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The effect of skipping exercises on increasing agility and leg muscle power in mentally retarded children

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Abstract

The low level of physical activity in the lives of children with intellectual disabilities may contribute to reduced muscle strength and fitness levels. Therefore, effective interventions are needed to enhance the physical capacity of children with intellectual disabilities to support better mobility and quality of life in the future. This study aims to explore the effects of moderate-intensity skipping exercise on improving agility and lower limb muscle power in children with intellectual disabilities. A total of 15 male children aged 10–12 years with intellectual disabilities were recruited from SDLB-B Tunas Bangsa Educational Foundation (YPTB), Malang City, and underwent a moderate-intensity skipping intervention program for six weeks. Data collection included agility measurements using the hexagon agility test and lower limb muscle power assessed through the vertical jump test. Statistical analysis was performed using a paired-sample t-test. The results revealed a significant improvement in agility from pretest to posttest (38.56 ± 4.86 to 33.65 ± 6.02 seconds; Effect Size (ES): 0.897; p = 0.001). Similarly, vertical jump test results showed a significant increase in leg muscle power between pretest and posttest (17.99 ± 4.29 to 23.61 ± 5.64 cm; ES: 1.121; p = 0.001). These findings suggest that a six-week skipping program can be an effective method to enhance motor abilities in children with intellectual disabilities.

Keywords: Agility; Leg Muscle Power; Exercise; Mentally Retarded Children; Motor Ability

1. Introduction

Intellectual disability affects approximately 3% of the global population and influences various aspects of individual development, including intellectual functioning, adaptive behavior, and motor skills (Aminikhah & Bahiraei, 2025; Pestana et al., 2018; Kesumawati & Rahayu, 2019). Children with intellectual disabilities generally exhibit limitations in physical abilities and movement coordination, which may affect their participation in daily activities (Wojnarska et al., 2023). Moreover, a sedentary lifestyle is common within this population, increasing the risk of obesity, metabolic disorders, and cardiovascular diseases in adulthood (Lin et al., 2023). The lack of physical activity also contributes to weakened muscle strength and lower fitness levels compared to typically developing children (Jacinto et al., 2021; Dairo et al., 2016; Hsieh et al., 2017; Bull et al., 2020). Hence, effective interventions are essential to enhance their physical capacity to support better mobility and overall quality of life.

One of the critical factors in developing motor skills in children with intellectual disabilities is lower limb muscle power and agility, which are crucial for performing daily activities such as walking, running, jumping, and hopping (Bishop & Pangelinan, 2018). Lower limb muscle power refers to the ability of muscles to generate force quickly, vital for explosive activities like jumping and sprinting (Jaric & Markovic, 2009). Agility, on the other hand, reflects the ability to move

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swiftly and accurately, which is particularly necessary for activities requiring rapid changes in direction or quick reactions (Wang et al., 2025). Children with intellectual disabilities often require postural care due to severe motor function impairments (Robertson et al., 2018), affecting their everyday activities. Enhancing physical abilities such as agility and lower limb endurance may offer new avenues for addressing challenges faced by children with intellectual disabilities. Given this significance, a training method that can simultaneously improve both muscle power and agility—while accommodating the specific characteristics and limitations of these children—is needed.

In this context, skipping (jump rope) exercises emerge as a potential alternative. This form of training is not only aerobic but also involves explosive muscle contractions that can improve muscle power, balance, and coordination (Chen & Wu, 2022). However, research on the effects of skipping in children with intellectual disabilities remains scarce, making it difficult to determine whether this method offers comparable benefits. Jump rope training may present challenges and require adjustments for this population, as they often struggle with movement synchronization and rhythm (Ilbeigi et al., 2016; Chiba et al., 2009). While fostering independence in children with special needs is already a meaningful goal, supporting their health and adaptability to their environment can lead to a more fulfilling life for themselves and those around them. Therefore, this study aims to explore the effects of skipping exercises on enhancing lower limb muscle power and agility in children with intellectual disabilities, with the hope of offering new insights for designing more inclusive and effective physical training programs for this population.

2. Material and methods

This study employed a pre-experimental design with a one-group pretest-posttest format. A total of 15 male children aged 10–12 years with intellectual disabilities were recruited from SDLB-B Tunas Bangsa Educational Foundation (YPTB), Malang City. Participants underwent a six-week moderate-intensity skipping exercise intervention. Before the intervention, all participants were provided with a detailed explanation of the research procedures, objectives, benefits, and potential risks, which was delivered by their homeroom teacher. Informed consent was obtained from their parents or guardians by signing a consent form voluntarily and without coercion. All procedures in this study adhered to the ethical principles of the Declaration of Helsinki issued by the World Medical Association regarding research involving human subjects.

The skipping intervention program consisted of 3–5 sets of 12–15 repetitions each, performed at 60–70% of the participant's maximum heart rate (HRmax), for 30 minutes per session, three times per week for six weeks. Each session included dynamic stretching for warm-up and static stretching for cool-down, each lasting 5 minutes. Throughout the intervention, participants were supervised by a coach to ensure that movements were executed correctly and in accordance with the procedures. Heart rate monitoring during the intervention was conducted using a Polar Heart Rate Monitor H10.

Data collection involved agility assessment using the Hexagon Agility Test and lower limb muscle power evaluation using the Vertical Jump Test. Measurements were taken at baseline (pre-intervention) and four weeks after the intervention (post-intervention).

Statistical analysis began with the Shapiro-Wilk test to assess data normality. For normally distributed data, the Paired Samples t-test was employed with a 95% confidence level. Additionally, Cohen's d was calculated to determine the effect size between pre- and post-intervention. All statistical analyses were performed using SPSS version 21.

3. Results and Discussion

The results revealed a significant improvement in agility between pretest and posttest measurements (38.56 ± 4.86 to 33.65 ± 6.02 seconds; Effect Size (ES): 0.897; $p = 0.001$). Similarly, leg muscle power assessed via the vertical jump test showed a significant increase from pretest to posttest (17.99 ± 4.29 to 23.61 ± 5.64 cm; ES: 1.121; $p = 0.001$). These changes are visually presented in Figure 1, illustrating the differences in agility and leg muscle power before and after the intervention.

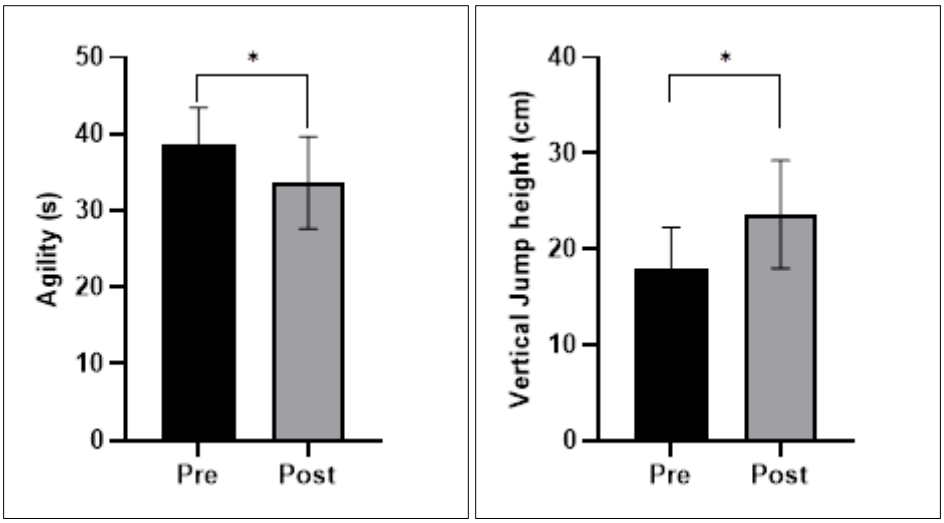

Figure 1 Assessment of agility and leg muscle power between pre and post. Description: (*) significant at pre ($p \leq 0.001$). p-value was evaluated with a paired sample t-test

This study investigated the effects of skipping exercise on improving lower limb muscle power and agility in children with intellectual disabilities. Our findings demonstrate that skipping exercises significantly enhance both lower limb muscle power and agility in this population. These two attributes serve as markers of motor development, reflecting the extent to which physical training can improve their functional capacity (Bishop & Pangelinan, 2018; Jaric & Markovic, 2009; Wang et al., 2025). The improvement in lower limb muscle power is evident from participants' increased ability to jump and support their body weight more effectively, indicating neuromuscular adaptation to explosive training (García-Pinillos et al., 2020). Skipping involves repetitive movements that require rapid and forceful muscle contractions, thereby strengthening muscle fibers and enhancing leg propulsion (Chen & Wu, 2022). Meanwhile, the improvement in agility suggests that skipping also enhances sensorimotor coordination (Deng et al., 2024), balance, and faster motor responses in daily activities.

Lower limb power and agility are not merely physical indicators but also reflect the functional independence potential of children with intellectual disabilities (Scifo et al., 2019). Children with better muscle power are more likely to move efficiently and rely less on assistance for everyday tasks such as walking, climbing stairs, or transitioning between locations (Kashi et al., 2024). Similarly, agility enables them to respond more swiftly to environmental changes and coordinate their movements more effectively (Wang et al., 2025). Improvements in physical capability and active participation in sports activities may also help reduce societal stigma toward children with intellectual disabilities, potentially increasing their opportunities for social engagement—even though this was not directly measured in the present study. In other words, progress in these two areas may contribute to long-term improvements in quality of life.

When compared with previous studies, our findings align with research conducted among the general adolescent population. Ahsan (2025) reported improvements in both psychological parameters (self-esteem, confidence, aggression, and anxiety) and physiological components (speed, agility, strength, and endurance) among rugby and football players following a six-week plyometric training program. This is further supported by Ramirez-Campillo (2023), who found that plyometric jump training is an effective intervention for enhancing physical fitness in adolescents, including maximal dynamic strength, linear sprint speed, horizontal jump performance, reactive strength index, and sport-specific performance. However, studies specifically examining the effects of skipping on adolescents with intellectual disabilities remain limited. Therefore, this study contributes new insights to the scientific literature, showing that skipping exercises can be a viable intervention for improving motor skills among individuals with cognitive and motor limitations. Nonetheless, variation in training response was observed, likely influenced by the degree of disability, individual motivation, and adherence to the training protocol. Thus, skipping exercises should be tailored to the specific conditions and needs of each participant to ensure optimal benefits.

From an implementation perspective, the findings suggest that skipping can be incorporated into physical education programs in inclusive schools or rehabilitation centers. This exercise is easy to perform, does not require expensive equipment, and can be adapted to various conditions. In practice, however, educators and trainers must adjust the exercise intensity to match the participant's abilities. For instance, adolescents with higher coordination difficulties may

begin with simplified movement patterns before introducing more complex skipping sequences. This gradual approach not only enhances training effectiveness but also minimizes injury risk and promotes greater participant engagement.

While this study offers new insights, several limitations must be acknowledged. First, the sample size was relatively small, limiting the generalizability of the findings to the broader population of adolescents with intellectual disabilities. Second, the duration of the intervention was relatively short, and thus the long-term effects of skipping on motor development remain uncertain. Additionally, external factors such as participant motivation, training environment, and support from caregivers or teachers may have influenced the outcomes. Future studies should consider using longitudinal designs with larger sample sizes and explore the combination of skipping with other exercise modalities to gain a more comprehensive understanding of its impact.

4. Conclusion

A six-week skipping intervention, performed three times per week, produced significant improvements in both agility and lower limb muscle power in children with intellectual disabilities. These findings suggest that skipping exercises can be an effective method to enhance motor abilities in this population, particularly in terms of leg strength and agility. However, the effectiveness of such training programs may also depend on other factors, including the duration of training, participants' initial physical abilities, and the instructional methods employed during the intervention.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

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