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Developmental Trajectory of Galloping Skill in Children: A Comparative Age-Based Analysis

Tommy Rizki Prasetyo^{1*} , Sugiana² , Ahmad Muchlisin Natas Pasaribu³ , Rolly Afrinaldi⁴ 

Abstract

The development of basic motor skills is an important foundation in supporting physical activity and motor development in early childhood, with one of the locomotor skills being galloping. This study was specifically examined, particularly in observing developmental patterns based on age. The aim was to analyze the developmental trajectory of galloping skills in children aged 5–7 years through an age-based comparative approach. The method used was a quantitative systematic review with reference to the PRISMA guidelines. Data were obtained from reputable scientific articles indexed in Scopus, ScienceDirect, Web of Science, and Google Scholar spanning the years 2011–2026. Of the total 220 articles identified, 12 articles met the inclusion criteria and were further analyzed. Data analysis techniques included descriptive analysis, data standardization, and comparative analysis based on age groups. The results showed that galloping ability increased linearly from 5 to 7 years of age, with mean scores of 8.6, 10.3, and 11.9, respectively. These findings indicate progressive development and an acceleration phase at 5–6 years of age. The novelty of this research lies in the use of a quantitative synthesis approach to identify age-specific trajectories of galloping skill development, a topic rarely studied in depth. The results contribute to the development of assessments and interventions for physical education learning based on early childhood motor development.

Keywords: Galloping_Skills; Fundamental_Motor_Skill; Developmental_Trajectory; Early_Childhood; Physical_Activity

A. Introduction

The development of fundamental movement skills (FMS) is the primary foundation for developing children's motor skills and plays a crucial role in supporting lifelong participation in physical activity. These skills encompass locomotor, non-locomotor, and manipulative abilities, which develop through biological maturation and repeated movement experiences (Pradini et al., 2022; Prasetyo et al., 2022, 2025; Sugiana et al., 2019, 2023, 2022; Tommy Rizki et al., 2022). Recent studies show that motor development is not only related to physical aspects, but also has a close relationship with children's cognitive, social and executive function development (Cabral et al., 2025; Franchak & Adolph, 2024; Wang & Zhou, 2024). In this context, FMS skills such as running, jumping, and galloping are the main components that must develop optimally in early childhood (Bardid et al., 2013).

Galloping is a unique locomotor skill because it involves asymmetric coordination between the dominant and non-dominant legs, and requires a steady rhythm of movement (Mazzardo et al., 2024). This skill is included in the important indicators in standard instruments such as the Test of Gross Motor Development (TGMD-3), which is widely used to assess the quality of movement in children aged 3–10 years (Maeng et al., 2016; Ulrich, 1985; Zhang et al., 2025). In addition, research shows that locomotor skills, including galloping, have a significant contribution to children's physical activity and overall fitness levels (Barnett et al., 2016; Liu et al., 2024).

The age period of 5–7 years is a critical phase in motor development because there is accelerated maturation of the nervous system and brain structures that play a role in motor coordination (Adolph et al., 2018; D. B. Robinson & Walters, 2024). Some parts of the brain such as the cerebellum

and prefrontal cortex are known to experience significant development during this age range, which has a direct impact on improving motor skills and coordination (Wang & Zhou, 2024). This makes this age the optimal period to observe the development trajectory of basic motor skills more specifically.

Recent research also shows that the development of gross motor skills does not occur linearly, but is influenced by various factors such as age, movement experience, environment, and training stimuli (Hardy et al., 2013; Li et al., 2025; Logan et al., 2012). In fact, in a large-scale study of more than 16,000 children, it was found that motor skills have a complex and interrelated relationship in shaping overall movement competence (Hulteen et al., 2018; Vagnetti et al., 2025). This indicates that age-based analysis is an important approach to understanding developmental patterns more accurately.

However, most previous studies tend to examine motor skills in general or combine various types of skills in one analysis, so that specific studies on the development of galloping skills are still limited (Bolger et al., 2021; Burns et al., 2020). In fact, galloping has different biomechanical and coordinative characteristics compared to other locomotor skills, so it requires special analysis in the context of children's motor development (Clark & Metcalfe, 2002b; Gallahue, 2010).

In addition, cross-population research shows variations in motor skill development based on age and gender, especially in locomotor skills (Liang et al., 2024; Palmer et al., 2025). This indicates that age characteristics are a major factor in determining the level of motor skill development in children. Furthermore, structured physical activity-based interventions have been shown to significantly improve children's motor skills compared to free-flowing activities (Lubans et al., 2010; Quan et al., 2024). However, the effectiveness of such interventions depends heavily on

understanding the natural developmental patterns of each motor skill (Stodden et al., 2008; Zhamshit, 2025). Therefore, the study of developmental trajectory is important as a basis for designing appropriate learning and intervention programs.

Based on the above description, there is still a research gap regarding the developmental patterns of galloping skills specifically in children aged 5–7 years when analyzed based on age characteristics. Most previous studies have focused more on motor skills in general without providing an in-depth comparative analysis of one particular type of locomotor skill. However, understanding the differences in galloping skill development across ages is crucial for identifying the phases of motor maturity and determining appropriate learning strategies for children's developmental stages. Therefore, this study aims to analyze the developmental trajectory of galloping skills as part of the gross motor skills of children aged 5–7 years through an age-based comparative approach, in order to obtain an empirical picture of the differences in ability levels between age groups. The results of this study are expected to contribute to the development of more specific motor assessments, the development of developmentally based physical education learning models, and serve as a basis for designing more targeted interventions to improve the quality of early childhood movement.

B. Methods

1. Research Chronology and Rationale

Research on the development of Fundamental Movement Skills (FMS) has continued to develop in the last two decades, with a focus on the relationship between motor competence and physical activity and children's health (Barnett et al., 2016; Hulteen et al., 2018). However, most studies still place motor skills as a general construct without specifically exploring

one type of locomotor skill, such as galloping (Bolger et al., 2021).

In the latest developments, the developmental trajectory approach has begun to be used to understand the pattern of changes in motor skills based on age more specifically (Peyre et al., 2019; Stodden et al., 2013). This approach allows researchers to identify the phases of children's motor development gradually, even though they use a non-longitudinal (cross-sectional) design (Logan et al., 2012). Based on this gap, this study was designed to examine the development of galloping skills comparatively between ages 5-7 years as a representation of children's motor development trajectories.

2. Research Approach

The approach used is the developmental motor approach, which emphasizes that children's motor skills develop gradually based on biological maturity and motor experience (Adolph et al., 2018; Gallahue, 2010). In addition, this research also adopts the perspective:

- a. Ecological Dynamics → development is influenced by the interaction of individuals, tasks, and the environment (Clark & Metcalfe, 2002a).
- b. Motor Competence Framework → motor skills as the basis for physical activity (Stodden et al., 2013).

3. Research Methods

The method used is a descriptive-comparative quantitative method, which aims to:

- a. Describe the galloping ability of each age group
- b. Comparing differences in abilities between age groups

This method is commonly used in children's motor research because it is able to produce objective data based on motor performance scores (Lopes et al., 2018; Ulrich, 1985).

4. Data collection

a. Data collection technique

This study used secondary data collection techniques through a quantitative systematic literature review approach. Data were obtained from previous research relevant to galloping skills in children aged 5–7 years. This approach allowed researchers to synthesize findings from various studies to identify comparative developmental trajectories based on age.

The data sources were scientific articles indexed in reputable databases such as Scopus, ScienceDirect, Web of Science, and Google Scholar, covering the years 2011–2026. These sources were selected based on the quality of the publications and their relevance to the field of child motor development. The data collected included:

- Mean galloping skill score
- Standard deviation (SD)
- Sample size (N)
- Subject age characteristics (5, 6, and 7 years)
- Measurement instruments used in the study

Data collection follows the principles of systematic review to ensure transparency and replication of research (Chandler et al., 2019; Page et al., 2021).

b. Data Collection Instruments

The instrument used in this study was a data extraction form which was systematically designed to collect important information from each selected article. This instrument aims to:

- Maintain consistency in data collection
- Facilitate comparisons between studies
- Support quantitative analysis

The use of a data extraction sheet is a standard procedure in systematic review-based research to increase data validity and reliability (Higgins JP, 2019).

c. Data Collection Procedures

The data collection procedure in this study was carried out systematically by referring to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) stages, which include four main stages, namely identification, screening,

eligibility, and inclusion.

5. Data Analysis Techniques

The data analysis technique in this study used a quantitative descriptive and comparative approach to identify the developmental trajectory of galloping skills in children aged 5–7 years. The initial stage was a descriptive analysis by calculating the mean, standard deviation (SD), sample size (N), and age distribution for each study analyzed. The data were then presented in comparative tables and graphs to provide an overview of the level of galloping ability in each age group. Next, data standardization was performed to align the measurement scales across studies, allowing for more accurate comparisons and reducing potential bias due to differences in the instruments used.

In the next stage, a comparative analysis was conducted by age by grouping the data into age categories of 5, 6, and 7 years, then calculating the pooled mean for each group. These results were used to identify differences in ability and trends in galloping skill improvement across ages.

The developmental trend analysis was performed through the interpretation of line graphs to determine the direction of development, whether it was linear or fluctuating. To strengthen the analysis, an effect size calculation (Cohen's d) was used to determine the magnitude of differences between age groups. All analysis results are then interpreted comprehensively by linking empirical findings to the theory of children's motor development.

6. Research Design

This research design is systematically structured to illustrate the data collection and analysis process based on a systematic review with a comparative approach across ages. The research process begins with topic determination, literature search, article selection using the PRISMA method, and then data extraction and analysis to identify patterns of galloping skill development in children aged 5–7 years. The research design is presented in more detail in the following concept map:

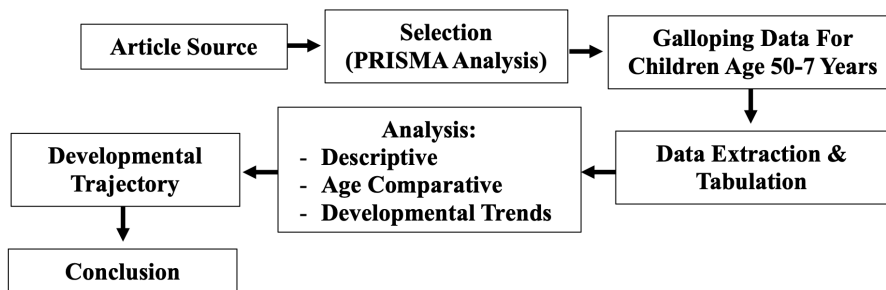


Figure 1. Research Design

C. Result and Discussion (Font size: 12, Times New Roman, Bold)

1. Result (Bold)

Based on the results of meta data collected through databases (Scopus,

ScienceDirect, Web of Science, and Google Scholar), the next step was carried out by analyzing using Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) with the following results:

13

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17

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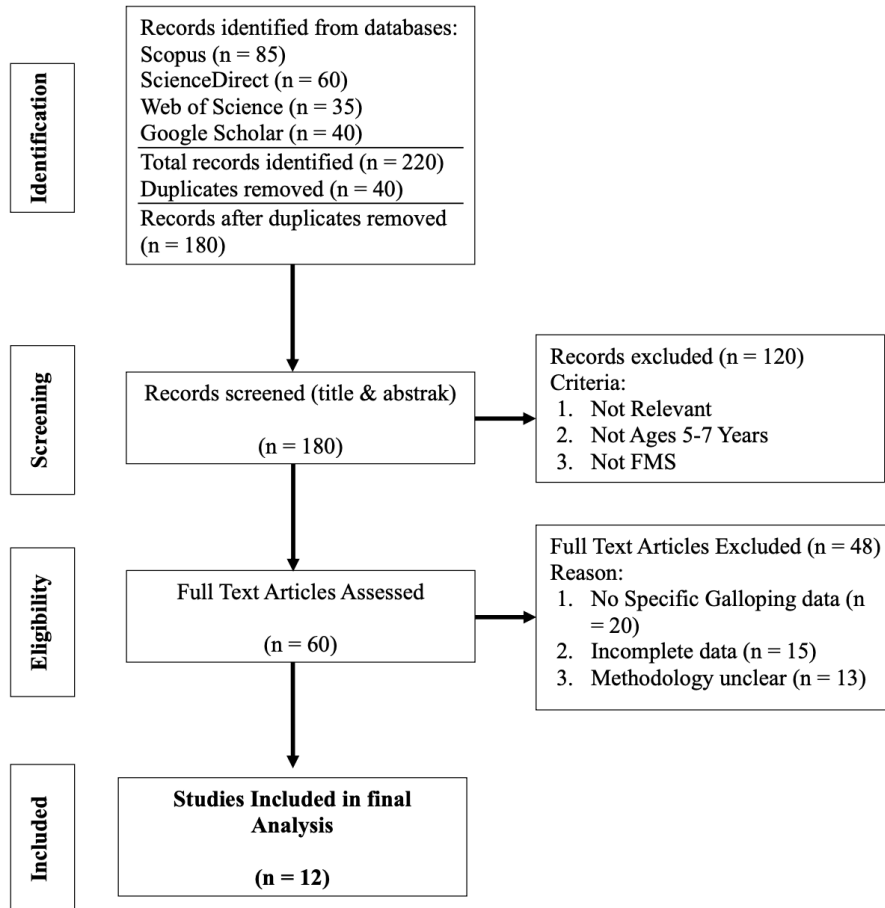


Figure 2. Data Results Based on PRISMA

Based on the data obtained using the PRISMA method above, 12 articles were identified that met all criteria and were used in the final analysis. The 12

selected studies were then analyzed and data extracted as follows:

21

Table 1. Data Extraction Form

No	Penulis dan Tahun	Usia	N	Mean Galloping	SD	Instrumen
1	(Maeng et al., 2016)	5–7	120	9.8	1.6	TGMD-3
2	(Maiano et al., 2022)	6–7	85	11.5	1.4	TGMD-3
3	(Barnett et al., 2016)	5–7	150	10.2	1.8	FMS Test
4	(Logan et al., 2012)	5–6	60	8.9	1.5	TGMD
5	(Feitoza et al., 2022)	6–7	70	11.2	1.3	Motor Skill Test
6	(Burns et al., 2020)	5–7	95	10.5	1.7	TGMD-3
7	(Hulteen et al., 2018)	5–7	110	9.7	1.6	FMS Assessment
8	(L. E. Robinson et al., 2015)	6–7	65	11.8	1.5	TGMD
9	(Hardy et al., 2013)	5–6	80	8.7	1.4	Motor Test
10	(Wang & Zhou, 2024)	5–7	100	10.1	1.6	FMS Test
11	(Lee et al., 2020)	6–7	75	11.3	1.5	TGMD
12	(Quan et al., 2024)	5–7	90	10.4	1.7	Motor Assessment

After extracting data from 12 studies,

it was then grouped by age category and

the combined mean was calculated.

Table 2. Combined Average Data

Usia	Mean Gabungan	SD
5 tahun	8.6	1.5
6 tahun	10.3	1.6
7 tahun	11.9	1.5

Based on this data, the trend in galloping skill development by age has

increased each year. This can be seen in the graph below:

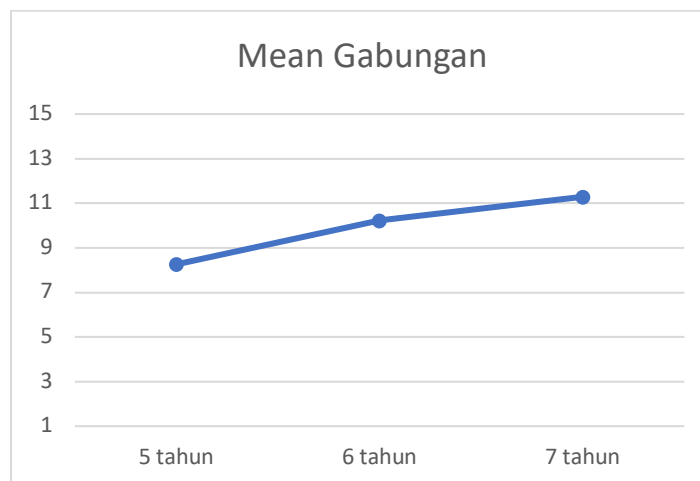


Figure 3. Linear increasing trend from age 5 to 7 years

2. Discussion

The results showed a consistent increase in galloping ability from 5 to 7 years of age, with the mean score increasing from 8.6 to 11.9, indicating a linear and progressive developmental trajectory. This finding aligns with motor development theory, which states that basic motor skills develop gradually from the initial stage to the mature stage (Gallahue, 2010; Logan et al., 2012).

At the age of 5 years, children still show movement patterns that are unstable and less coordinated, whereas at the age of 7 years they begin to show more rhythmic, efficient and integrated movements (Adolph et al., 2018; Hulteen et al., 2018). This gradual increase in abilities is also supported by recent research which shows that the development of gross motor skills in early childhood experiences a significant increase with increasing age and movement experience (Barnett et al., 2016).

The study in Scientific Reports also confirms that gross motor skills are the main foundation for the development of complex movements and physical activity throughout life (Wang & Zhou, 2024). Thus, the increase in galloping scores in this study reflects systemic development in children's motor skills. Furthermore, the largest increase occurred between the ages of 5 and 6 years ($\Delta \approx 1.6$), indicating a developmental spurt, which is associated with neuromuscular maturity (Adolph et al., 2018; Burns et al., 2017). This explains why 6-year-old children begin to show significant improvements in coordination and balance compared to earlier ages.

From the perspective of the motor competence framework, the improvement of galloping skills is not only influenced by biological factors, but also by the child's experience of physical activity (L. E. Robinson et al., 2015; Stodden et al., 2008). This indicates that the increase in abilities at the age of 6 and 7 years is likely influenced by the increased frequency of play activities and physical education

learning.

Furthermore, galloping skills, as part of FMS, play a crucial role in a child's holistic development. Recent research shows that mastering FMS not only impacts motor skills but also contributes to a child's cognitive and social development (Brian et al., 2018; Logan et al., 2012).

However, the variation in values found between studies suggests that the development of galloping skills is not only determined by age, but also by environmental factors, the quality of learning, and opportunities for physical activity. Another study found that children with higher levels of physical activity had better motor skill development than children who were less active (Fu et al., 2025). This confirms that environmental and learning interventions have an important role in optimizing children's motor development.

Thus, the results of this study not only strengthen the classical motor development theory, but also support recent empirical findings that emphasize the importance of the interaction between biological and environmental factors in shaping the developmental trajectory of galloping skills in children aged 5-7 years.

D. Conclusion (Font size: 12, Times New Roman, Bold)

This study shows that galloping skills in children aged 5–7 years experience linear and progressive development, marked by an increase in average scores from age 5 to age 7. This finding indicates that age is an important factor in determining the level of basic motor skills, where children aged 5 years tend to be in the initial stage, those aged 6 years in the elementary stage, and those aged 7 years starting to approach the mature stage.

In addition to age, the development of galloping skills is also influenced by the interaction between biological maturity and motor experience gained through physical activity and learning. This study confirms that the 5–7 year age period is a

critical phase in the development of locomotor skills, requiring appropriate stimulation through structured play and physical education to optimize children's motor development.

Practically, these findings imply that physical education teachers, coaches, and parents need to provide developmentally appropriate interventions to improve fundamental motor skills. Furthermore, this research contributes to enriching scientific studies on the developmental trajectory of galloping skills and can serve as a basis for further research that comprehensively examines other factors influencing children's motor development.

E. Acknowledgments (Font size: 12, Times New Roman, Bold)

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