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Biomechanical Study on Passing Technique Using Feet in Football Game; The Effect of Body Angle and Feet Position, Student of Sports Education Muhammadiyah University of East Kalimantan

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ABSTRACT

Football is one of the most popular sports in the world and requires good basic technique mastery to achieve optimal performance. This study aims to analyze the effect of body angle and foot position on the effectiveness of the inside foot passing technique in football, and this study does not only aim to understand the theory behind the passing technique. This research method is a type of quantitative descriptive research with a survey data collection technique on the inside foot passing test and measurement. The instruments used are a cellphone camera for video capture, a laptop containing the kinovea 2023 1.1 application/software object 1 body angle of 144.5° there is a balance of load distribution between the two feet, the distance between the feet is 78.11 cm. Meanwhile, the body angle is 168.3° The distance between the feet is 109.19 cm which is too wide also has an impact on the lack of dynamic stability. These results support the findings of previous studies which state that optimal body posture, appropriate body angle, and stable distance between the feet can significantly increase passing accuracy.

1. Introduction

Football is one of the most popular sports in the world and requires good basic technique mastery to achieve optimal performance. According to (Rajidin, 2014), this game requires a combination of individual technical ability, understanding of game tactics, and solid teamwork to produce an interesting and productive performance. One of the vital basic techniques in the game of football is the technique of passing or passing the ball to teammates. The passing technique is vital because it is the key to maintaining ball control, building attacks, and creating goal opportunities.

The inside of the foot passing technique is often considered the most accurate and effective technique for controlling the direction and speed of the ball (Komarudin et al., 2018). In this context, a player's ability to adjust the angle of the body and the position of the feet when passing plays a very important role in determining the success of the pass. Teams that are able to pass quickly, accurately, and effectively tend to be more dominant in the match. One of the passing techniques that is often used and has a high level of accuracy is passing using the inside of the foot.

The technique of passing using the inside of the foot requires good coordination between various parts of the body, especially the angle of the body and the position of the feet. The ideal body angle and the correct foot position when passing play a major role in determining the accuracy and effectiveness of the pass. Players who are able to adjust their body angle optimally can direct the ball with more precision, while the correct foot position can increase body stability when passing.

Technique is the ability to utilize principles or theories to improve skills efficiently. Understanding biomechanics allows athletes and coaches to understand how body posture and movement affect performance. Therefore, a biomechanical approach to passing techniques in soccer is important to improve the effectiveness of training and match performance (Sudarmada & Wijaya, 2015).

The vast and dynamic football field demands players to have adequate physical fitness. Elements such as speed, explosive power, agility, balance, and reaction time are very influential in maintaining optimal performance. By understanding the relationship between biomechanics and basic techniques, coaches can design more specific and effective training programs.

Several previous studies have shown that biomechanical factors, such as balance, posture, and foot angle, greatly affect the accuracy and effectiveness of passing (Dunsky et al., 2017). Kicking a ball is not only about power, but also about proper technique, motor coordination, and body stability.

Biomechanics as a science that studies human movement based on mechanical principles, offers an analytical framework to systematically evaluate sports techniques. According to (Sugiyanto, 2017) and (Triaiditya et al., 2018), students who have a strong understanding of biomechanics are expected to be able to apply it in sports practice and also in future coaching activities. Therefore, it is important to integrate biomechanics studies into the process of learning sports techniques, including in soccer passing techniques. The application of biomechanics in sports aims to understand and improve techniques, so as to optimize performance and prevent injury. In soccer, understanding the biomechanics of passing, especially body angles and foot positions, is very important for pass accuracy.

According to (Bambang et al., 2014) in his book entitled basic sports biomechanics, biomechanics is the study of the structure and function of biological systems with mechanical methods or approaches, which are related to statics, dynamics, kinematics and kinetics. Includes linear (straight) and angular (circular) motion, as well as other general movements (combined movements), which can occur.

(Meriyanto et al., 2016) Biomechanics is a science related to external and internal forces acting on the human body and the effects produced by these forces. According to (Uddin et al., 2020) as a trainer or teacher, it is necessary to evaluate and analyze all techniques and movements performed by students biomechanically to improve student achievement in learning physical education, health and sports. In short, the researchers tried to find and analyze information about the passing aspect using the inside of the foot, in the game of soccer.

This study aims to analyze the effect of body angle and foot position on the effectiveness of passing techniques using the inside of the foot in soccer games, and this study not only aims to understand the theory behind passing techniques, but also provides practical contributions for coaches and athletes in improving playing skills. By examining biomechanical aspects, this study is expected to provide scientific contributions that can be used as references by coaches, players, and researchers in developing more effective and evidence-based training methods.

In addition, this study also seeks to provide new insights for students of Sports Education, especially in applying the concept of biomechanics to technical skills in football. Thus, it is hoped that the results of this study will not only be useful in an academic context, but also in coaching practice and development of sports achievements.

2. Methodology

This research method is a type of quantitative descriptive research with a survey data collection technique on the test and measurement of the inside of the foot passing. Descriptive is a research method that concerns questions about the existence of independent variables, either in just one variable or more (Sugiono, 2013). Because this study analyzes using biomechanical videos of students' movements when doing underhand serves to determine body angles, foot distances, and foot angles. According to (Waruwu, 2023) The data collected in this type of survey is data that is a combination of measurements, calculations and short narrative explanations, which are then analyzed using descriptive statistics.

The method used by researchers in biomechanics research is to examine the biological system (such as the human body) and the principles of mechanics or motion science when performing an underhand serve in volleyball. The analysis of biomechanics data in this study also follows the method of observing movement and measuring body motion angles, according to the approach recommended in current biomechanics research (Carlsson et al., 2025). The research objects in this study use 2 objects, namely object 1 and object 2. The two objects are students of Sports Education from the class of 2023 who are currently studying at the Muhammadiyah University of East Kalimantan.

At the time of data collection, the researcher took a video using a cellphone camera, from the camera angle to the left of object 1 and object 2 when doing an underhand serve. Each object passed 2 times to pass using the inside of the foot. After taking

the video, the researcher measured the body angle, foot distance, and foot angle of the object using a laptop that already had the kinovea 2023 1. 1 software application.

Data processing was carried out using descriptive statistics to describe the characteristics of passing techniques based on the measured biomechanical parameters. In addition, data interpretation refers to the latest sports biomechanics theory that supports the analysis of motion angles and body posture.

Data collection process: 1) prepare a cellphone camera and when taking a video of the foot pass using the inside of the foot from the left side of both objects. 2) each object passes the inside of the foot 2 times to pass the inside of the foot. 3) the results of the body angle data are 144.5° , the distance between the feet is 78.11 cm, the distance to pass is 848.54 cm, 4) conduct data analysis using an Asus tuf f15 laptop and using the kinovea 2023 software application. 1.1.

3. Result and Discussion

Object data collection was carried out by manual measurement to obtain an objective scale of field conditions. Furthermore, measurements of athlete steps and body angles were carried out using kinovea software. The documentation and measurement data are presented as follows:

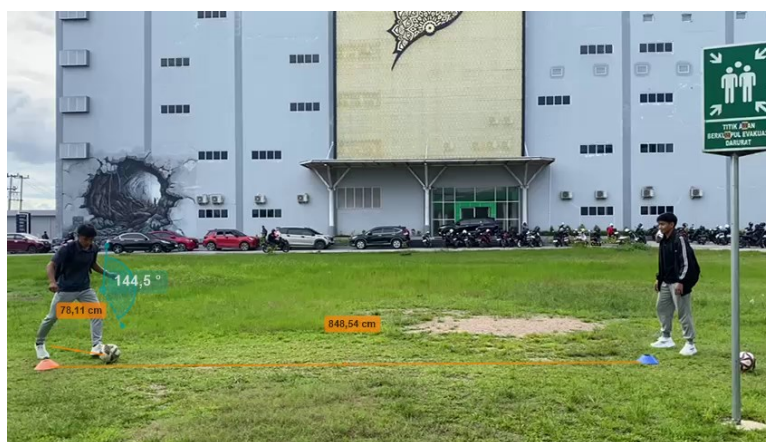


Figure 1. Results of measuring angles, distance between feet and distance between objects

After data collection through the Kinovea 2023.1.1 software application and video recording, analysis was carried out using the Kinovea application to measure body angles, distance between feet, and the distance between object 1 and object 2. Based on the data obtained from the measurement results using the Kinovea application, it is known that object 1 has a body angle of 144.5° , a distance between feet of 78.11 cm, and a distance between objects of 848.54 cm. This data was obtained through a series of video recording processes when the subject passed using the inside of the foot in a soccer game, then further analyzed to obtain the necessary biomechanical parameters. What do you think according to Shibata et al. (2024),

which states that the suitability of the body angle plays a very important role in producing effective short passing techniques in modern soccer games.



Figure 2. Results of measuring angles, distance between feet and distance between objects.

Table 1. Inside foot passing data results from 2 objects

	Object 1	Object 2
Foot distance	78,11 cm	109,11 cm
Body angle	144,5°	168,3°
Object distance	848,54 cm	845,79 cm

Figure 2 results of body angle measurement, distance between feet and distance between objects when passing the inside foot in a soccer game. With a series of body angles, foot distance and distance between objects when passing the inside foot in figure 2. Object 2 produces data of 168.3° at the body angle when passing the inside foot. And the distance between the feet when passing produces data of 109.19 cm. While the distance between objects 1 and 2 845.79 cm from the data shows less effective movement results.

In contrast, in object 2, the body angle is more open (168.3°) and the distance between the feet is wider, which has an impact on decreasing the effectiveness of passing. (Rubiono & Qiram, 2018) supports this finding, that the angle of the foot when kicking greatly affects the direction and speed of the ball's trajectory. A deeper analysis of the differences between objects shows that effective passing is not determined by just one factor, but rather a combination of ideal body angle, stable distance between the feet, and controlled kicking power. These three aspects play a simultaneous role to ensure that the ball can reach the target with high precision. In addition, optimal movement quality in each phase of the movement (preparation, contact, follow-up) significantly affects the success of passing (Hasan & Clemente, 2021). In this study, object 1 showed more structured and well-coordinated movements in all three phases. This can be seen from the stability of the body when swinging the leg and when contacting the ball, resulting in a more accurate ball trajectory.

From a biomechanical perspective, a body angle of 144.5° provides a balance in the distribution of weight between the two feet, and allows for more optimal energy transfer from the body to the ball. The distance between the feet of 78.11 cm also creates a wide enough base of support to maintain balance. According to (Dunsky et al., 2017), success in passing is greatly influenced by the quality of movement in each phase, namely the preparation phase, contact phase, and follow-up phase. Meanwhile, a body angle of 168.3° as shown by object 2, causes the weight distribution to be unbalanced and results in a lack of control when making contact with the ball. The distance between the feet of 109.19 cm which is too wide also has an impact on the lack of dynamic stability, so that the passing results are less precise.

The ineffectiveness of passing on object 2 can be further explained through the theory of biomechanics of body movement. With a body angle greater than optimal, the force vector applied to the ball becomes more horizontal than vertical, potentially causing the ball to lose direction and accuracy, this study also shows the importance of coordination factors between body parts.

Effective passing involves coordination between footwork, body position, arm swing, and eye gaze towards the target. This is in line with the theory put forward by (Hasan & Clemente, 2021), that effective passing depends on the integration of overall body movements, not just focusing on footwork alone.

Accurate passing speeds up the flow of the ball, increases control of the game, and opens up more dangerous attacking opportunities for opponents. This study also opens up room for further research, such as biomechanical analysis of passing in various match conditions (e.g. while running, under pressure from opponents, or on different pitch surfaces). Further research could use more sophisticated measurement methods such as motion capture systems to obtain more detailed data on body dynamics during passing.

By understanding more deeply about the biomechanics of passing, both in terms of body angle, distance between feet, and overall body coordination, it is hoped that the achievements of players in the sport of soccer can continue to be significantly improved, both at the amateur and professional levels.

4. Conclusion

This study shows that body angle and foot position are key factors that influence the effectiveness of passing techniques in soccer games. Object 1, which has a body angle of 144.5° , a foot distance of 78.11 cm, and an object distance of 848.54 cm, shows more effective and accurate passing. These results support previous research findings that stated that optimal body posture, appropriate body angle, and stable foot distance can significantly improve passing accuracy. The application of biomechanical principles has been shown to provide significant benefits in improving players' technical skills. Thus, understanding and applying biomechanics in basic soccer technique training, especially passing techniques using the inside of

the foot, is very important. This study also contributes to the development of motion analysis-based training methods, which can help improve the effectiveness of training and athlete performance on the field. For further research, it is recommended to expand the sample and consider the dynamic conditions of the match to obtain more comprehensive results.

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