

INTERNATIONAL GRADUATE COLLOQUIUM

i-SPEAK

2026

**SPORTS AND PHYSICAL EXERCISE
ASSEMBLY OF KNOWLEDGE SHARING**

SERIES 1. 2026

COLLOQUIUM PROCEEDINGS

EXTENDED ABSTRACT



Malaysia, 10 February 2026



eISBN 978-629-7989-01-3



Comparative Analysis of Reaction Time and Decision-Making Among Goalkeepers of Different Playing Levels During Penalty Kicks

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Keywords: Reaction Time, Decision-Making, Goalkeeper Performance, Goalkeeper Level, Penalty Kick

I. INTRODUCTION

Penalty kicks are important moments in football because they can determine the result of a match. For goalkeepers, this situation is challenging because they have less than one second to react after the ball is kicked. Within this short period, the goalkeeper must observe the kicker, decide the direction of the shot, and dive quickly. Reaction time and decision-making are therefore important skills for saving penalty kicks. Goalkeepers must react quickly and make accurate decisions. Previous studies explain that skilled players are usually better at reading body movements, using visual cues, and making quick decisions during sport situations [1][2].

In penalty kicks, the goalkeeper must read cues from the penalty taker, such as body position, approach angle, and kicking-leg movement. The interaction between the goalkeeper and penalty taker influences the chance of success for both players [3]. Skilled soccer players are also better at using visual search strategies, which helps them make better decisions during play [4]. Goalkeeper performance also involves reactive agility, meaning that the goalkeeper must respond to unpredictable movement rather than move quickly in a planned direction only. Trecroci et al. [5] stated that change-of-direction speed and reactive agility are different because reactive agility includes perception and decision-making. Video-based analysis can measure goalkeeper reaction time in a practical way. Kinovea® has been shown to be reliable for analysing human movement when compared with a three-dimensional motion system [6]. Therefore, this study aimed to compare reaction time and decision-making performance between experienced and less-experienced goalkeepers during penalty kicks.

II. METHODS

This study employed a quasi-experimental research design. A total of 20 male goalkeepers ($N=20$) participated in the study and were divided into two groups: university goalkeepers and amateur goalkeepers. Each goalkeeper faced 10 penalty kicks in a controlled field setting. All testing sessions were recorded using a video camera. Reaction time was

measured from the moment the ball was kicked until the goalkeeper-initiated movement. Decision-making performance was evaluated based on whether the goalkeeper dived in the correct direction of the penalty kick. The video recordings were analysed using Kinovea software. The collected data were analysed using descriptive statistics and independent-samples t-tests to compare reaction time and decision-making performance between the university and amateur goalkeeper groups.

III. RESULTS AND DISCUSSION

The results showed differences in reaction time and decision-making performance between university and amateur goalkeepers during penalty kicks. Playing experience may help goalkeepers react faster and select the correct direction more consistently. One possible explanation is that experienced goalkeepers are better at anticipation. They may not wait until the ball is kicked but instead read early cues from the penalty taker, such as body movement, approach angle, and kicking-leg action. This supports previous research showing that skilled athletes are better at using early information to predict subsequent actions [1]. Decision-making performance among goalkeepers also supports studies on expertise in sport. [2] explained that experienced players make better decisions because they have more practice, stronger pattern recognition, and greater match exposure. [4] also found that skilled soccer players use better visual search behaviours when making decisions. The findings further show that penalty saving is not only about diving speed.

A goalkeeper must perceive the cue, decide quickly, and move in the correct direction. This is related to reactive agility, which includes both movement and decision-making [5]. The findings are also consistent with Noël et al. [3], who explained that penalty kicks involve an interaction between the goalkeeper and penalty taker. Overall, this study suggests that structured experience and realistic penalty training may improve reaction time and decision-making during penalty kicks. Training should include reading body cues, reacting to

different shot directions, and making quick decisions under pressure. Video tools such as Kinovea may also be useful for analysing reaction time and movement performance in practical training settings [6].

A. Normality Test

TABLE I
NORMALITY TEST

	W	p
Average Rt	0.970	0.753
Accuracy Dm	0.944	0.280

B. Reaction Time

TABLE II
NORMALITY TEST AVERAGE REACTION TIME

Group	N	Mean	SD	SE
University	10	246	8.44	2.67
Amateur	10	257	5.91	1.87

C. Decision-Making

TABLE III
ACCURACY OF DECISION MAKING

	Group	N	Mean	SD	SE
Accuracy Dm	University	10	44.0	9.66	3.06
	Amateur	10	69.0	8.76	2.77

IV. CONCLUSIONS

This study concluded that goalkeepers with higher playing experience demonstrated better performance in penalty situations compared to less-experienced goalkeepers. The experienced goalkeepers recorded faster reaction times and showed better decision-making accuracy when responding to penalty kicks. These findings indicate that successful penalty saving does not depend only on physical speed. It also requires anticipation, visual cue recognition, and quick decision-making. Therefore, goalkeeper training should include both physical reaction drills and cognitive-based activities, such as reading the penalty taker's body movement, predicting shot direction, and responding under time pressure. Overall, the study supports the importance of experience and structured training in

improving goalkeeper performance. Future studies should involve a larger sample size, include goalkeepers from different competition levels, and examine other factors such as visual search behaviour, anticipation ability, and diving technique to provide a deeper understanding of penalty-saving performance.

ACKNOWLEDGMENT

First, I would like to thank Allah SWT for giving me the strength, guidance, and opportunity to complete this research project. I would also like to express my sincere appreciation to my supervisor, Muhamad Noor bin Mohamed, for his guidance, support, advice, and patience throughout this study. His feedback helped me improve and complete this research. My appreciation also goes to Universiti Teknologi MARA (UiTM), the Faculty of Sports Science and Recreation, lecturers, and staff for their support and knowledge during my studies. Special thanks to all participants who gave their time and cooperation in this study. This research would not have been completed without their involvement. I would also like to thank my family and friends for their prayers, support, understanding, and motivation throughout this journey. Finally, I sincerely thank everyone who contributed directly or indirectly to the completion of this research project.

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