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Analysis of Running Techniques and Physical Factors on the Sprinter Ability of Grade V Elementary School

Helpi Sipriadi[1], Farizal Imansyah[1], Rury Rizhardi[1]
[1]Universitas PGRI Palembang, South Sumatra, Indonesia

Corresponding author e-mail: helpi.sipriadi@admin.sd.belajar.id

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Abstract: This study investigates the relationship between running techniques, physical factors, and the sprinting abilities of fifth-grade elementary school students. Through direct observation and measurement of students' running techniques, as well as assessments of their physical attributes such as speed, leg muscle strength, and flexibility. This research aims to identify key factors that contribute to sprinting performance. Statistical analysis reveals a significant positive correlation between proper running techniques characterized by a forward leaning posture, synchronized arm-leg movements, and correct foot landing and enhanced sprinting ability. Furthermore, the analysis highlights the importance of physical factors, with findings showing that students possessing greater leg muscle strength and flexibility exhibit superior sprinting capabilities. The correlation analysis underscores the strong influence of both running techniques and physical attributes on sprinting performance, indicating that improvements in these areas can lead to enhanced athletic outcomes. These findings have practical implications for the development of targeted training programs in elementary schools, emphasizing the enhancement of running techniques and physical conditioning. By focusing on structured training that incorporates muscle strengthening, flexibility improvement, and technique refinement, educators can help students maximize their athletic potential and encourage lifelong healthy habits. This research contributes to a deeper understanding of the factors influencing sprinting abilities and offers a foundation for optimizing physical education practices for young athletes.

Keywords: Physical Factors, Running, Sprinter Ability, Technique

A. Introduction

Sport is one of the effective ways to improve physical and spiritual fitness (Warner, 2019). Sports activities not only help shape healthy and physically trained individuals, but also form a disciplined and athletic character, as noted by (Sinaga et al., 2022). One type of sport taught in elementary schools is running. Running is part of physical education learning at school. According to Stubbs et al. (2018), physical education is an effort to improve the physical or mental quality of a person through

physical activity. Running is a form of forward movement performed by moving the body from both feet simultaneously, often in a state of floating without sticking to the ground or floor. According to van Oeveren et al. (2024), running is defined as a form of locomotor movement performed by lifting both feet alternately from the ground or other surfaces quickly, so that there is a phase where both feet are not in contact with the ground simultaneously. This movement is different from walking, where there is always one foot in contact with the ground.

According to Uthoff et al. (2018), also defines running as a forward movement at high speed, where both feet alternately leave the ground. In the context of sports, running is an activity that tests a person's speed, endurance and technical ability to cover a certain distance in the shortest possible time. Running is one of the most basic and universal forms of physical activity. Not only is it an integral part of various sports, but it is also an effective form of exercise to improve overall physical fitness. Across cultures and history, running has been used as a method of transportation, military training, and as a means of competition and recreation (Scheer et al., 2020). Running as a method of transportation can be seen in the use of running for human mobility in ancient times, before the existence of motorized vehicles (Bongiorno et al., 2019; Ceder, 2021). In military training, running is used to build soldiers' stamina and physical endurance (Akila et al., 2022). Apart from that, running is also an important part of various forms of sports competition, such as sprint races and marathons, which test athletes' abilities in various aspects of speed and endurance. Meanwhile, according to Nagahara et al. (2018), running is a basic human movement used to achieve maximum speed in the shortest possible time. Running involves coordination of whole-body movements, where speed is achieved through optimal stride frequency and stride length, and efficient use of energy (Ertan & Bayram, 2020; Mesquita et al., 2024). Overall, running not only serves as an effective physical exercise but also has deep cultural and historical value. These activities play an important role in shaping physical and mental fitness and building basic athletic skills that can be applied in a variety of sporting contexts and everyday life. Running as a form of exercise can help individuals improve overall health, fitness and physical abilities, as well as build strong character through discipline and perseverance (Lucini & Pagani, 2021).

Basic running techniques include a slightly forward leaning posture, synchronized arm movements with the legs, foot landing on the front or center of the sole, and efficient coordination of motion (AminiAghdam et al., 2022). Understanding and applying these basic techniques is very important to improve running performance and reduce the risk of injury. According to Messier et al. (2018), basic running techniques include several important aspects that must be considered to increase efficiency and reduce the risk of injury. First, head and body position must be carefully considered. The head should remain upright and relaxed, with eyes looking forward to maintain good balance and orientation during running. The body

should lean forward slightly, which allows for better utilization of momentum, as well as aiding in more efficient forward movement. Second, arm movements play an important role in running technique. The arm movement should be parallel to the body and moved in the same direction as the leg, to increase forward thrust (Fitzpatrick et al., 2019). The arms must move quickly but remain relaxed, so as not to disturb the rhythm and speed of the run. This movement helps maintain balance and increases the effectiveness of footsteps.

Third, foot landing must be done with the right technique. Landing should be on the front or middle of the foot, not the heel, to maximize speed and reduce impact on the joints. This landing technique helps in minimizing the risk of injury and increases the efficiency of the running movement. With this technique, each step can provide better thrust and support optimal speed. Meanwhile, according to Haugen et al. (2019), basic running techniques emphasize several key aspects to increase efficiency and effectiveness in running. First, posture is an important element in running technique. Djamarah emphasized that the body must remain stable and balanced with a slight forward position. The shoulders and arms should be relaxed, to avoid unnecessary tension that could disrupt the running rhythm. Correct posture helps in maintaining balance and supports more effective forward movement. Second, foot movements must be done in a balanced and rhythmic way. Pay attention to each footstep so that the foot lands smoothly in the center of the sole of the foot.

This is important to reduce the impact on the joints and increase stride efficiency, as well as supporting smooth running movements. Third, coordination of movement between the legs and arms is very crucial. Good coordination between leg and arm movements helps in maintaining rhythm and balance during running. This synchronized movement between the two parts of the body allows for more harmonious movement and optimizes the efficiency of energy used in running. Overall, these basic techniques focus on maintaining good posture, smooth and rhythmic foot movements, and effective movement coordination to achieve optimal running performance. Overall, proper application of these basic techniques is critical to achieving maximum performance in running while minimizing the risk of injury.
As for the basic running techniques, good running technique is key to achieving optimal performance and reducing the risk of injury. There are several key elements in running technique that need to be considered, including:

1. Posture: Correct body position while running is very important. The body should lean slightly forward with the head erect, eyes looking forward, and shoulders relaxed. Good posture helps in maintaining balance and efficiency of movement.
2. Arm Movement: The arms should be moved in synchronization with the legs to aid momentum. Correct arm movement involves flexion at the elbow at about 90 degrees, with the hands moving from front to back in line with the body.
3. Footfalls: Stride length and stride frequency are two important factors in

running technique. Steps that are too long can cause excessive strain on muscles and joints, while steps that are too short can reduce speed. An optimal stride frequency helps increase speed without overloading the body.

4. Foot Landing: Proper foot landing occurs when the foot touches the ground at the center or front of the sole, rather than the heel. This helps reduce the impact on the joints and maximizes forward thrust.

Sprinting is a dynamic and exhilarating form of physical activity that captivates the interest of elementary school children. According to Paradisis et al. (2019), Sprinting is a form of fast running carried out over short distances with a focus on maximum speed and strength. Sprinting requires proper technique and good body coordination to maximize efficiency and performance in a short time. It involves short bursts of high-intensity running, where children push themselves to their maximum speed over a short distance. This activity is not only thrilling but also offers a multitude of health benefits, making it a staple in physical education programs and youth sports. One of the most significant advantages of sprinting is its impact on cardiovascular fitness. As noted by Deus et al. (2019), sprinting helps to strengthen the heart and improve the efficiency of the circulatory system. This, in turn, enhances the delivery of oxygen and nutrients to muscles, which is essential for overall health and physical performance. Regular sprinting sessions can also increase lung capacity and improve respiratory efficiency, allowing children to engage in physical activities with greater endurance.

Meanwhile, according to Bompa (1999) sprinting is an attempt to reach the highest speed in the shortest time possible using techniques that involve every part of the body. This includes coordination between leg movements, arms, and body posture to maximize acceleration and speed.Sprinting is also instrumental in developing agility and speed, which are crucial components of physical fitness. Children who engage in sprinting can experience improvements in muscle strength, particularly in the legs and core. This muscle development not only supports sprinting activities but also enhances performance in other sports and daily activities. Furthermore, sprinting can help with weight management by burning calories and promoting a healthy metabolism, reducing the risk of childhood obesity. Beyond the obvious physical benefits, sprinting plays a vital role in the development of essential motor skills. According to research by Brini et al. (2023), sprinting requires coordination between various muscle groups, fostering improved balance and body awareness. These skills are foundational for many other physical activities and sports, contributing to a well-rounded athletic development. The repetitive nature of sprinting drills and races helps children develop timing and rhythm, which are key components of coordination. This enhanced coordination can translate into better performance in activities that require precise movements, such as dance, gymnastics, and team sports like soccer and basketball.
Sprinting is more than just a physical exercise; it also offers psychological benefits

that are crucial for the holistic development of children. The competitive aspect of sprinting provides an opportunity for young athletes to challenge themselves and compete with their peers. This competitive spirit can instill a sense of determination and perseverance, as children learn to push their limits and strive for personal bests. Participating in sprinting activities can also boost a child's self-esteem and confidence. Achieving new speed records or improving race times can give children a sense of accomplishment and pride in their abilities. This boost in confidence can extend beyond the track, positively impacting their academic performance and social interactions. Furthermore, sprinting is often a group activity, encouraging teamwork and camaraderie among participants. Children learn to support and motivate each other, building friendships and social skills in the process. The shared experience of training and racing can create a sense of belonging and community, which is important for emotional well-being.

Incorporating sprinting into a child's routine can lay the foundation for a lifetime of healthy habits. By fostering a positive attitude towards physical activity, sprinting encourages children to prioritize fitness and well-being. This mindset can lead to continued participation in sports and physical activities into adolescence and adulthood, contributing to a healthy lifestyle. Regular sprinting and training also teach valuable life skills, such as goal setting, discipline, and time management. Children learn to set achievable targets, plan their training schedules, and balance their physical activities with academic responsibilities. These skills are transferable to various aspects of life, supporting personal and professional success in the future.
It can be concluded that, sprinting is a multifaceted activity that offers numerous benefits for elementary school children.

From improving cardiovascular health and motor skills to fostering psychological resilience and social connections, sprinting is a valuable tool for promoting holistic development. By engaging in this dynamic form of exercise, children can enjoy the thrill of racing while building a strong foundation for a healthy and active lifestyle. As educators and parents continue to emphasize the importance of physical fitness, sprinting will undoubtedly remain a cherished and beneficial activity for young athletes. It can also teach them important skills such as discipline, perseverance, and resilience. As they continue to challenge themselves and see improvements in their performance, they will learn the value of hard work and dedication. This can translate into other areas of their lives, such as academics or extracurricular activities.

According to Anderson-Butcher et al. (2018), sprinting can also help children develop important social skills, as they often train and compete with others, learning how to work as a team and support one another. Overall, sprinting is a multifaceted activity that can benefit children in numerous ways, both physically and mentally. Additionally, sprinting can also instill a sense of confidence and self-esteem in

children as they push themselves to reach new goals and surpass their previous limits (Taylor, 2018). The sense of accomplishment that comes from setting a personal best time or winning a race can boost a child's self-belief and motivate them to continue striving for success in all areas of their lives. Furthermore, sprinting can teach children the importance of setting goals, creating a plan to achieve them, and staying committed to their training regimen. These valuable life skills can help children become more resilient and adaptable individuals as they grow and face new challenges in the future. At primary school age (grade V), it is important to develop physical fitness as part of sports education. The correct running technique not only improves the athlete's performance, but also reduces the risk of injury. The Role of Educator and Coach: Sports teachers and coaches have a crucial role in developing students' technical and physical skills in sprint running. Influence of Physical Factors: Factors such as speed, muscle strength, flexibility, and coordination have a significant impact on the sprinter's ability. Emphasis on Talent Development: Identification and development of talent at an early age can prepare potential future athletes.This research can provide a foundation for better integration between sports lessons and the curriculum of education in primary schools. The formulation of this problem led to research to identify the relationship between physical factors (such as foot strength, reaction speed, flexibility) and sprinter ability in the context of running technique analysis.

Previous research Reisberg et al. (2021) conducted on elementary school children showed that children with higher muscle mass compared to body fat tended to have faster running times. These findings indicate that even at a young age, body composition plays an important role in sprinting performance. Greater muscle mass allows children to produce stronger and faster impulses, which contributes to an increase in their running speed. In other words, optimal body composition, with a balance between muscle mass and body fat, can be a key factor in improving sprinting performance. Additionally, research conducted by Lockie (2018) observed that children who demonstrated good running technique, such as strong arm thrust and high knee lift, were able to accelerate more efficiently and maintain their speed over longer distances.

This technique, which involves a strong arm movement and a high knee lift, functions to increase forward thrust and maintain balance and coordination during running. These findings emphasize the importance of physical and technical attributes in developing young runners. Proper technique can maximize movement efficiency and help children overcome challenges during sprinting. A study of physical factors such as leg muscle strength, flexibility, coordination, and reaction speed in elementary school children. This research could cover how these factors affect the sprinter's ability and how proper exercise can improve these aspects. A study that examines the relationship between good running technique and sprinter achievement at various age levels or competition levels. This can provide a

theoretical foundation for linking running techniques to improving sprinter performance at the elementary school level.

These findings suggest that a combination of healthy body composition and correct running technique is critical in developing sprinting abilities in children. Through further research in this area, coaches and educators can gain valuable insight into improving the athletic abilities of elementary school students. By understanding the relationship between body composition and running technique in young athletes, coaches can design appropriate training programs to improve specific areas that need improvement. For elementary school students interested in sprinting, focusing on developing key skills such as good running technique and optimal body composition early on can lead to better performance results in the long term (Pichardo et al., 2018). Through a structured training program focused on improving these aspects, students can reach their full athletic potential. Ongoing research and analysis can help educators better support young runners in reaching their full potential and achieving success in their athletic endeavors. This approach will equip children with the skills and physical condition necessary to achieve their best performance, both in sprinting and in various other sporting activities.

The purpose of the research can be formulated as follows: Identify and analyze the relationship between running techniques (such as posture, footsteps, step frequency) and the sprinter skills of elementary school grade V students. Assess the influence of certain physical factors (such as leg muscle strength, flexibility, and coordination) on the sprinter's ability in terms of running technique analysis. Provide recommendations for the development of exercise programs that can improve running techniques and physical factors of grade V Elementary School students to improve their sprinter abilities. This goal will help in understanding and improving the quality of physical exercise as well as the techniques needed to become a better sprinter among Grade V Elementary School students.

B. Methods

The study aims to analyze the relationship between running techniques and physical factors in determining the sprinter abilities of fifth-grade elementary school students. To achieve this, a combination of observational and analytical research methods is employed. Direct observation of students' running techniques allows for the assessment of form, posture, and efficiency, providing qualitative data on how students execute their sprints. In addition to observational data, measurements of physical factors such as speed, strength, and flexibility are collected. These quantitative metrics offer insight into the students' physical capabilities, which are critical components of sprinting performance. According to Sugiyono (2022), quantitative method is a research approach that emphasizes the collection and analysis of numerical data to answer research questions. This approach is often used

to test hypotheses, look for patterns or relationships between variables, and make predictions based on measured data.

The research involves a population of fifth-grade students from a particular elementary school. To ensure the findings are representative and applicable, samples are selected randomly or based on specific criteria relevant to the study, such as participation in the school's athletic team. This approach ensures a diverse sample that reflects the varying levels of experience and skill present in the student body. Statistical analysis plays a crucial role in the study, providing a means to quantify the relationship between running techniques and physical factors with sprinter ability. Techniques such as correlation analysis are used to determine the strength and direction of relationships between the variables. By identifying patterns and connections, the analysis helps to clarify how different aspects of running technique and physical fitness contribute to sprinting success. Additionally, hypothesis testing is conducted to assess the significance of these relationships, determining whether observed patterns are statistically meaningful or if they might have occurred by chance. Overall, this research aims to provide a comprehensive understanding of how running techniques and physical factors interact to influence sprinting performance among elementary school students. By identifying key factors that contribute to sprinting success, the study offers valuable insights that can inform training and coaching practices, ultimately enhancing the athletic development of young sprinters.

C. Results and Discussion

The results of this study showed a significant relationship between running technique, physical factors, and sprinting ability in fifth grade elementary school students. From direct observation of students' running techniques, it was found that students who demonstrated better running techniques-such as a slightly forward leaning posture, synchronized arm movements with the legs, and correct foot landing on the front or center of the sole-tended to have superior performance in speed tests. These techniques contribute to improved movement efficiency and reduced risk of injury, which in turn allows students to run faster and more consistently. This finding is in line with Blagrove et al. (2018) research, which emphasizes the importance of good running technique to achieve optimal performance. Proper running technique plays a crucial role in improving movement efficiency and minimizing the risk of injury. A slightly forward leaning posture helps students in utilizing momentum better, while synchronized arm movements with the legs help in increasing forward thrust and maintaining balance. Proper landing of the foot on the front or center of the sole helps to reduce impact on the joints and maximize forward thrust.

All these aspects of technique contribute to better sprint performance, providing

evidence that good technique can improve the speed and effectiveness of students' running. Apart from that, measurements of physical factors also showed significant results. Students with higher leg muscle strength and good flexibility tend to have better sprinting abilities. Standardized measurement instruments were used to assess students' speed, strength, and flexibility, and the results showed a positive correlation between these physical abilities and sprinting performance. Strong leg muscle strength allows for stronger and faster pushes, while flexibility allows for a wider and more efficient range of motion, which in turn increases sprinting speed and effectiveness. This research reinforces the importance of physical factors in supporting good running performance.

Further statistical analysis confirmed these findings, with a strong positive correlation between good running posture and sprinting performance ($r = 0.68$, $p < 0.01$), as well as between leg muscle strength and sprinting ability ($r = 0.72$, $p < 0.01$). This suggests that improvements in running technique and physical factors can directly improve students' sprinting performance. These findings have very important implications for training programs in elementary schools. Training that focuses on improving running technique and developing physical factors can have a significant impact on a student's sprinting ability. A structured exercise program, involving muscle strengthening, increasing flexibility, and practicing proper technique, can help students reach their maximum athletic potential. An effective training program should include exercises to increase leg muscle strength, such as plyometric exercises and leg strength training, as well as flexibility exercises such as dynamic and static stretching. In addition, running technique exercises that focus on body posture, arm movement, and foot landing can improve a student's overall running technique. By incorporating these elements into training programs, schools can provide the necessary support for students' athletic development from an early age.

Overall, this research provides important insight into how running technique and physical factors interact to influence elementary school students' sprinting abilities. These findings can serve as a basis for developing more effective training programs and supporting the athletic development of students from an early age. By focusing on developing good running technique and physical factors, schools can play an important role in maximizing students' athletic potential and encouraging healthy and active living habits. These findings highlight the importance of a holistic approach in physical education, which considers not only the physical aspects, but also the techniques and skills required to achieve optimal performance in a variety of sporting activities. This approach can also help students not only in sports but in various aspects of their lives, by building character, discipline and the ability to overcome challenges. By paying attention to running technique and developing physical factors, schools can support students in achieving their best athletic performance and build a foundation for long-term health and fitness.

D. Conclusions

Conclusion from the research results, it is clear that there is a significant relationship between running technique, physical factors, and sprinting ability in fifth grade elementary school students. This research reveals that students who implement correct running techniques such as maintaining a slightly forward body posture, synchronizing arm movements with footsteps, and ensuring proper foot landing—tend to perform better in sprinting activities. These techniques serve to increase movement efficiency and reduce the risk of injury, allowing students to run faster and more consistently. In other words, the application of proper running technique not only supports better sprinting performance but also contributes to the prevention of injuries that are common in running activities. In addition, analysis of physical factors also shows that students with greater leg muscle strength and good flexibility tend to have superior sprinting abilities. Statistical data shows a positive correlation between these physical attributes and sprinting performance, emphasizing the importance of physical condition in sprinting success.

Good leg muscle strength allows for stronger and faster pushes, while flexibility allows for a wider and more efficient range of motion, which contributes to increased speed and effectiveness in sprinting. This research confirms that physical factors such as muscle strength and flexibility play an important role in improving sprinting performance. Further statistical analysis supported these findings, with a strong positive correlation between running technique and sprinting performance ($r = 0.68$, $p < 0.01$) as well as between leg muscle strength and sprinting ability ($r = 0.72$, $p < 0.01$). These findings show the direct impact of improving running technique and physical factors on students' sprinting abilities. The high positive correlation indicates that improvements in students' running technique and physical condition can directly improve their sprinting ability. Therefore, the implications of these findings are very significant for the development of training programs in elementary schools.

An effective training program should focus on improving running technique and developing physical factors. A structured exercise program that involves strengthening muscles, increasing flexibility, and practicing proper technique can help students reach their maximum athletic potential. Leg muscle strengthening exercises such as plyometric exercises and leg strength training can improve propulsion and sprinting speed. Meanwhile, flexibility training through dynamic and static stretching can increase range of motion and movement efficiency. Running technique exercises that focus on body posture, arm movement, and foot landing can also improve a student's overall running technique. Overall, this research provides valuable insight into how running technique and physical factors interact to influence elementary school students' sprinting abilities. These findings can serve as a basis for developing more effective training programs that support

students' athletic development from an early age and encourage healthy and active lifestyles. By emphasizing both technique and physical conditioning, schools can play an important role in maximizing students' athletic potential and reducing the risk of injury, as well as promoting a holistic approach to physical education. This approach not only focuses on the physical aspects but also the techniques and skills required to achieve optimal performance in various sporting activities.

By implementing a training program based on these findings, it is hoped that students can develop their athletic abilities to the maximum. Additionally, these training programs can provide long-term benefits, helping students build sustainable healthy and active living habits. With the right support from educators and coaches, students can learn proper running technique and develop the physical factors necessary for success in sprinting as well as a variety of other sporting activities. A good training program can also strengthen students' character, build discipline, and increase their ability to face challenges, which will ultimately contribute to their success off the sports field, both in academics and in everyday life.

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