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ABSTRACT

Petanque is a competitive skill sport that is popular in Malaysia. Athletes often must perform in a high-pressure situation during a game. The purpose of the research is to understand the influence of the quiet eye duration on the performance outcome across different difficulties amongst the athletes. Ergoneer Dikablis (v3.55) eye-tracking system was used to collect the quiet eye duration of 8 Malaysian petanque athletes in a field setting at the National Sports Council (MSN), Keramat. The athletes were required to shoot the single ball (SB) and double ball (DB) (right ball only) across five different distances from the starting point alternately. The arrangement of a double ball is more difficult compared to a single ball. Three trials were permitted for each distance. Successful trials were recorded when the targeted ball was displaced from its original position in SB (whole ball) and in DB (ball on the right). A previous study found that athletes with higher levels of expertise and successful performance had longer QE duration. The performance outcome and the quiet eye duration were analysed for normality. The Mann-Whitney U-test and Kruskal-Wallis tests were conducted using SPSS statistical software. From the statistical findings, it was found that irrespective of distance, there is a difference in the quiet eye between a single ball and a double ball. As p=0.846, which is greater than p=0.05, there is no significant difference between distance and quiet eye for a single ball. As p=0.865, which is greater than 0.05, there is no significant difference between the distance and quiet eye for the double ball. In conclusion, the duration of the quiet eye is influenced by the difficulty level of the ball arrangement. The performance outcome was not found to be influenced by the quiet eye.

Keywords: *Eye- tracking, Quiet eye, Petanque, Malaysian*

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INTRODUCTION

Boules games are a bunch of traditional sports with the same common objective of throwing or rolling heavy balls closest to a smaller target ball often called jack (Parlindungan et al., 2019). Boules games which are popular in European countries have many derivatives or types which include Bocce, Lawn Bowl, Bocce Volo and also Petanque. In Petanque games specifically, the balls are thrown instead of rolled. The balls are hollow and made of metals such as aluminium, steel or bronze. Petanque was introduced in Malaysia in 1989. From then till date there is active participation by athletes in both local and international tournaments. The Malaysian team won 4 medals in the last Southeast Asia Games (SEA Games) held in the Philippines. Petanque can be played in three categories which are Triple (all male or female), Double (male, female and mix) and Single (male and female). In Single and Double categories, each player will play with three balls while in the Triple category each player will only play two balls. Petanque initially can be played on any terrain or playing areas but for an official National and International Championship, the minimum dimension must be 15m long and 4m wide. All marking lines are considered dead ball lines.

Petanque belongs to target sports (Ex: archery and bowling) which requires the athletes to have a high accuracy in pointing or shooting which is the primary skill used in the game (Doshi et al., 2002). Pointing is the technique used to send the ball close to the target while shooting is a technique to displace the opponent's ball away from the target to disrupt the opponents' game plan (Irawan et al., 2019). Shooting is an advanced technique that requires excellent concentration and coordination in order to execute it successfully (Chia et al., 2017). Shooting can be done by a player while standing or squatting. Meanwhile, good performance in target sports like Petanque was often related to the Quiet Eyes (QE). Quiet Eyes was defined as the final fixation of tracking gaze on a specific location or object in the visual-motor area within a 3-degree visual angle for a minimum period of 100ms in the final movement of a task (Vickers, 1992; Chia et al., 2017). QE is one of the crucial factors that differentiate successful and unsuccessful performance (D. Y. Mann et al., 2007).

The level of expertise is also highly related to the performance outcomes. Expert athletes have enhanced perceptual-motor skills which are often related to their differences in gaze-control strategies compared to novice athletes (D. T. Y. Mann et al., 2011). One study by observed that there are individual differences in QE duration within both expert and near-expert golfers in golf putting task-based results from their single-subject analysis (A.M. et al., 2002) . From the research, it is also believed that QE duration can also vary from people within the same skill level. There is also a lack of research up to this date that compares the QE duration between gender parameters. Most of the studies related to QE are more focused on expert and non-expert athletes (Causer et al., 2010; D. T. Y. Mann et al., 2011;Vickers, 2016) self-paced and reaction-based studies (Chia et al., 2017; Kishita et al., 2020) or task difficulty (Pinder et al., 2011). Previously the duration of quiet eye was measured during the performance of several sports such as volleyball, basketball, golf and skeet shooting (Vickers & Williams, 2007). A total of 220.8 ± 16.8ms of quiet eye was used by elite shotgun athletes while 255.5± 19.5ms is required by sub-elite shotgun shooters to aim at the target (Lim et al., 2018). In a sport like baseball, the batters swing their bat at a high-speed ball within a time of 0.5 seconds (Carnegie et al., 2020). The duration of quiet eye is influenced by the target. A moving target would enable only a short quiet eye compared to a target that is staying still as there is no time restriction. To the authors best knowledge there are no quiet eye studies conducted for the sport

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petanque. The purpose of the study is to investigate the influence of the difficulty of ball arrangement on quiet eye duration as well as the influence of the quiet eye duration on performance outcome.

METHODOLOGY

This is a cross-sectional study involving a total of 8 Malaysian national Petanque athletes (24.3 ± 3.2 Age, 161.5 ± 7 cm height, 65.4± 11.8 kg weight). They were three male and five female athletes involved in his study. Data collection was conducted at the national Petanque training venue in National Sports Council (MSN) Keramat. Data collection was conducted in the regular training venue to prevent influence of environmental change. The training venue is set up as in Figure 1. Five distances were marked on the ground from the starting point (6, 7, 8, 9 and 10 meter).

The athletes were first informed regarding the procedure of data collection. They then proceed to warm-up and train to shoot. The respective eye tracker is worn by the athletes. Ergoneer Dikablis (version 3.55, Egling, Germany) eye tracker system with an accuracy of 0.1 to 0.3º was used to collect data from the athletes. Three-point calibration is conducted with the Dikablis eye tracker as per the instruction manual. The athletes are then instructed to train while wearing the device for familiarization. The athlete is then required to stand in the circle and shoot a single ball (SB) that was placed in 6 meters. The position of the ball is then moved to further distances in increments of 1 meter until 10 meters. The ball is then placed again at 6 meter and the step is repeated two more times for each distance.

If the ball is completely removed or slightly moved after the impact, the attempt is considered as a success. Then the study was continued with a Double Ball (DB) shooting session. In this test, the athletes were instructed to shoot only the right ball. The distance between the both balls were measured from centre to centre and ensured to be 8.4 cm as depicted in Figure 2. The attempt is considered as successful only if the ball on the right is completely removed or slightly removed from the starting point. The attempt is considered as unsuccessful if the ball on the left is removed or the athlete has hit in between both balls. In the case where both balls move, if the right ball has moved further than left then it is considered as a successful attempt. There was no restriction imposed on the athletes during starting position to ensure they can best replicate or show their true performance in this study. Each athlete used their own ball which they also use during training and competition.

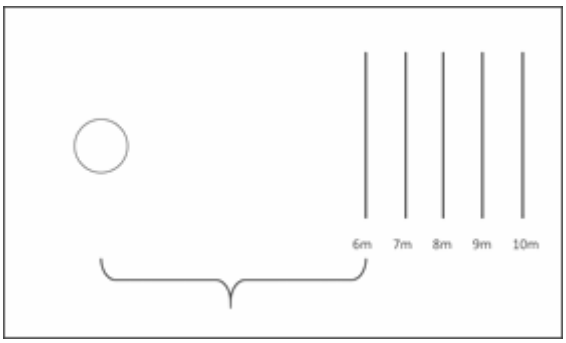

Figure 1: Study area set up.

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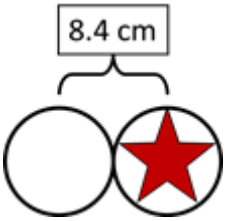

Figure 2: Double Ball trials, ball arrangement

The system records the trials video using a corneal reflection system which measures gaze (at 30 Hz) based on vertical and horizontal distances between pupil centre and corneal reflection. No additional camera was used during the study. Quiet eyes duration was measured using the D-Lab software and determined as the final fixation on target ball prior the initiation of forward arm swing in this study. The fixation time can vary with a minimum of 100ms (Vickers & Williams, 2007). Head movement or eyes deviation from the target of more than 3-degree were the cut-off point for the QE duration in this study. Out of the 360 trials (30 trials for each athlete), 10 trials (2.77%) were excluded from the study due to deviation for the target (no eye fixation) or video record problem Performance outcomes (in terms of successful or unsuccessful) of each trial were also recorded, and expressed as a ratio between successful and unsuccessful attempts by all players for each distance. Normality of the data was tested. The data was found to be not normally distributed. The data is then analysed with the Man-Whitney U test and Kruskal-Wallis test. All the statistical analysis was performed by using Statistical Package for the Social Sciences (SPSS) (version 25, IBM Corporation, Armonk NY, USA). The significance level was set at $p<0.05$.

RESULTS AND DISCUSSION

The objective of the research is to find the influence of quiet eye duration on performance. From the statistical findings, there is no significant difference between distance and quiet eye for a single ball ($p=0.846$). In addition, there is no significant difference between distance and quiet eye for double ball ($p=0.865$). Another objective of the study is to investigate the influence of difficulty on the quiet eye duration. It was found that irrespective of distance there is a difference in quiet eye between single ball and double ball. The average quiet eye duration was plotted in a bar chart for each distance for both single ball and double ball in Figure 3 and 4 respectively. No influence of the distance on the quiet eye duration was found. From Figure 3, the longest average quiet eye duration was found for the distance 8 meter. Meanwhile the longest average quiet eye duration based on Figure 4 was found to be for the distance 6 meter. The average performance value was provided in Figure 5 and Figure 6 respectively. The highest performance for single ball was for the distance of 8 meter while the highest performance for double ball was for the distance of 6 and 8 meter. Therefore, the impact of the distance on the performance outcome could not be established.

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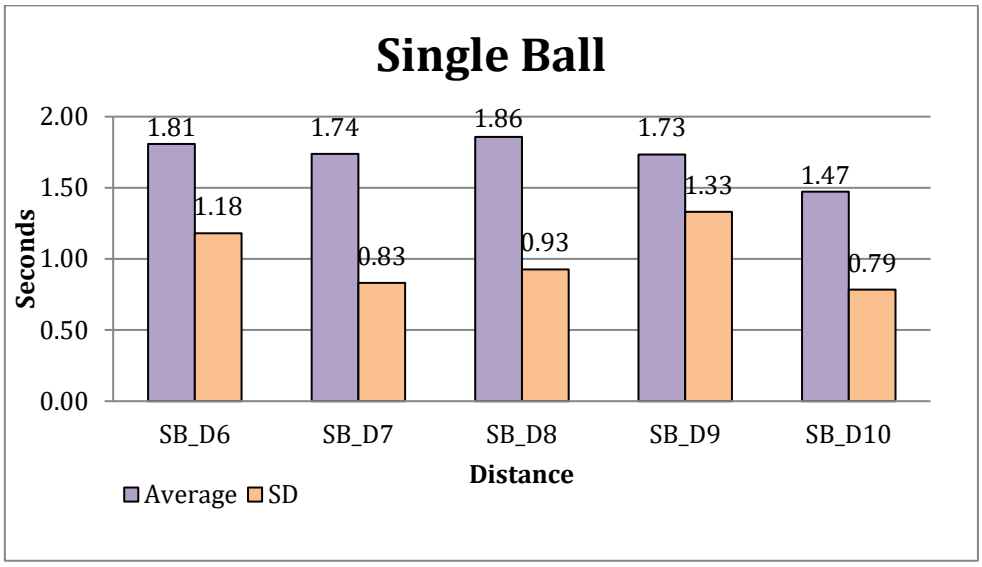

Figure 3. Average Quiet Eye duration for each distance for Single Ball

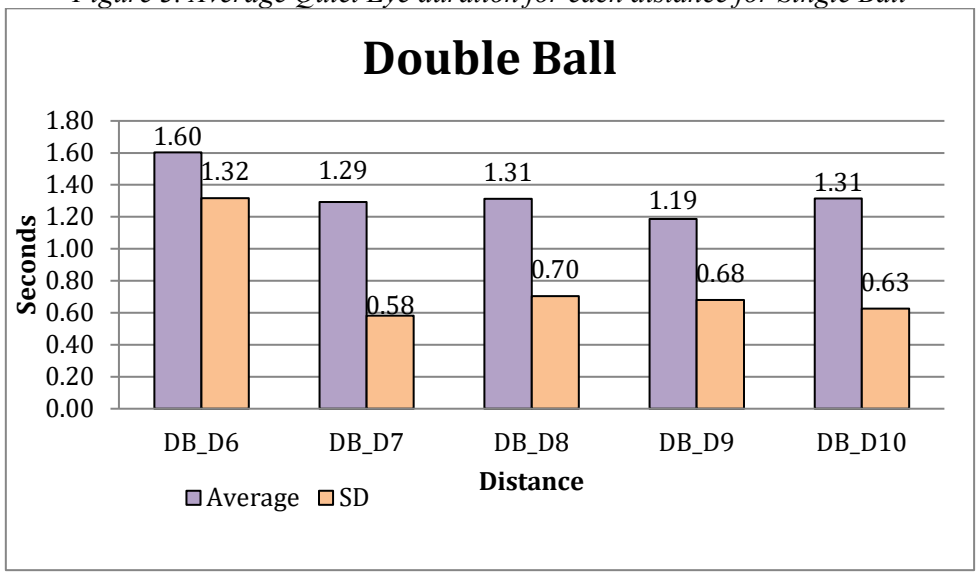

Figure 4. Average Quiet Eye duration for each distance for Double Ball

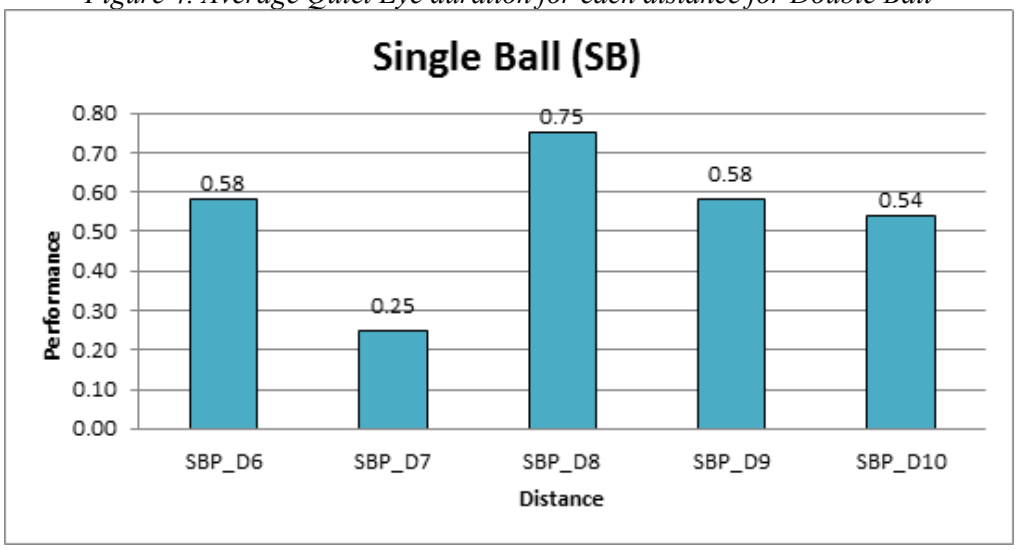

Figure 5. Average performance for each distance for Single Ball

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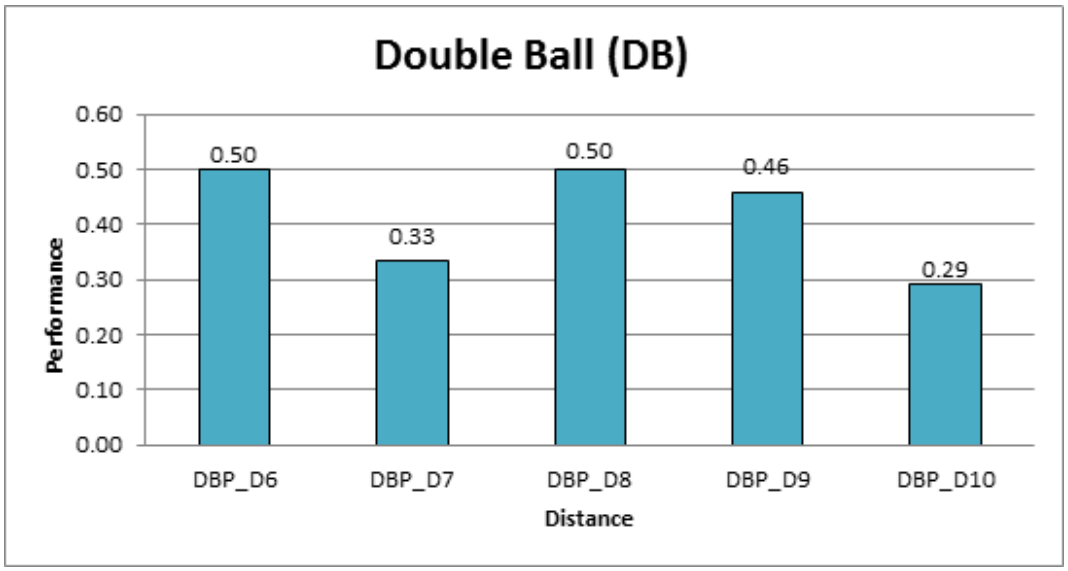

Figure 6. Average performance for each distance for Double Ball

In the current study, the quiet eye duration prior to ball release for single and double ball is 1.72±1.07 and 1.34±0.83s respectively. However, a previous study conducted in tenpin bowling revealed shorter quiet eye duration. Quiet eye duration prior to ball release was revealed to be 0.131±0.021s while quiet eye before movement initiation or push away was revealed to be 0.413±0.152s (Lim et al., 2018). As the data collection is conducted during training, there is no time restriction. During competition, there is no time limit to release a ball as well. In conclusion, the duration of quiet eye is influenced by the difficulty level of ball arrangement. The arrangement for the double ball is more difficult compared to single ball because of the constraint not to hit the wrong ball. The findings of the study are on par with one previous work that emphasized on the difficulty of movement and the performance outcome where it was found that there was a significant difference in the duration of fixation for difference in putting slope conditions (Carnegie et al., 2020). To the author's best knowledge, the athletes may have preferred distance(s) at which they perform better. The athletes may not be doing the proper throw routine when faced with a situation, distance or formation that they do not prefer.

CONCLUSION

Petanque is a sport which requires precision and control. During a game the difficulty of ball arrangements differs depending on the tactical strategies adapted by both teams. During a game of petanque, the arrangements of balls are unpredictable and the difficulty to perform successfully varies accordingly. This study concludes that difficulty of ball arrangement has an impact on the quiet eye duration. During an actual game as the difficulty increases, the athletes should be trained to utilize an appropriate quiet eye duration prior to movement execution. In the future, more studies could be conducted to further analyse the influence of other ball arrangements and its impact on the quiet eye as well as the stress induced on the athlete.

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Conflict of Interest
The authors declare that there are no conflict of interest.

Author's Contribution
The author confirms contribution to the paper as follows:
Study conception and design: Yallini Selva,
Data collection: Yallini Selva,
Analysis and interpretation of results: Yallini Selva, Amir Arifudeen and Viswanath Sundar.
Draft manuscript preparation: Yallini Selva, Viswanath Sundar and Amir Arifudeen.

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