1)	0.4169
	≥3 times/week	16	0.88	0.49	1.27		
Session Times	≤40minutes	14	0.87	0.59	1.15	1.55(2)	0.4608
	≥60minutes	14	0.86	0.41	1.30		
	>60minutes	10	0.36	-0.41	1.13		
Number of Sessions	≤15sessions	7	0.28	-0.92	1.48	6.55(2)	0.0378
	≤30sessions	19	0.61	0.34	0.88		
	>30sessins	12	1.18	0.80	1.56		
Intervention	Single Activity	22	0.47	0.15	0.79	10.17(2)	0.0062
	Peer-Related	10	1.15	0.81	1.49		
	Multiple	6	1.24	0.66	1.83		
Number of Participants	≤8 participants	7	1.09	0.61	1.57	2.52(2)	0.2836
	≤9-11 participants	13	0.80	0.13	1.47		
	≥12participants	18	0.63	0.33	0.93		

Publication Bias Analysis

Publication bias was assessed to evaluate the validity of the overall ES (Cohen's d). Both a forest plot and a funnel plot were visually inspected for asymmetry (Figures 3 and 4). Visual inspection suggested potential publication bias, as some asymmetry was observed.

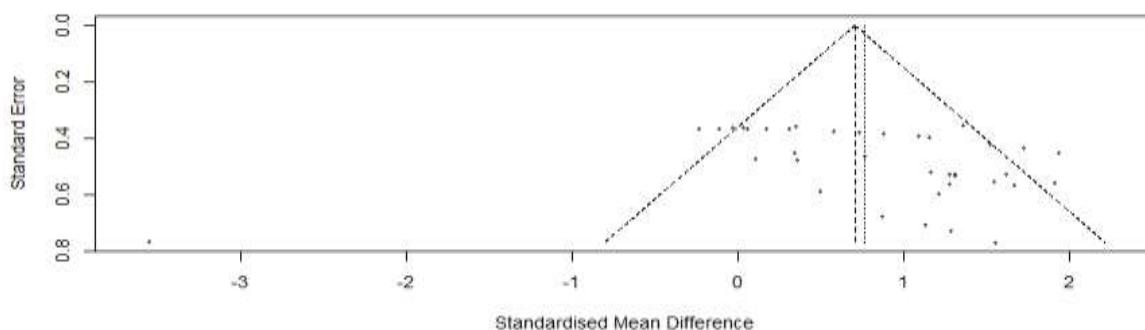


Figure 4. Funnel plot

Egger's regression test was performed to further examine this asymmetry, but the result was not statistically significant (bias = 1.9011, SE = 1.2342, $t = 1.54$, $df = 36$, $p > .05$). Given the inconsistency between visual inspection and Egger's test, a trim-and-fill analysis [23] was conducted (Table 5). This analysis estimated 12 potentially missing studies; after imputation, the overall ES decreased to 0.42 but remained statistically significant. Although the adjusted ES was smaller than the original estimate, it remained of similar magnitude according to [22]. Heterogeneity increased slightly compared with the initial analysis but remained close to the threshold for high heterogeneity. Overall, these findings suggest that any potential publication bias did not materially affect the robustness of the results.

Table 5. Results of the Trim-and-Fill

모형	K	ES	L	H	Q(df)	I^2	p
Random	38	0.76	0.51	1.01	105.32(37)	64.9	.0001
T-a- F(R)	50	0.42	0.15	0.69	185.98(49)	73.7	.0020

Although the visual inspection and trim-and-fill analysis indicated some potential publication bias, a fail-safe N analysis was conducted to further evaluate the robustness of the meta-analytic results. The fail-safe N, calculated using the formula $(5k + 10)$ [24], was 1,530 ($p < .001$), far exceeding the commonly accepted threshold of 200. This means that 1,530 null-result studies would be needed to reduce the overall effect size (ES, Cohen's d) to a non-significant level, indicating that the potential impact of publication bias is minimal.

Overall, these results suggest that any publication bias present is not large enough to undermine the validity of the findings. Therefore, the estimated overall effect size for the influence of physical activity on the social skills of individuals with disabilities can be considered robust.

Sensitivity Analysis

Sensitivity analyses were conducted to assess the robustness of the meta-analytic findings under different study inclusion criteria and content. First, the study with the largest ES (Cohen's d) and highest heterogeneity was excluded, and the results were recalculated. Removing this study resulted in an overall ES of 0.76, with heterogeneity decreasing to 55.6%, indicating that the exclusion of the most influential study did not materially change the results. Second, to examine the impact of study quality, six studies rated as "High" risk in at least one of the eight RoBANS 2.0 domains were excluded. Analysis of the remaining 12 studies ($k = 21$) produced an increased ES of 0.94 (95% CI = 0.54–1.33), with heterogeneity rising slightly to 70.2%. These results indicate that, even after removing studies with higher risk of bias, the magnitude and direction of the effect remained consistent, confirming the robustness of the findings.

Table 6. Sensitivity Analysis Excluding High Risk Studies

Model	K	ES	L	H	Q(df)	I^2	p
Main Analysis(Random)	38	0.76	0.51	1.01	105.32(37)	64.9	.0001
Sensitivity Analysis(Random)	21	0.94	0.54	1.33	67.19(20)	70.2	.0001

Discussion

The purpose of this study was to examine the overall effect size of physical activity on the social skills of individuals with disabilities and to identify moderating variables influencing this effect. To achieve this, a meta-analysis was conducted on 18 studies selected according to the PICOS criteria of the PRISMA guidelines. The results and their implications are as follows.

First, physical activity demonstrated a statistically significant moderate effect on the social skills of individuals with disabilities ($ES = 0.76$). To assess the validity of this overall ES, publication bias was examined. Although visual inspection of the funnel plot indicated some asymmetry, Egger's regression test ($bias = 1.9011$, $p > .05$) found no statistically significant bias, suggesting no clear evidence of publication bias. Given these mixed observations, a trim-and-fill analysis was conducted under the assumption of 12 missing studies. While the ES decreased slightly, it remained in the moderate range, supporting the robustness of the findings [23]. Furthermore, the fail-safe N was calculated to be 1,530 ($p < .001$), far exceeding the threshold of 200, indicating that publication bias was unlikely to meaningfully affect the results [24]. These findings are consistent with prior research. For example, [14] reported a moderate effect ($ES = 0.68$) of physical activity on the social aspects of adolescents with intellectual disabilities, [15] found a moderate effect ($ES = 0.54$) for children with autism spectrum disorder, and [16] highlighted the role of physical exercise in improving social skills among children and adolescents with autism spectrum disorder. This consistency strengthens the evidence base for the positive impact of physical activity on social skills development.

In Korea, the participation rate of individuals with disabilities in inclusive physical activities has increased to 35.2% but remains far below that of non-disabled individuals (60.7%) [26]. Notably, 49.1% of non-participants with disabilities reported no intention to engage in physical exercise, underscoring the need for targeted policy interventions to promote participation. Previous studies have shown that higher motivation for leisure sports participation is associated with greater improvements in quality of life [27]. Recommended strategies include promoting the psychosocial benefits of physical activity

through media campaigns, public advertisements, and social media, as well as offering direct experiential opportunities. Regular recreational sports events organized by local governments could also foster interest and a sense of belonging. Achieving these goals requires improving community perceptions by creating opportunities for both individuals with and without disabilities to access and use community facilities together. This inclusive approach would promote social cohesion and enhance the accessibility of physical activity spaces [28]. While stress relief is the primary motivation for participation among non-disabled individuals, persons with disabilities report significantly lower rates of participation for leisure or social interaction [26, 29]. This highlights the need to reframe physical activity not only as a health-promoting behavior but also as a means of social engagement and integration. Beyond the empirical evidence, current participation rates in Korea underscore the practical necessity of such interventions.

Second, heterogeneity in ES across studies was moderate ($I^2=64.9\%$), likely due to differences in intervention structure, content, participant characteristics, and measurement tools. Moderator analysis revealed statistically significant effects for the number of sessions ($Q_b=6.55$, $df=2$, $p<.10$) and intervention type ($Q_b=10.17$, $df=2$, $p<.10$). These findings indicate that sustained, multi-faceted physical activity interventions exceeding 30 sessions may be particularly effective in enhancing social skills in individuals with disabilities. This is consistent with [16], which reported the largest ES (1.57) for combined activities in individuals with autism spectrum disorder. Although [15] did not find combined exercise to produce the highest ES compared to other interventions, it still reported a moderate effect (ES = 0.68), indirectly supporting the current results. Furthermore, [15] found the greatest effects in programs lasting over 12 weeks, whereas [12] reported that a 12-week intervention alone was insufficient to meaningfully improve social skills in students with autism spectrum disorder. This suggests that longer intervention durations may be necessary, reinforcing the conclusions of this study. Therefore, to effectively enhance social skills, it is recommended that combined physical activity programs include at least 30 sessions. Achieving this goal requires strengthening the expertise and competencies of instructors. According to [26], the most requested supports among individuals with disabilities participating in inclusive physical activities were the provision of appropriate programs and the availability of qualified instructors. While the consistent delivery of a given program is important, expanding the diversity of available programs may further increase participant engagement. Moreover, physical and mental development during childhood and adolescence has a lasting positive impact on emotional development in adulthood [30]. This suggests that promoting physical activity during these formative years can substantially improve social skills in later life. Continuous attention to physical activity participation among school-aged children with disabilities is therefore essential. Although some students with disabilities attend private after-school physical activity programs with non-disabled peers, many private instructors lack adequate expertise in disability-specific instruction. Disability awareness and instructional training should therefore be extended to private academies and sports organizations. Given the limitations of relying solely on voluntary participation, a policy framework should mandate disability-awareness education in instructor qualification examinations and require regular training and continuing professional development.

By synthesizing ES (Cohen's d) from multiple studies, this study quantitatively confirmed the positive impact of physical activity on the social skills of individuals with disabilities, thereby addressing the limitations of prior case-specific discussions. The moderator analysis, centered on intervention type and participation duration, provides practical guidance for field application. These findings offer empirical evidence to support the development and implementation of physical activity programs aimed at enhancing social skills, and may inform future policy-making and program design.

Conclusions and Suggestions

This meta-analysis evaluated the effects of physical activity on the social skills of individuals with disabilities, estimating the overall effect size and identifying key moderating variables. Based on the findings, the conclusions are as follows.

First, physical activity showed a statistically significant, moderate positive effect on the social skills of individuals with disabilities.

Second, Comprehensive physical activity programs delivered in more than 30 sessions demonstrated the strongest effects on social skills. In contrast, variables such as type of disability, number of participants, session duration, and frequency per week did not significantly influence the relationship between physical activity and social skills.

Third, although some evidence of publication bias was detected, its magnitude was insufficient to meaningfully affect the results. Therefore, the findings can be considered robust and valid.

Based on these findings, the following recommendations are offered.

First, this study assessed social skills using social skills, interpersonal relationships, empathy, and prosocial behavior as dependent variables. However, because the concept of social skills is defined in diverse ways and measurement tools vary across studies, future research should report ES (Cohen's *d*) for each subcomponent of social skills and conduct more detailed analyses accordingly.

Second, future research should also examine qualitative aspects such as the content and instructional methods of physical activity programs. Although this study classified interventions by activity type, it did not assess the content validity of each program. Incorporating qualitative evaluations of program content would enhance the interpretability and practical applicability of future findings.

Third, future research should expand the scope of analysis internationally by including studies reported across diverse countries and cultural contexts. This would enhance the external validity of the findings regarding the impact of physical activity on improving the social skills of individuals with disabilities. Furthermore, conducting meta-analyses that categorize social skills into its specific subdomains could provide more precise evidence for program design. In addition, the application of advanced statistical techniques, such as meta-regression, would be valuable for exploring continuous variables that influence the magnitude of the effect size in greater depth.

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