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Original Article Research

Analysis of Locomotor Movement Skills in Students with Down Syndrome at SLBN-A Citereup, Cimahi City

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Abstract

There is limited information available regarding special education in Indonesia. Nonetheless, the development of motor skills is crucial for students with Down syndrome in an inclusive educational setting. Purpose: This research aims to assess the fundamental locomotor skills of students with Down Syndrome and to explore whether there are differences in motor performance based on sex. Method: A descriptive quantitative approach was employed, with a sample of 20 students, consisting of 10 males and 10 females with Down Syndrome. The Test of Gross Motor Development-2 (TGMD-2), created by Ulrich (2000), served as the evaluation tool. Data were analyzed using descriptive statistics and independent samples t-tests, utilizing SPSS version 29.0 and Microsoft Excel software. Results: The subtest component of jumping achieved the highest mean score (M = 4.1, SD = 1.944), whereas hopping showed the lowest performance (M = 2.35, SD = 1.182). About 70% of participants (n = 14) displayed average basic locomotor movement skills. Overall, there were no significant differences in locomotor movement skill performance based on gender ($p = 0.195 > 0.05$). Conclusion: Students with Down Syndrome showcase a range of skill levels across different movement abilities, with jumping identified as one of their strengths that requires intervention. The outcomes of this study aim to establish a valuable database regarding the locomotor skill profiles of students with Down syndrome in Indonesia, which is pertinent to inclusive education, and to provide a fresh perspective on the exploration of gender-related locomotor skills.

Keywords: Locomotor movement skills; down syndrome; inclusive education

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1. INTRODUCTION

The significance of education for children extends beyond the general population of

children to also encompass those with special needs. This is supported by Law Number 8 of 2016 regarding individuals with disabilities, specifically in article 10, which states, "Individuals with disabilities are entitled to receive quality education in all educational institutions across various types, paths, and levels, both inclusively and specifically." In this context, Mardhia and Pransista (2025) highlighted that special education is provided for learners who encounter obstacles during their educational journey due to physical impairments, emotional issues, mental health disorders, cognitive challenges, and social difficulties. This research focuses on children with special needs, particularly those diagnosed with Down Syndrome.

Down Syndrome (DS) is a genetic condition characterized by an additional chromosome, which influences the traits of individuals affected by this disorder, including reduced intellectual capacity, distinctive physical features, and limited environmental responsiveness (Kamil et al., 2023). Moreover, individuals with Down Syndrome face challenges or delays in cognitive development, with their intellectual abilities falling below those of their peers, and they often struggle with learning and adapting (Qalbi & Efendi, 2020). Extensive studies indicate a notable correlation between intellectual capabilities and motor skills, revealing that children with cognitive disabilities frequently exhibit disruptions in motor development, adversely affecting their independence and daily life activities (Alesi & Battaglia, 2019). These motor development issues are characterized by deficiencies in planning and controlling movements, delays in reaching motor development milestones, struggles with fine motor skills and writing, as well as difficulties in tasks requiring manual dexterity, which are common within this demographic (Alesi et al., 2018).

Fundamental motor skills (FMS) refer to the essential abilities and skills necessary for children to execute a sequence of structured basic movements in their daily activities. This includes locomotor skills (e.g., running, jumping, and sliding) and object control skills (e.g., hitting, catching, or kicking) (Wick et al., 2017; Alesi & Battaglia, 2019). FMS plays a vital role in the execution of more intricate and specialized skills required in play, games, and sports (Logan et al., 2018; Zhang & Cheung, 2019). Furthermore, proficiency in FMS is a critical element in achieving and sustaining physical activity (Leis et al., 2020) and overall fitness (Cattuzzo et al., 2016), promoting a healthier body weight (Barnett et al., 2016) and facilitating the progression of more advanced motor skills as individuals grow older, both currently and in the future (Logan et al., 2015).

However, it is a fact that children across the globe experience deficiencies in fundamental motor skills, and numerous studies carried out in various countries have come to comparable findings (Kit et al., 2017; Aye et al., 2018). A thorough examination of 65 distinct studies concerning the levels of basic motor skills in children revealed that their fundamental motor skills (FMS) were classified within the "below average" to "average" range in relation to the normative standards established by the Test of Gross Motor Development, second edition (TGMD-2) (Bolger et al., 2021). Insufficient levels of FMS can impede children's overall development in multiple domains (Jones et al., 2020). Increasing evidence indicates that a lack of competence in FMS during childhood may result in lower levels of physical activity and is correlated with obesity, which carries health risks for children (Wibowo et al., 2021).

This research will concentrate on a specific element of basic motor skills, particularly locomotor skills in children with Down Syndrome. Locomotor skills encompass the ability to navigate from one place to another, including actions such as walking, running, jumping, and

hopping (Hernández et al., 2022). Children with Down Syndrome (DS) frequently encounter significant challenges in developing locomotor skills due to issues related to their musculoskeletal system, delayed neurodevelopment, and hypotonia (muscle weakness) (Jain et al., 2022). Studies indicate that children with DS typically encounter delays in reaching gross motor development milestones until they are between two and three years old, in contrast to their typically developing peers (Malak et al., 2015). Gender has been identified as a crucial factor affecting motor development in the general population. Longitudinal studies indicate that boys tend to exhibit superior gross motor skills, such as throwing and kicking, while girls generally excel in fine motor skills and balance (Barnett et al., 2019).

Conversely, research exploring gender differences in locomotor skills among individuals with Down Syndrome remains scarce and yields inconsistent findings when compared to the general population. The study by Zheng et al. (2022) affirmed that there is no uniform agreement regarding the presence of gender differences in FMS abilities among children. Various studies have highlighted gender differences in fundamental motor skills in children (Niemistö et al., 2020; Bolger et al., 2021), with boys normally demonstrating superior capabilities in object control skills compared to girls (Temple et al., 2016; Bolger et al., 2021). However, other research suggests that both boys and girls exhibit comparable levels of locomotor skill capabilities, though some evidence points to girls showing enhanced abilities in this area (Temple et al., 2016; Niemistö et al., 2020).

The primary aim of this research was to examine the profile of locomotor movement skills among students with Down Syndrome, looking at the overall ability as well as each specific subtest component. Additionally, the study sought to identify any gender-based differences in locomotor movement ability within this population. This research addresses gaps or issues identified in prior studies. A notable aspect of this investigation is the variance in population characteristics and educational systems between Indonesia and other nations. Specifically, the objectives of this study are (1) to outline the locomotor movement ability profile in students with Down Syndrome and (2) to evaluate the differences in locomotor movement skills linked to gender among these students. It is anticipated that this study will enhance understanding in the realm of adaptive physical education, particularly concerning the development of effective learning processes for students with Down Syndrome.

2. METHOD

This study uses a quantitative descriptive approach to identify the locomotor movement profile of Down syndrome students at SLBN-A Citereup, Cimahi City. This approach provides a complete explanation of the phenomenon being studied (Aggarwal & Ranganathan, 2019) and utilizes statistical analysis to gain a deeper understanding of the related factors (Waruwu, 2023). This study is a cross-sectional study, which offers a snapshot of variables at a certain point during data collection, with data collected using a Likert scale questionnaire. Respondents rate their agreement with certain statements using this scale (Pranatawijaya et al., 2019).

2.1 Participants

This research employs a quantitative descriptive method to examine the locomotor movement characteristics of students with Down syndrome at SLBN-A Citereup in Cimahi City. This method gives a thorough insight into the phenomenon under investigation (Aggarwal & Ranganathan, 2019) and applies statistical analysis to enhance the understanding of the relevant

factors (Waruwu, 2023). The study takes a cross-sectional approach, which captures a view of variables at a specific moment during the data gathering process, with information obtained through a Likert scale questionnaire. Participants express their level of agreement with various statements using this scale (Pranatawijaya et al., 2019).

2.2 Research Design

This This research employs a quantitative descriptive approach. This method facilitates an extensive explanation of the phenomena under examination (Aggarwal & Ranganathan, 2019) and utilizes statistical evaluation to achieve a more profound understanding of pertinent variables (Waruwu, 2023). The specific focus of this study is to elaborate on the state of locomotor abilities in students with Down syndrome, while also considering their gender.

2.3 Instruments

In any research endeavor, instruments play a crucial role in data collection. For this particular study, the instrument utilized is the Test of Gross Motor Development-2 (TGMD-2), created by Ulrich (2000), which encompasses various aspects of the locomotor skills subtest. This subtest includes activities such as running, galloping, jumping, hopping, and sliding, as well as the documentation of external influences like noise levels, clarity of instructions, distractions, light intensity, and environmental temperature.

2.4 Procedures

This research adheres to a systematic process that begins with identifying the problem, formulating the problem statement, selecting instruments, gathering data, and analyzing that data. The research procedure initiates with preliminary observations and coordinating with the school to obtain approval for conducting the study and to identify eligible subjects who meet the specified criteria. Additionally, the researcher selects and modifies the measurement instruments for locomotor skills, following the guidelines of the Gross Motor Development Test (TGMD-2), which includes various movement components like running, jumping, hopping, sliding, and racing. Subsequently, data collection occurs through a direct observation method, wherein the researcher records the performance of each subject as they execute the movements according to the test instrument's instructions. The results are documented on a predetermined observation sheet. The collected data are then analyzed descriptively to illustrate the proficiency levels of the students' locomotor skills, including calculations for minimum, maximum, average (mean), and standard deviation values. Each phase of this process is conducted in an organized manner to ensure the data's accuracy and the relevance of the findings to the research objectives.

2.5 Data Analysis

Statistical analysis techniques were used to process data from the results of the locomotor skills test. Microsoft Excel and IBM Statistical Product and Service Solution (SPSS) Version 29 were used in this analysis technique. In this study, two different data analysis methods were applied. First, the level of emotional intelligence was divided into three groups using percentage analysis: low, medium, and high. Second, the T-test was used to determine the significance of the difference between one or two sample groups.

3. RESULTS

Analysis of the level of locomotor skills in Down Syndrome students produced a series

of data which were then processed using SPSS software version 29. Table 1 presents details of the results of the descriptive analysis of the components of locomotor skills that have been carried out.

Table 1.

Descriptive Statistics of Locomotor Skills Components

	N	Minimum	Maximum	Mean	Std. Deviation
Run	20	2	8	3,95	1,849
Gallop	20	0	8	2,75	2,403
Jump	20	1	8	4,1	1,944
Jumping	20	1	5	2,35	1,182
Horizontal-Jump	20	0	8	3,5	1,987
Shift	20	1	8	3,65	2,498
Valid N (listwise)	20				

Source: Primary Data

The descriptive statistical analysis presented in Table 1 conducted on 20 Down Syndrome students related to locomotor skill components provides several important findings. The "Jump" component has the highest average value of 4,1, indicating that the jump component is relatively better compared to other components. On the other hand, the jumping component shows the lowest average value of 2,35, indicating that this component is the weakest in Down Syndrome students.

Then, regarding the overall picture of locomotor skills in Down Syndrome students, this will be presented in Table 2.

Table 2.

Overall Value of Descriptive Statistics of Locomotor Skills of Down Syndrome Students

	N	Range	Minimum	Maximum	Mean	Std. Deviation
Male	10	29	6	35	17,40	8,422
Female	10	31	10	41	23,10	10,429
Total	20	35	6	41	20,25	9,426

Source: Primary Data

The descriptive statistical analysis presented in Table 2 reveals several important findings. The mean score for locomotor skills in Down Syndrome students was 20.25. There was a large range between the lowest and highest scores, with a minimum score of 6 and a maximum score of 41, leading to a difference of 35 points. The recorded standard deviation was 9.426, reflecting the variability in the data.

To provide a more detailed picture, the level of locomotor skills in Down Syndrome students will be shown in the frequency distribution presented in Table 3 below.

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Table 3.

Frequency Distribution of Locomotor Skill Levels of Down Syndrome Students

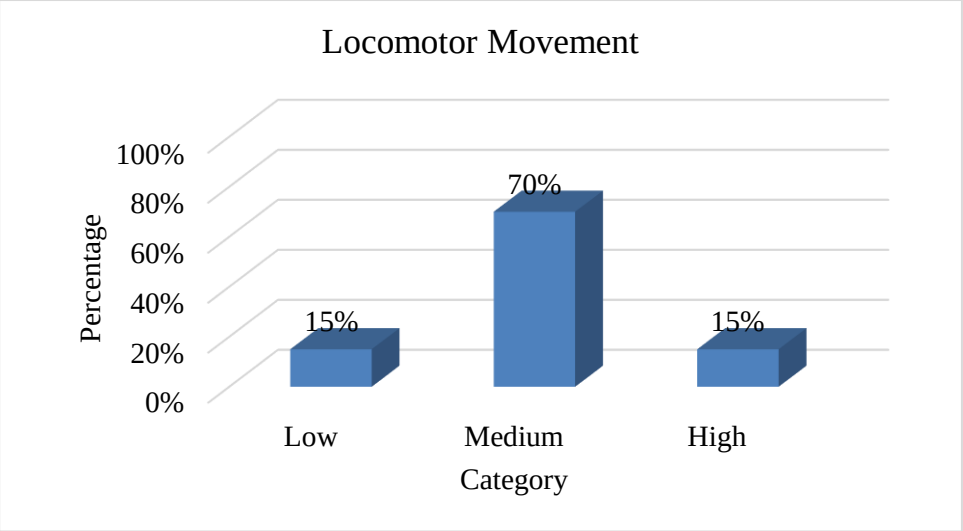
No	Interval	Criteria	Frekuency	%
1	X < 11	Low	3	15%
2	11 ≥ X < 30	Medium	14	70%
3	X ≥ 30	High	3	15%
	Total		20	100%

Source: Primary Data

The frequency distribution data presented in Table 3 is the basis for further visualization. To facilitate understanding and interpretation, the level of locomotor skills of Down Syndrome students is represented in the form of a frequency graph. This visualization can be seen in Figure 1 which illustrates the distribution of locomotor skill levels.

Figure 1.

Percentage Graph of Overall Locomotor Skill Levels of Down Syndrome Students



The analysis shown in Figure 1 shows the distribution of locomotor skill levels of Down Syndrome students. The results show that 70% of the students are in the medium category. Meanwhile, 15% of the students are in the high category, with the remaining 15% in the low category.

To provide a deeper perspective, Figure 2 shows the distribution of locomotor skill levels by gender. This percentage graph will allow for a deeper comparison of locomotor skills between male and female Down Syndrome students.

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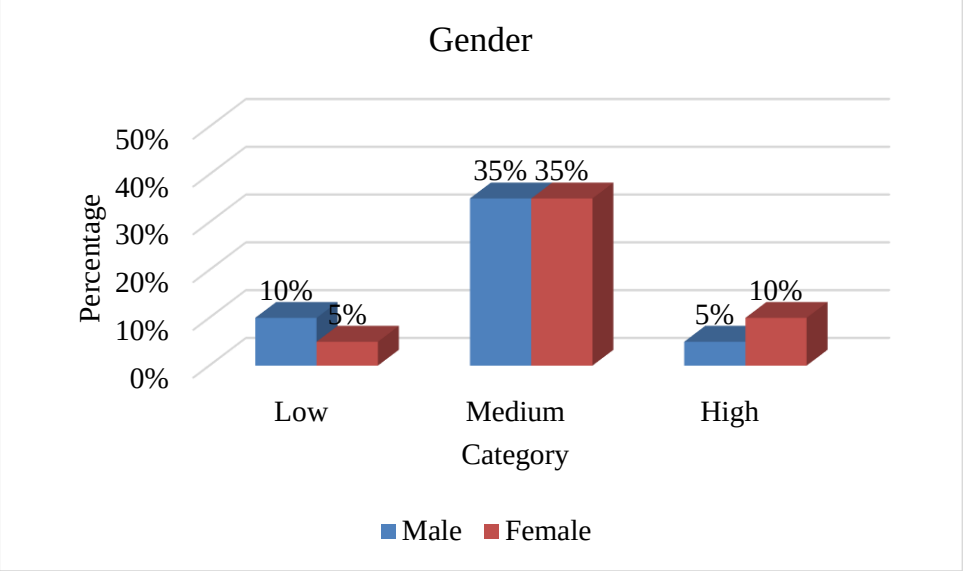
Figure 2.

Percentage graph of locomotor movement skill levels based on gender



Data analysis in Figure 2 shows the percentage of locomotor skills in Down Syndrome students based on gender and category. The distribution of locomotor skills among male students is as follows: 10% are in the low category, 35% are in the medium category, and 5% are in the high category. Meanwhile, among female students, the low category consists of 5%, the medium category consists of 35%, and the high category consists of 10%.

Regarding the comparison of locomotor skill levels in Down syndrome students based on gender, the details will be presented in Table 3 below as follows.

Table 4.

Independent Samples T-test Results Comparison of Locomotor Skills of Down Syndrome Students Based on Gender

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
Nilai	Equal variances assumed	.527	.477	-1.345	18	.195
	Equal variances not assumed			-1.345	17.236	.196

Source: Primary Data

Based on the data analysis presented in Table 4, an independent samples T-test was

conducted to test the level of locomotor skills of male and female Down Syndrome students, resulting in a Sig. (2-tailed) value of 0.195. Since the Sig. (2-tailed) value exceeds 0.05, it can be concluded that there is no significant difference in locomotor skills between males and females.

4. DISCUSSIONS

In the setting of inclusive education, every individual, including children with special needs like those diagnosed with Down Syndrome, has an equal entitlement to receive equitable and meaningful educational opportunities that are adapted to their unique requirements. Physical Education, as one of the subjects provided in schools and an essential component of inclusive education, significantly contributes to the development of basic motor skills, especially those necessary for daily physical activities. By utilizing adaptable and supportive methods, movement-oriented exercises can aid students with Down Syndrome in improving their physical abilities, coordination, and independence. This study specifically aims to investigate a particular aspect of fundamental motor skills known as locomotor skills.

Findings from this research indicate that the jumping skill demonstrated by students appears to be more advanced compared to other skills; however, jumping is also identified as the most difficult or least proficient area for students. In contrast to other locomotor movements, jumping possesses biomechanical features that are relatively less complex, thus providing students with an improved opportunity to master it as opposed to various locomotor skills that require more complex coordination and timing adjustments (Pitetti et al., 2013). The lower performance of students in the jumping category can be linked to the challenging coordination demands, which involve maintaining rhythm, balance stability, and muscle support. This issue is made worse by the presence of muscle hypotonia—characterized by reduced strength and tone—which is frequently seen in individuals with Down Syndrome, resulting in difficulties in this aspect. Such challenges interfere with postural stability and impair the ability to generate a consistent force (Malak et al., 2015).

Additionally, a considerable number of students with Down Syndrome have locomotor skills categorized in the moderate range, with around 70%, or 14 children, fitting into this classification. This suggests there is a chance for improvement through suitable interventions or support provided by teachers during a well-structured and flexible physical education program. This approach adheres to the principle of inclusive education, which advocates for the provision of educational services catered to the individual needs of each learner (UNESCO, 2017). Moreover, the average locomotor skills among students with Down Syndrome did not show significant differences based on gender, as illustrated by the significance value (2-tailed) = 0.195, which exceeds 0.05 in the independent sample t-test.

Analyzing the data through a gender-based lens, the findings of this research correspond with earlier studies, such as those by Tun et al. in 2023, which reported no significant differences between male and female participants in terms of locomotor skills. A study that focused on children aged between 7 and 10 years, utilizing the TGMD-2 assessment tool, confirmed a significance value above 0.05. These results are important for inclusive education, indicating that instructional strategies can be applied without prioritizing gender differences during the planning phase. This aligns with the theory of motor development education, which contends that biological and neurological factors usually have a greater influence than socio-cultural factors associated with gender in the early stages of basic motor skill development, as indicated by Clark

and Metcalfe in 2002. This suggests that students with Down Syndrome might experience more significant delays in overall neuromotor development in comparison to the gender-based developmental trends seen in the neurotypical population.

However, it is vital to recognize the limitations inherent in this study. First, the research utilizes a cross-sectional design without addressing contextual factors such as the severity of Down Syndrome or students' previous educational experiences. A deeper understanding of the developmental trajectory for locomotor skills could be gained through longitudinal studies employing a variety of research methodologies. Second, the sample size is notably small, and limiting the research to a single school constrains the generalizability of the outcomes. Therefore, subsequent studies should involve larger participant samples and various settings to strengthen external validity.

5. CONCLUSIONS

In general, the results of this study are expected to provide a valuable data base on the profile of locomotor skills of students with Down Syndrome in Indonesia, which is relevant to inclusive education. The characteristics identified, where locomotor skills in the jumping component subtest are considered as areas of strength and jumping are considered as areas that require a lot of assistance, can be the basis for creating educational programs based on empirical evidence. These findings indicate that detailed assessment of the components and appropriate interventions are essential for educators who deal with children with special needs to help develop motor skills, especially in the basic motor skills of students with Down Syndrome, and it is also hoped that inclusive education services can be improved by incorporating the results of this study into teacher training programs and in the learning processs.

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