

Research Article

# Relationship of Selected Kinematic Variables with the Performance of a Goal Kick Techniques in Football Goalkeeper

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## Abstract

**Introduction:** A goal kick is awarded when the whole of the ball passes over the goal line, on the ground or in the air, having last touched a player of the attacking team, and a goal is not scored. The purpose of this study was to find out the relationship of selected angular kinematic variables with the performance of goal kick technique of soccer goalkeepers in Ethiopia's higher premier league. **Method:** Purposive sampling technique was used for choosing highly skilled goalkeepers. In the present study, a total of seventeen male goalkeepers (18 to 30 years of age) who had participated in the Ethiopian premier league participated. Goal kick technique was divided into three phases, such as the stance phase, the execution phase and the follow-through phase. All goalkeepers were given three trials and the best trial was used for analysis. Each participant performed three goal kicks with maximum strength that were video recorded with a camera (nikon d3200) positioned 9 m away from the place of the kick at the height of 0.95m. The silicon coachpro 7 and kinovea software were used for analyzing the data. The Joint Point Method was used in order to obtain the values of selected angular kinematic variables by developing a stick figure. The height of the Center of Gravity was calculated by segmentation method. The relationship of selected angular & linear kinematic variables with the performance of goal kick soccer goalkeeper was obtained by spearman rank correlation method. **Conclusion:** During stance phase, hip joint (left and right), ankle joint right, shoulder joint right and elbow joint left, do have a significant relationship with the performance of goal kick in soccer goalkeeper. At the time of execution phase, angular kinematic variables such as ankle joint left, hip joint right, shoulder joint right and elbow joint right do show a significant relationship with the performance of goal kick in soccer goalkeeper. Whereas the elbow joint left and wrist joint left were insignificant relationships. At the time of follow-through phase, ankle joint right, elbow joint left and hip joint were significant.

## Keywords

Kinematics, Centre of Gravity, Joint Angles, Goal Kick

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## 1. Introduction

Life and physical activity are two aspects of a coin. Surprisingly, the sport has made many changes and has reached its current level [1]. To this end, sports medicine specialists, sport nutritionists, biomechanics, coaches, physical therapists, psychologists and physiologists have made an undeniable contribution [2-4]. Biomechanics have adjusted their errors using modern technology to maximize their potential [5].

Biomechanics is a science that is study about human moment specially, in sport it is highly significant for performance improvement and minimization of injury [6-9]. Biomechanical or movement analysis is repeatedly assumed that the procedure of sighted the performance of a skill, finding faults in the performance, and so long as give feedback to the performer to help correct those faults [10, 11]. The ultimate aim of exercise and sports biomechanics is to push athletes in pick performance [9, 12].

Generally, goalkeepers have two ways of passing, either by throwing the ball in ground or by kicking and sending the ball high in the air to a teammate on the opponent's side of the field [13]. The main objectives of offensive in soccer is to break the opponents goal in short time with small number of touches. Relates to this, goal kick is considered as the first assist for the scored goal. Based on this goalkeepers should have good kick accuracy and kicking the ball in long distance were needed [14].

TakahitoTago conducted study on investigate punt kicks by football goalkeepers on the basis of differences in the effort of the kick. And his result shows that, In comparison to lower intensity goal kicks, the higher effort goal kicks involved increasing the hip joint extension angle for the right foot during the backswing and lowering the knee joint angle of the right leg at the start of the forward swing, thereby producing forward swing velocity for the right foot [15]. The main objective of this study was investigat the relation of different body angle on goalkick performance. Inaddition, The history of goalkeepers in Ethiopia was absoulty poor. For fixing this problem as a sport man, we belive that such type of performance anlaysis has great role. The ways in which we evaluate sporting activity in ethiopia are very odd. In developed countries, they provide information-based on using a variety of modern technology like cameras and software. In our country, still giving feedback only by observation at it as it is commonly done. So, as a sports science

teacher, i need to see this thing fixed in our country. I have taken this into consideration and have undergone the first video analysis in our country. Following this we conducted a study entitled that relationship of selected kinematic variables with the performance of goal kick techniques in football goalkeeper. For looking the relationship and giving orientation.

## 2. Method and Materials

Seventeen male goalkeepers (18-30) who had participated in the Ethiopian premier league tournament were selected as subjects for this study. They were from different clubs arbaminchkenema, sidamabuna, south police, wolitadicha and hawasakenema football club. Purposive sampling technique was used for choosing highly skilled goalkeepers. Goal kick technique was divided into three phases such stance phase, execution phase and follow-through phase. The kinematic variables were consisted of selected angular kinematic variables means the measurements of angles at various joints of ankle joints (right & left), knee joints (right & left), hip joints (right & left), shoulder joints (right& left), and elbow joints (right & left). The linear kinematical variables selected were: height of cg at the time of stance phase, height of cg at the time of execution, height of cg at the time of follow-through phase. The nikon d3200 camera was used for registering that complex moment. The various angles were obtained by the use of silicon coach and kinovia software. The data were recorded from both planes which means in sagittal plane and frontal plane. Each subject was given three trials and the best trial was used for analysis. The performances of subjects were evaluated by the qualified judges on the basis of execution of the skill evaluated by five judges. Segmentation method was employed in order to assess to the centre of gravity. The relationship of selected angular & linear kinematic variables with the performance of goal kick on soccer goalkeeper was obtained by employing the spearman rank correlation method.

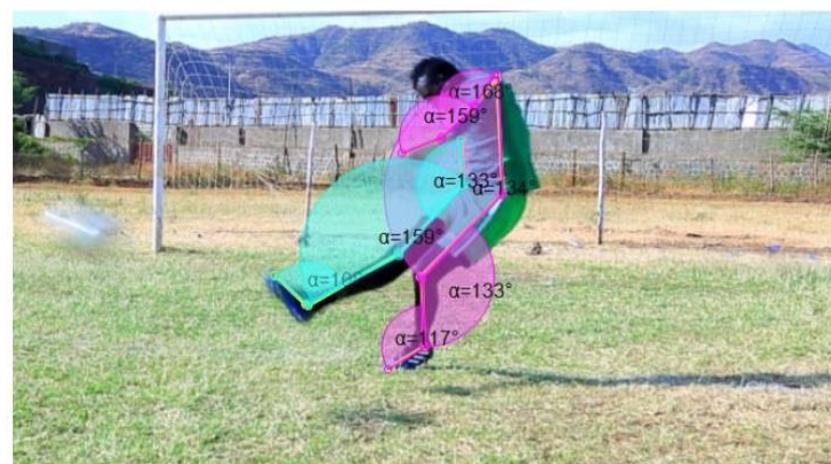
Segmentation method was employed in order to assess to the centre of gravity of the performance on eache phase. Stance phase in (Figure 1), execution phase (Figure 2) and follow through phase in (Figure 3).



*Figure 1. Angular kinematic variable at time of stance phase.*



*Figure 2. Angular kinematic variable at time of execution phase.*



*Figure 3. Angular kinematic analysis of goal kick at time of follow-through phase.*

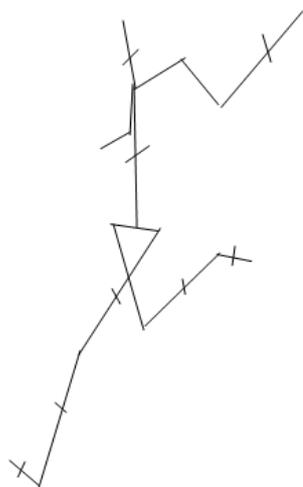


Figure 4. Stance phase of Stickfigure of goalkick.

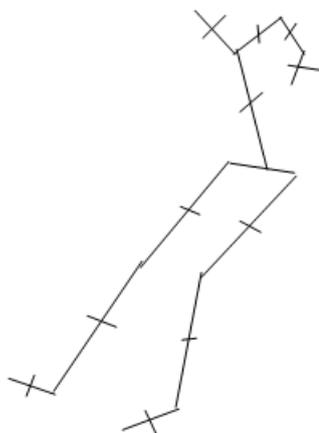


Figure 5. Execution phase of Stickfigure of goalkick.

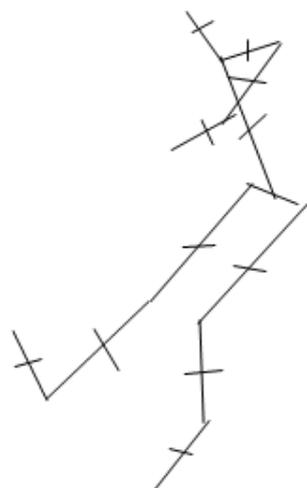


Figure 6. Follow-Through phase of Stickfigure of goalkick.

### 3. Results

The finding of table 1 showed that negative significant

relationship of goal kick performance with ankle joint left, hip joint right, shoulder joint right elbow joint right and wrist joint left at the time of stance phase (-0.5), (-0.32) (-0.396), (-1.0) and (-0.5) respectively were obtained. Where as there is Postivesignificantrelationship withAnkle joint (right), knee joint (left), knee joint (right), shoulder joint (left), Elbow joint (left), and wrist joint (right) at time of stance phase.

Table 1. Relationship of selected angular kinematic variables with the performance of goal kicks in stance phase.

Independent variables	Correlation coefficient
Ankle joint (left)	-0.5
Ankle joint (right)	1.00*
knee joint (left)	0.43
knee joint (right)	0.23
hip joint (left)	0.22
hip joint (right)	-0.32
shoulder joint (left)	0.5
shoulder joint (right)	-0.396
Elbow joint (left)	1.0*
Elbow joint (right)	-1.0*
wrist joint (left)	-0.5
wrist joint (right)	1.00*

The finding of table 2 showed that negative significant relationship of goal kick performance with ankle joint left, hip joint left, shoulder joint left, wrist joint left and right at the time of execution phase (-0.926), (-0.817), (-0.668), (-0.826) and (-0.912) respectively were obtained. Where as there is highly significant relationship with knee joint left and elbow joint left at time of execution phase (0.96) and (0.707) respectively were obtained. Whereas other selected angular kinematic variables does not show any significantrelationship with at the time of execution phase because the calculated value wasfound less than the table value at 0.05 level of significance.

Table 2. Relationship of selected angular kinematic variables with the performance of goal kicks in execution phase.

Independent Variables	Correlationcoefficient
AnkleJoint (left)	-0.926
Anklejoint (Right)	0.226
Kneejoint (left)	0.96

Independent Variables	Correlationcoefficient
KneeJoint (Right)	0.105
Hipjoint (left)	-0.817
Hipjoint (Right)	0.04
Shoulderjoint (Left)	-0.668
Shoulderjoint (right)	0.397
Elbow joint (left)	0.707
Elbowjoint (right)	0.115
Wrist joint (left)	-0.826
Wrist joint (right)	-0.912

The finding of table 3 showed that significant relationship of goal kick performance with ankle joint left, knee joint left and right, hip joint left, shoulder joint left, elbow joint left and wrist joint left and right at the time of follow through phase (0.75), (0.924), (0.575), (0.952), (0.898), (0.825), (0.699) and (0.533) respectively were obtained. Whereas other selected angular kinematic variables does not show any significant relationship with at the time of follow through phase because the calculated value was found less than the table value at 0.05 level of significance.

**Table 3.** Relationship of selected angular kinematic variables with the performance of goal kicks in follow through phase.

IndependentVariables	Correlationcoefficient
AnkleJoint (left)	0.75
Anklejoint (Right)	0.146
Kneejoint (left)	0.924
KneeJoint (Right)	0.575
Hipjoint (left)	0.952
Hipjoint (Right)	0.407
Shoulderjoint (Left)	0.898
Shoulderjoint (right)	-0.484
Elbowjoint (right)	0.139
Wrist joint (left)	0.699
Wrist joint (right)	0.533

### 4. Discussions

In case of goal kick at the time of stance phase angular kinematic variable such as ankle joint left, shoulder joint right, elbow joint right do show negative significant relation-

ship and shoulder joint left and knee joint left do show positive relationship with the performance of goal kick in soccer goalkeeper were as in execution phase ankle joint left, hip joint left, shoulder joint left, wrist joint left were negative relationship in addition, knee joint left and elbow joint left were positive significant with goal kick skill.

Finally, ankle joint left, knee joint left and right, hip joint left, shoulder joint left, elbow joint left, wrist joint left and right do positive significance of follow through phase with goal kick of goalkeeper in soccer. Whereas the findings of other selected linear kinematic variable centre of gravity at stance phase and center of gravity at follow through phase do positive significant and center of gravity at execution phase do negative relationship.

### 5. Conclusions

In case of goal kick at the time of stance phase angular kinematic variable such as ankle joint left, shoulder joint right, elbow joint right do show negative significant relationships and shoulder joint left and knee joint left do show a positive relationship with the performance of goal kick in soccer goalkeeper.

In the execution phase ankle joint left, hip joint left, shoulder joint left, wrist joint left was a negative relationship in addition, knee joint left and elbow joint left were positive significant with goal kick skill.

At the time of follow through phase ankle joint left, knee joint left and right, hip joint left, shoulder joint left, elbow joint left and wrist joint left and right positive significant (0.75), (0.924), (0.575), (0.952), (0.898), (0.825), (0.699) and (0.533) respectively was obtained. Whereas other selected angular kinematic variables do not show any significant relationship with.

In linear kinematic variable, height of centre of gravity at the time of execution, was found a significant relationship with the performance goal kick.

### Abbreviations

BMI Body Mass Index

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### Author Contributions

All authors, but mainly Aychew, were responsible for the concept and design of the study. Abhishek develops the model, advise many thing on this study. Birhan and Bantie

were responsible for data collection and data analysis.

**Aychew Kassa Belete:** Conceptualization, Methodology

**Abhishek Kumar Yadav:** Supervision, Validation, Visualization

**Birhan Ambachew Taye:** Data curation, Formal Analysis, Software, Writing – review & editing

**Bantie Getinet Yirsaw:** Project administration, Software, Writing – original draft, Writing – review & editing

## Data Availability Statement

The datasets used and/or analyzed during the current study available from the corresponding author on reasonable request.

## Conflicts of Interest

The authors declare no conflicts of interest.

## References

- [1] During, S., Popular culture on a global scale: a challenge for cultural studies? *Critical Inquiry*, 1997. 23(4): p. 808-833.
- [2] Sherry, E. and D. Bokor, *Sports medicine: problems and practical management*. 1997: Cambridge University Press.
- [3] Ward, K., *Sports and Exercise as Medicine*, in *Routledge Handbook of Sports and Exercise Therapy*. Routledge. p. 648-744.
- [4] Chandler, T., W. Vamplew, and M. Cronin, *Sport and physical education: The key concepts*. 2007: Routledge.
- [5] Halilaj, E., et al., Machine learning in human movement biomechanics: Best practices, common pitfalls, and new opportunities. *Journal of biomechanics*, 2018. 81: p. 1-11.
- [6] Knudson, D. V. and D. Knudson, *Fundamentals of biomechanics*. Vol. 183. 2007: Springer.
- [7] Vainio, L., *Economic preferences explaining physical activity stages of change*. 2019.
- [8] Nigg, B. M., B. R. MacIntosh, and J. Mester, *Biomechanics and biology of movement*. 2000: Human Kinetics.
- [9] Bartlett, R., *Introduction to sports biomechanics: Analysing human movement patterns*. 2014: Routledge.
- [10] Knudson, D. V., *Qualitative diagnosis of human movement: improving performance in sport and exercise*. 2013: Human kinetics.
- [11] Knudson, D. and T. Morrison. Using sport science to observe and correct tennis strokes. in *Applied Proceedings of the XVII International Symposium on Biomechanics in Sports, Tennis*. 1999.
- [12] McGinnis, P. M., *Biomechanics of sport and exercise*. 2013: Human Kinetics.
- [13] Mielke, D., *Soccer fundamentals*. 2003: Human Kinetics.
- [14] Santos, J., et al., Analysis of offensive and defensive actions of young soccer goalkeepers. *Human Movement*, 2022. 23(1): p. 18-27.
- [15] Takahito TAGO, et al., Kinematic analysis of punt kick in football goalkeepers based on the level of kick effort. *NSSU Journal of Sport Sciences*, 2015. 3: p. 36-43.