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Analysis of Physical Activity, Motor Skills, and Social Skills in Children with Disabilities with Autism Spectrum Disorder (ASD)

Tenica Meliana Saputri[1]✉, Jajat[2]✉, Kuston Sultoni[3]✉

Universitas Pendidikan Indonesia, Bandung, Indonesia[123]

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Abstract

This study aims to analyze physical activity, gross motor skills, and social skills in children with Autism Spectrum Disorder (ASD) and to examine the relationship between these three variables. This study used a descriptive quantitative method involving nine children with ASD at SLB-D YPAC Bandung. Physical activity was measured using ActiGraph GT3X for seven days, motor skills were assessed through long jump, ball throw, 10-meter run, and balance tests, while social skills were measured using the Social Skills Questionnaire (SSQ). Data were analyzed descriptively and using Spearman's correlation to examine the relationship between variables. The results showed that the level of physical activity among children with ASD tended to be low, gross motor skills varied between individuals, and social skills were in the moderate category. Correlation analysis showed no strong relationship between physical activity, motor skills, and social skills, reflecting the diversity of developmental characteristics in children with ASD. However, these three aspects remain important to improve through structured interventions tailored to individual needs. These findings emphasize the importance of a holistic approach in supporting the physical, motor, and social development of children with ASD.

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✉ Correspondence address :
E-mail: tenicamelianasaputri19@upi.edu ; jajat_kurdul@upi.edu ; kuston.sultoni@upi.edu

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INTRODUCTION

Physical activity is a fundamental element in the growth and development process of children (Y. Li et al., 2023). Through physical activity, children learn about their physical potential, hone their motor skills, and build physical fitness, which forms the basis of their health (Xing et al., 2024a). Physical activity significantly contributes to increased muscle strength, balance, flexibility, and endurance (Wu et al., 2024). In line with this, the WHO, through its Guidelines on Physical Activity and Sedentary Behavior, states that: "Children and adolescents should engage in at least 60 minutes per day of moderate to vigorous physical activity, mostly aerobic, throughout the week." In other words, this recommendation emphasizes that children and adolescents (aged 5–17 years) are encouraged to engage in an average of at least 60 minutes of moderate to vigorous physical activity every day of the week, with a primary focus on aerobic activities. Not only does it emphasize the duration and intensity of movement, but it also affirms the importance of regular physical activity to support children's physical, cognitive, and social health (Jia et al., 2023a). Children's participation in active play, sports, or structured physical activities can improve thinking skills, concentration, and strengthen social interactions with close friends (Koh, 2024). A number of studies have shown that physically active children have better self-control and tend to adapt more easily in social environments (Arkesteyn et al., 2022). Therefore, physical activity is not only a means of recreation, but also a medium for learning and character building in children's developmental stages (Cheng et al., 2022).

Motor development is the result of interactions between the central nervous system, muscles, and environmental experiences (Y. A. Wang et al., 2025). Good motor skills reflect efficient sensorimotor coordination, which fundamentally influences children's confidence in participating in social environments (Skaletski et al., 2024). According to Q. Wang et al., (2025), basic motor skills such as walking, running, jumping, and throwing are related to a child's ability to interact socially, as these activities are often performed in social settings such as group games or sports (Hatipoğlu Özcan et al., 2025). Conversely, delayed motor development can hinder children's social participation and lead to withdrawn behavior. According to Dionisio et al., (2024), children with poor motor skills tend to avoid physical activities with peers because they feel insecure or afraid of failure. This condition can reduce social motivation and worsen interpersonal isolation (Xing et al., 2024b). Therefore, treatment that stimulates basic motor skills not only has an impact on physical aspects but also acts as a conduit for improving children's social and emotional skills (L. Li et al., 2023).

Autism Spectrum Disorder (ASD) is a neurobiological developmental disorder that affects how individuals communicate, interact socially, and process sensory information (Kou et al., 2024). Children with ASD exhibit a range of symptoms, from difficulties with speech and understanding social cues to repetitive behaviors and restricted interests (Jia et al., 2023b). Research by Ji ji et al., (2022) states that this disorder affects not only social functioning but also motor skills and body coordination. Several studies, such as those conducted by Alhowikan et al., (2023) and Mohd Nordin et al., (2021), show that children with ASD experience sensorimotor integration disorders that result in difficulties in controlling fine and gross motor skills, such as holding small objects, maintaining body balance, or following sequential movement instructions. These impairments hinder their participation in physical activities at school and in social settings (Monteiro et al., 2022). In addition, limitations in nonverbal communication often cause children with ASD to be less able to understand social cues when playing or exercising with friends, which further reinforces their tendency toward social socialization and low participation in group physical activities (Suárez-Manzano et al., 2024).

Various studies show that children with ASD have lower levels of physical activity compared to normal children. Research by Sung et al., (2021) and Zhao & Chen, (2018) reports that children with ASD spend more time in sedentary activities such as sitting or staring at screens, which leads to decreased fitness and impaired motor coordination. Research conducted by Taylor et al., (2024) found that environmental factors such as a lack of opportunities to play outdoors and an inability to adapt to sports groups aggravate this condition. However, various sports-based interventions and structured activities have shown positive results. In addition to physical improvements, structured activities also play an important role in developing executive function, self-discipline, and emotional control. As such, targeted physical activities have great potential to become an effective therapeutic strategy for improving motor skills and behavior in children with ASD.

Social skills are one of the most influential

factors for individuals with ASD. Difficulties in understanding facial expressions, body language, and social norms often cause children with ASD to experience barriers in building relationships with others (Fajriyati et al., 2024). However, research shows that motor skills can help improve children's social functioning. Shalehah et al., (2023) added that physical activities involving interaction, such as paired games or team sports, can stimulate social skills and empathy responses. This means that physical activity and motor skills are not only biological aspects but also function as rehabilitation tools that encourage children with ASD to learn to understand social dynamics more naturally.

Although many studies have examined physical activity, motor skills, and social skills in children with ASD separately, research combining these three aspects is still limited. Most studies focus on the impact of physical treatment on motor development, while social behavior is often only a supporting variable. In fact, the relationship between these three dimensions is reciprocal and effectively influences each other. Physical activity can improve motor skills, as it can improve children's social and emotional behavior. Therefore, research is needed that can clearly analyze this relationship to provide a complete picture of the characteristics of physical activity, motor skill levels, and social skills in children with ASD. Based on this issue, the study entitled "Analysis of Physical Activity, Motor Skills, and Social Skills in Children with Autism Spectrum Disorder (ASD)" aims to provide an overview of the relationship between these three variables and serve as a basis for more effective rehabilitation treatment for children with ASD in Indonesia.

METHODS

This study is an observational study with a descriptive quantitative approach (Toyon, 2021). This approach describes quantitative data to obtain a clear understanding of physical activity, motor skills, and social skills in children with Autism Spectrum Disorder (ASD) (Sharma et al., 2023). This study was conducted at SLB-D YPAC Bandung, West Java, Indonesia. The location was chosen based on the availability of participants with ASD diagnoses and school facilities that support physical activity measurement and social observation. Data collection was conducted from September to October 2025, covering the stages of participant recruitment, installation of physical activity measurement devices, implementation of motor tests, and questionnaire distribution.

The research subjects were children with Autism Spectrum Disorder (ASD) enrolled at SLB-D YPAC Bandung. The inclusion criteria were: (1) children diagnosed with ASD, (2) aged 5-17 years, (3) able to follow simple instructions in physical activities, and (4) obtained permission from parents or guardians. Exclusion criteria were children with severe physical disabilities that limited their participation in physical activities. Sample selection was conducted using purposive sampling, taking into account participant availability and ethical criteria. A total of 9 children with ASD participated in this study. This study has three main variables, namely:

1. Physical activity, measured through intensity, duration, and frequency of movement using ActiGraph GT3X for 7 consecutive days.
2. Gross motor skills, measured through four components: long jump (explosive strength), ball throw (hand-eye coordination), 10-meter run (speed), and static balance (postural stability).
3. Social skills, measured using the Social Skills Questionnaire (SSQ) by (Gresham et al., 2011), which includes the dimensions of cooperation, communication, empathy, and self-control.
4. Each variable is accompanied by indicators and assessment categories to facilitate quantitative and qualitative interpretation of the results.

Physical activity data were obtained objectively from ActiGraph GT3X devices worn on the waist of participants during daily activities. Gross motor data were obtained through direct testing using standard procedures at the school field. Social skills data were collected through SSQ questionnaires completed by parents. All instruments had been tested for validity and reliability in previous studies and were adapted to the context of children with ASD. To minimize measurement bias, all procedures were conducted by the same researcher with special training on the characteristics of children with ASD.

In addition, the ActiGraph device was calibrated before use and was used consistently. Social response bias was minimized by asking accompanying teachers and parents to complete the questionnaire because they had direct observations of the children's behavior. The sample size was determined based on the availability of children with ASD in the school and considerations of the ethical and technical feasibility of individual measurements. Although the number of participants was relatively small (n = 9), data

were collected intensively and in depth to ensure the quality of the results and representativeness of the characteristics of children with ASD in the school. Quantitative data from ActiGraph, gross motor tests, and SSQ were processed in numerical form. Mean, minimum, maximum, and standard deviation values were calculated to describe the general trends of each variable. Some variables (e.g., physical activity level and social skills) were categorized into low, medium, and high levels based on score distribution to facilitate descriptive analysis and interpretation of inter-variable relationships. Data analysis was performed descriptively and inferentially using statistical software. Descriptive analysis was used to display participant characteristics and variable distributions (mean, SD, range of values). Inferential analysis was performed using Spearman's rank correlation test to examine the relationship between physical activity levels, motor skills, and social skills because the data were not normally distributed and the sample size was small. The two data sets were combined at the interpretation stage to obtain a comprehensive understanding of the relationships between variables.

RESULTS AND DISCUSSION

The table comparing moderate to vigorous physical activity according to the WHO with the research subjects shows that the average duration of moderate to vigorous physical activity in children with ASD in this study is still far below the WHO recommendations. Based on the WHO Guidelines on Physical Activity and Sedentary Behavior, children and adolescents (5–17 years) are recommended to engage in an average of 60 minutes per day of moderate to vigorous physical activity per week, which in this study was operationalized with a comparison of 60 minutes per day as the reference standard.

Table 1. Comparison of WHO moderate-vigorous with subjects

Subyek	MVPA (minutes/days)
1	29.61
2	22.50
3	25.49
4	31.99
5	71.73
6	42.52
7	25.85
8	31.92
9	0.97
Mean	31.40

However, of the 9 subjects studied, only 1 child met the criteria for physical activity duration that was close to or exceeded the standard, namely 11.11%. Meanwhile, the other 8 children did not reach the recommended duration. The average duration of moderate to vigorous physical activity was only 31.40 minutes per day, meaning that, in general, the level of physical activity among children with ASD in this study fell into the category of not meeting WHO recommendations. When viewed in more detail, only subject number 5 showed a duration of moderate to vigorous physical activity above the WHO recommendation (71.73 minutes per day), while the other subjects were well below 60 minutes, and there was even one child (subject 9) with a very low duration of activity (0.97 minutes per day). These findings are similar to the results of a study conducted by Chong et al. (2024), which analyzed physical activity, sedentary behavior, and sleep in children from 33 countries. The results showed that only 14.3% of 7,017 children met the WHO recommendations for physical activity.

Table 2. The relationship between physical activity, motor skills, and social skills in children with ASD

Variabel	M	SD	1	2	3
Physical Activity	30803.	14177.	-		
Motor Skills	120.24	18.08	0.98	-	
Social Skills	49.67	7.55	0.76	0.97	-

Table 2 shows the correlation between physical activity, motor skills, and social skills in children with ASD. The results show no strong or consistent relationship between the three variables. Most of the correlations are low, indicating that physical activity and motor performance are not directly related to social skills in this small sample.

The results of this study indicate that the physical activity patterns of children with ASD tend to be low, which is consistent with the literature stating that children with ASD are more often involved in sedentary activities than physical activities (Yarımkaya & Esentürk, 2022). This condition can be influenced by several factors, such as difficulty adapting to the play environment, communication barriers, and a tendency to engage in repetitive and static activities. Low involvement in physical activity has the potential to slow down the development of basic health and fitness components in children with ASD, making structured interventions such as game-based exercise programs, physical activity therapy, or fun sensorimotor activities important for encouraging more optimal movement participation.

Gross motor skills in children with ASD in this study showed considerable variation, indicating that motor development in this group is not uniform. This diversity reflects differences in sensorimotor abilities, coordination levels, and visual and proprioceptive information processing that are very characteristic of children with ASD (Wagle et al., 2021). These findings support the previous view that children with ASD tend to experience obstacles in locomotor abilities and postural control, which can affect their confidence when participating in physical activities. Thus, motor exercises that are designed gradually and focus on basic components such as balance, strength, and coordination can help improve their motor performance.

The social skills of children with ASD in this study appear to be at a moderate level, with fairly clear variations in ability between individuals. This condition illustrates that some children are able to engage in simple social interactions, although they still face challenges in controlling their emotions, empathy, and two-way communication. These obstacles are consistent with the characteristics of ASD, which affect the ability to process social cues and maintain consistent social contact. Therefore, strengthening social skills through interventions based on physical activity, group games, and social-emotional learning is an important step in supporting the development of more adaptive social interactions (Gagan et al., 2022).

When the relationship between physical activity, motor skills, and social skills was analyzed, no strong correlation was found in this study. The absence of such a relationship does not mean that the three aspects are independent, but may be due to the small sample size, the diversity of each child's profile, and the highly individual dynamics of ASD development. In the context of ASD, improvement in one domain does not always lead to improvement in other domains, so strong linear relationships often do not appear statistically. This reinforces the understanding that interventions for children with ASD must be personalized, adaptive, and consider the unique needs of each individual (Azzahra, 2020).

Although no significant relationship was found between variables, the findings of this study still make an important contribution to understanding the complexity of ASD child development. Physical activity, motor skills, and social skills remain relevant aspects to be improved because each has clear therapeutic and educational benefits. This study also emphasizes the need for integrated, sustainable, and multisectoral intervention programs involving teachers, therapists, and parents. Furthermore, future studies are recommended to use larger samples and longitudinal approaches to obtain a more accurate and comprehensive picture of the relationship between variables.

CONCLUSION

This study shows that children with Autism Spectrum Disorder (ASD) tend to have low levels of physical activity, varying gross motor skills, and moderate social skills. This condition reflects the unique developmental characteristics of children with ASD, in which physical, motor, and social aspects develop unevenly. These patterns emphasize the need for intervention programs tailored to individual needs, as each child's abilities differ and cannot be generalized.

Although the correlation analysis shows no strong relationship between physical activity, motor skills, and social skills, these findings underscore the importance of improving all three aspects through a structured, multisectoral approach. Interventions that combine physical exercise, motor stimulation, and social learning remain relevant for supporting the holistic development of children with ASD. Further research with larger sample sizes and longitudinal designs is needed to understand the dynamics of the relationships between variables in greater depth.

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