

THE EFFECT OF FOOTBALL CLEATS STUDS DESIGN TO AMATEUR FOOTBALL PLAYER PERFORMANCE EVALUATION

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Abstract Football is the world's number one sport in terms of popularity and technology development. Nowadays, There is a lot of football competition that has amateur players that aims to find the hidden talents in the football game. Therefore, research in technology and environment to find the best performance in amateur football players are needed. Changes in design and materials in football cleats, especially Football Cleats Studs, has some correlation which never been discussed before. This research will be given the analysis of the effect of cleats studs per level and position and will be check by the Key Performance Index provided by the trainer from the experiments, The result shows that Soft Ground Shoes has the best performance for the amateurs.

Key words Football Shoes, Amateur Football Player, Performance Measurement

1. Introduction

In the world of sports today, football is one of the most popular sport in the world, both from the number of players to the number of supporters (fans). In 2007, the Fédération Internationale de Football Association (FIFA) calculated that 265 million people actively played football throughout the world [1]. This number is 4% of the world population. Among that number, around 25% are amateur players. Therefore, investment in research of this sport in supporting the need to find the best strategies in improving the performance of existing athletes are very important for the management or the coaches. Changes in design and materials in football cleats, especially Football Cleats Studs, are included in the adaptation of the football world in the era of globalization [2]. These changes are in line with the increasing of the interaction from Football Cleats Studs on performance and risk [3]. Several studies have developed this field. However, there is no further detailed study of the correlation between Football Cleats Studs design to players' performance, there is only a systematical review that is used to look at the correlation between football cleats to the performance and risk [4].

The main characteristic of football cleats is that they have Pul on their soles to increase their durability on the ground, usually

on the natural grass. This increase in containment aims to improve performance during displacement, and especially during acceleration (sprint), braking and direction.

Football cleats surface interaction is an important and up-to-date topic that needs to be discussed because football cleats are the most important instrument in the game of football not only because they interfere the performance of football games, but also with the increased risk of injury [5]. According to T. Sterzing, on 2016 there was a decrease in sports performance with Soft Ground football cleats, and an increased risk of injury on artificial grass [2]. Performance analysis is related to performance indicators which are choices or combinations of action variables that aim to define several aspects of performance, and must be related to a success result. The indicator consists of many activities carried out by football players, but several studies group them into several categories such as Behavioral, Tactical, Technical and Physical [6]. Furthermore, the Key Performance Index is a performance measurement that is based on the coach's decisions and can be measured objectively, reliably, and accurately, but assessing performance in training and games is a difficult task. Determination of KPI in each category is set for each playing position in the team, and can be an input for analysts. Therefore, further research is needed in this condition.

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Table 1. Type of Football Cleats

Model of Shoes/Cleats	Football Cleats Studs Material	Football Cleats Studs		
		Amount	Size	Shape
 Turf	Rubber	55	6-7 mm	Cylinder, Cone, prismatic, dan sharp
 Artificial Grass	Rigid Plastic	22	8-10 mm	
 Hard Ground		14	10-12 mm	
 Firm Ground		11	10-12 mm	
 Soft Ground	Aluminium	6	13-16 mm	

2. Methodology

2.1. Experimental Design

In this research, the experimental design was arranged in the form of an assessment of the amateur football performance which was separated by the type of football shoes based on the pul shape. Experimental designs in this research, included [2]:

a. Dependent Variable

The experiment contained calculations on Dependent Variables of football player performance factors that arranged by the researcher and are based on the references in football activities. In this research, the performance factors are some of the activities performed by football players in training or matches. The Technical Indicator is divided into ***Kicking, Jumping, and Dribbling***. This research will take the value of the three performance indicators above, from the number of kicks per ball speed to the goal, the number of jumps in 1 minute, and the time taken by the player to carry the ball at a distance of 200 m.

b. Independent Variable

The independent variable of this research is Football Shoes Pul Design that has been considered playing an important role in the performance of athletes during training and matches. There are 3 namely pul design; Turf, Hard Ground and Soft Ground. This research will use the three types of shoes above to measure the difference in performance when using the three shoes. This is intended to see if there is any effect from each form of football shoes based on the pul above on the performance of amateur football players.

c. Research Subject

The research subjects are 30 amateur football players in the Department of Industrial Engineering, Faculty of Engineering, University of Indonesia.

c. Research Procedures

This research was conducted periodically, according to the availability of the research subjects. The initial requirements for fulfilling the procedure are [2]:

- 1) Conduct research on synthetic grass (University of Indonesia Stadium)
- 2) Conducting research at 8 a.m. until 12 p.m.
- 3) Research subjects were required to sleep for 8 hours and have not eaten heavily in the morning
- 4) The shoes used by the model are the same (Adidas X with pul Turf, Soft Ground and Hard Ground) In accordance with T. Sterzing, 2016, the initial requirements in research procedures are very important because the authors want to get the research subjects under the same conditions.

d. Steps for Primary Data Collecting

- 1) Subject fills out the biodata
- 2) Subject uses the Turf type from the football cleats to measure the kicking performance by kicking the ball 40 times from the point selected to the spot made on the face of the wicket with a distance of about 10-11 meters
- 3) Subject uses the Soft Ground cleats to measure the jumping performance by jumping towards the ball in 1 minute and prohibited to coming out from a small circle
- 4) Subject uses the Hard Ground cleats to measure dribbling performance by carrying the ball with a distance of 200 meters
- 5) The coach fills out the Key Performance Index (KPI) to obtain data about the neatness of the performance from the subject

Table 2. KPI based on the Player Position (Form of Performance Score)

No	Name	Position	Kicking (Passing)	Running (Dribbling)	Jumping (Heading)
1		Defender			
2		Midfielder			
3		Attacker			
4		Goalkeeper			

3. Results And Discussions

3.1. The Analysis of MANOVA Results

This analysis is carried out by conducting a significance test to see whether the different forms of Football Cleats Studs affect amateur football player performance.

3.1.1 Multivariate Analysis

Table 3. The Analysis of *Multivariate* Results on Football Shoes

Effect		Value	Sig.
Shoes	Pillai's Trace	0.340	0.000
	Wilks' Lambda	0.679	0.000
	Hotelling's Trace	0.446	0.000
	Roy's Largest Root	0.373	0.000

The results of multivariate processing in SPSS on different types of shoes indicate that the different forms of Football Cleats Studs *have different effects* on amateur football players performance.

3.1.2 The Analysis of Research Hypothesis

Table 4. Research Hypothesis

	Research Hypothesis
H	There is <i>no significant effect</i> on the differences of Football Cleats Studs design on amateur football player performance
H	There is <i>a significant effect</i> on the differences of Football Cleats Studs design on amateur football player performance

The results of multivariate analysis prove that H0 is rejected and H1 is accepted because the significance value is <0.05 , which is 0,000, proving that there is a significant effect on the different types of football shoes on the performance of amateur football players,

Industrial Engineering Department, Faculty of Engineering, University of Indonesia. This also proves the current research that there is a significant effect of the different forms of Football Cleats Studs on amateur football player performance. Both kicking movement performance, jumping movements, and dribbling movements have a significant value below 0.05.

3.1.3 The Analysis of Relationship between Football Shoes and Amateur Football Player Performance

Table 5. MANOVA Results

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Shoes	Kicking	98.88	2	49.439	11.487	0.000
	Jumping	95.76	2	47.878	3.839	0.025
	Dribbling	4443.01	2	2221.508	13.278	0.000

According to table 5, table 5 shows that the relationship between shoes and the dependent variable is all significant. With a magnitude of F 11,487 and a significance of 0,000 in the kicking motion, F 3,839 and significance of 0,025 in the jump movement, and for the dribbling movement the F is 13,278 with a significance of 0,000. This is consistent with the literature (Silva et al., 2017a) that different forms of football shoes have an influence on game performance. Then, this test showed that this research proved quantitatively the effect of football shoes on the performance of amateur football players.

3.1.4 The Performance Improvement Analysis

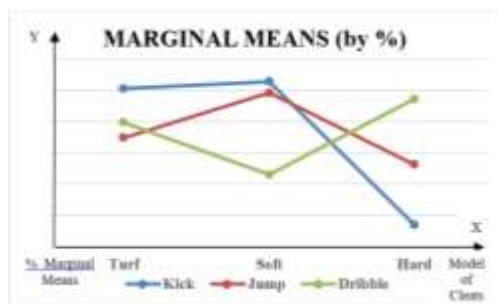
Table 6. shows that in each performance measurement using 3 different types of football shoes with different types of shoes have an increase from not wearing shoes. This study supports the statement (Silva et al., 2017) that the difference between wearing football shoes and not wearing football shoes is quite large in measuring performance. Then, the number of incidents of mastering the ball, wrong kicking, and wrong keeping the ball in practice and research prove that the effect of football shoes is quite large on increasing the performance of amateur football players.

Table 6. *Performance Improvement*

Types of Activities	% Performance Improvement		
	Types of Football Shoes		
	Turf	Soft Ground	Hard Ground
Kicking	41.86 %	42.60%	23.22%
Jumping	15.99 %	22.81%	11.32%
Dribbling	-27.71%	-41.58%	-22.23%

3.1.5 The Effect of Football Shoes on Amateur Football Player Performance Analysis

After analyzing the research data, the next step is to explain the results of this research in the form of a table that illustrates the effect of using structured worksheets on students' learning outcomes and motivation in the experimental class and the control class.

**Fig 2.** *Marginal Means in %*

In Figure 2, it can be seen that the average size of the Soft Ground football shoes has the highest results on the performance of the kicking movement, the jumping movement and having the least amount of time in the movement of dribbling the ball. The following is a broader explanation of the three performances:

1. Kicking Performance

Soft Ground type shoes have the highest average success with a value of 7.57 in measuring the performance of kicking the ball towards the goal on synthetic grass (University of Indonesia Stadium).

2. Jumping Performance

For the average number of jumps measured in the research subjects, Soft Ground shoes have the greatest success rate of jumping. However, the effect of the difference in the shape of the football shoes has a smaller effect on the jump performance compared to kicking performance and the movement of dribbling the ball.

3. Dribbling Performance

Soft Ground type shoes have an average speed faster than the other two types of shoes. This shows that using Soft Ground shoes as a whole the research subjects had a better time than the other 2 types of shoes.

3.2 Analysis of Performance Value per Position

In this part of the analysis, research shows differences in performance results in each position in the team. This needs to be analyzed because in order to find the best composition of players in a team, it is needed to have players in their best positions and can issue their abilities or performance to the maximum both during training and during matches. The position of the Football Player is divided into 5 positions. Goalkeeper position, defender position, midfielder position, winger position, and forward or striker position. The purpose of the analysis per position in this study is to provide quantitative evaluations and recommendations for the use of football cleats based on different pul types. Each performance per position of the research subject can be seen in this study, and divided into 5 parts:

1. Striker Position

From 5 subjects, Soft Ground is the most suitable cleats to the striker position in the Department of Industrial Engineering, with the most number of kicks, the most average number of jumps and the least time in carrying the ball.

Table 7. Marginal Means for Striker Position

MARGINAL MEANS	Kickin g	Jumpin g	Dribbli ng
Turf	8.69	22	69.91
Soft	8.96	23	57.23
Hard	6.36	21	73.87

2. Midfielder Position

There are 12 subjects for the midfielder position and the highest performance is attained from wearing the Soft Ground on the three performances with the score of 8,76 on the kicking, 19 times of jumping and 76,47 seconds in carrying the ball.

Table 8. Marginal Means for Midfielder Position

MARGINAL MEANS	Kicking	Jumping	Dribbling
Turf	8.44	18	80.27
Soft	8.76	19	76.47
Hard	5.79	16	87.71

3. Defender Position (Back Player)

The Defender Position performance is collected from 11 people and the result shows that the Soft Ground has better value than the two other shoes in kicking and dribbling (19 times of jumping and 79,8 seconds of dribbling). However, because in playing football the defender player does more kicking, so the most suitable shoes are Turf type.

Table 9. Marginal Means for Defender Position

MARGINAL MEANS	Kicking	Jumping	Dribbling
Turf	6.08	17	93.18
Soft	6.01	19	79.80
Hard	4.92	16	96.14

4. Goalkeeper Position

Unique results are found in the performance assessment carried out by the position of goalkeeper. Both from the kicking and dribbling, Hard Ground type is the most suitable shoes with the score of 7,23 and 78,26. However, because in playing football the goalkeeper does more kicking, so the most suitable shoes are Hard Ground type.

Table 10. Marginal Means for Goalkeeper Position

MARGINAL MEANS	Kickin g	Jumpin g	Dribbli ng
Turf	6.39	15	92.57
Soft	5.54	16	97.07
Hard	7.23	14	78.26

5. Winger Position

In this research, there are 8 subjects which played as the winger player. The results show from the jumping and dribbling, Soft Ground has bigger value than the other shoes.

Table 11. Marginal Means for Winger Position

MARGINAL MEANS	Kickin g	Jumpin g	Dribbli ng
Turf	8.45	18	80.45
Soft	8.11	20	66.11
Hard	5.48	17	87.85

3.3 Analysis of the Effect of Shoes with the Key Performance Index

Among 30 research subjects, only 7 player (2 goalkeeper, 4 defender player, 1 striker) whose performance values are still below 0 or according to table 3.3 is a standard technique (average). These results indicate that the coach feels an increase in performance after using recommended shoes from the results of the above research. This also supports the aim of the study to evaluate the type of football cleats that are most suitable for the research subject according to the shape of the studs.

3.4 Analysis of Specific Records in the Research

There are some research subjects who have special notes because they cannot complete performance measurements or repeat performance measurements due to several things. According to (Silva et al., 2017b) on his research on the measurement of kinetic, kinematic and neuromuscular performance of football athletes on the ankle, shows that no one knows for sure the most correct measurement for the performance. There have been no studies that can show the results of a clear change in the competition, because in each performance measurement study there are still many research subjects who ask to stop because of physical strength or not being fit (fatigue and minor injury).

3.5 Analysis of Player Fatigue

In this part of the analysis, the research shows the results of data processing of player fatigue after doing the exercise and collecting performance data in the experiment. Research with EMG was carried out by the subject of the study by kicking to a point so that the muscle will strain after doing the exercise for 90 minutes and can be measured. Data processing is done using an EMG tool to measure how much is the difference in fatigue from using football shoes with different pul types. The results of the study stated that using Soft Ground shoes at the

University of Indonesia's Football Stadium field, the value of muscle tension that caused fatigue to the research subjects was the lowest. Figure 3 shows the differences from using different type of studs.

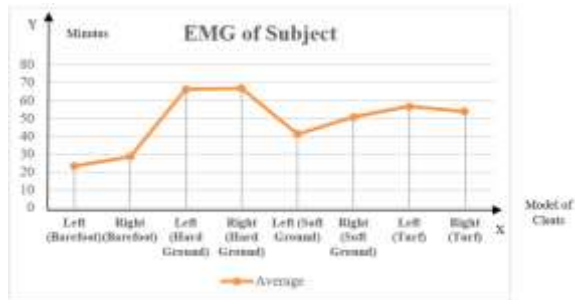


Fig 3. Average EMG Data of Subject

4. CONCLUSIONS

Based on data processing and analysis of the relationship between football shoes and amateur football player performance, this research get the results regarding football shoes that are most suitable for amateur football players in the Department of Industrial Engineering. The most suitable shoes based on performance value are Soft Ground type shoes. Then, the improved in performance was also seen after the results of the analysis of the performance value between wearing football shoes and not wearing football shoes. This following are suggestions and recommendations that can be applied for future research:

1. Further research should be added regarding the shape of the base of football shoes in order to create a new design that is suitable for amateur football players.
2. Further research can be carried out using different research variables, from performance indicators or the activities of different football players and different types of football shoes.
3. Further research can be done on professional football players, they can be assisted by the shoes of professional football players to get precise results and can be used in professional match analysis.
4. Further research can be carried out using experimental designs, different methods and tools and paying attention to the bias in the research because with differences and producing the same thing, it can support the maximum result for football

players. Then, the data can be measured using Recovery Pulse to make it clear in generating data.

5. Further research can be done by comparing amateur football players and professional football players. Hence, there can be improvement space for amateur football players to develop their abilities.

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