The Relationship between Ball Speed and Shooting Accuracy during Field Hockey Hit

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Abstract. There are numerous studies conducted on fundamental skills in field hockey especially drag flick but there is lack of study did on hit or drive skill despite of there were so many beginner and amateur players that required enhancement in this crucial skill. The purpose of this study was to investigate the relationship between ball speed, accuracy, and years of involvement during field hockey hit performance among student recreational players. Fourteen male players were recruited among university students (n=14; Weight = 65.71 ± 7.85 kg, Height = 168.29 ± 3.97 cm; BMI = 23.14 ± 2.41 kg/m²). The participants were required to perform a best single hit skill to determine their ball speed through Kinovea software and the accuracy by the designated score. Then, the data has been analysed through Pearson correlation using the Statistical Package for Social Sciences (SPSS) 21. The Pearson correlation indicated that there is no significant difference for between ball speed and accuracy (r = .024, p = 936) and years of involvement and accuracy (r = .250, p = 389). However, there was a strong and positive correlation between years of involvement and ball speed (r = .672, p =.008). Findings of the current study suggest that the ball speed and accuracy can be increase both at the same time vice versa during hit skill and years of involvement in this sports can be a contributing factor in skill performance.

1. Introduction
Field hockey games are often characterized by a high density of players some areas of the pitch, which puts players under heavy temporal stress. Long propulsions are commonly used to speed up the game and pass the ball over to players in free spaces. The two most widely known hit or drives used to deliver a long distance ball are classic field hockey drives [1]. Through this prior research, they stated that experts would execute these two drives for two main objectives aiming for goal and passing to teammates many meters away which often using the short grip drive for quick actions to help counter the opponent's defense, while the classic drive is more widely used for positioned attack strategies. Thus, Brétigny et al. [1] did mention the mastery of these drives also depends on the player's field position specifically mid and forward areas.

The skills that players need to play the game can be called basic skills. They are fundamentals because a player cannot play the game to his own satisfaction unless a person achieves a reasonable level of competence over which it doesn't mean these skills are easy as they are called basic [2]. One of the essential basic skills were hitting or drive that can be used to make a pass that can cover maximum distance in a short time and scoring a field goal or through penalty corner. According to
Hussain et al. [3], this skill being execute through an impact by hockey stick that transfer kinetic energy over a range of stick head speeds with good directional accuracy. A hockey player good performance depends on the mastery and good ability of basic skills, positional play, tactics, strategy and disciplines or general behaviors especially on the field.

As a hockey player, accuracy and speed were both important for performance [4]. Accuracy has been defined as the ability to control movement in a given direction or at a given intensity. This means in other words, the execution of the skill through maintaining control and being able to react promptly. The accuracy of a projectile is usually quantified as the proportion of effective target hits, or the distance of the shot to the target [5]. Ball speed is the rate at how fast an object is moving immediately after impact from the stick head, it doesn't have a direction and higher speed means an object is moving faster meanwhile lower speed means it is moving slower. If it isn't moving at all, it has zero speed. Other than that, years of experience obviously essential for a better performance in any sport [6]. However lack of research about the correlation of this three factor to the performance in hockey skills such as hitting.

Even though, hit is one of the most complex technical skills, which is it was one of the fundamental skills which a lot players struggle to master especially for a beginner and amateur players. From past research, most of research did in field hockey being focused on drag flick skills compare to other basic skills. The field hockey hit is extremely poorly understood despite its significance for long-range passing and shooting at goal [7]. There was little detail about these drives and their application on scientific literature. Therefore, the purpose of this study was to investigate relationship between ball speed, accuracy, and years of involvement during field hockey hit performance among recreational players.

2. Methodology

2.1. Participant

Regarding to the purpose of this study to focus on the hitting skill performance among recreational hockey player, participant was strictly taken only from recreational background who already involved in this sports more than 10 months. A total 14 male hockey players weight (65.71±7.85 kg), height (168.29±3.97 cm) and BMI (23.14±2.41 kg/m²) were involved as participants in this study.

2.2. Procedure

Before the research and process of data collecting was begun, participants were briefly and clearly explained about the experimental procedure and the measurement was taken on them. Participants also were questioned toward the health status or any injury on the assessment date. On the test day, participant were given a few minutes for warming up and get a comfortable touch with the stick and the ball. They were advised not to overdo the skill before the test as the study demanding for the best single hit for both speed and accuracy. A camera with appropriate angle and distance was setup to record the execution of the skill.

For the ball speed test, participant were perform skill in steady position on a static ball. The purpose of this setup was to increase the probability and ensure the participant manage to hit the ball to the maximum level of performance. The spot was be inside the ‘D’ area, as this is the valid area to score a goal in an official match as shown in figure 1 which marked 0.5 meter from the ‘D’ line as yellow cross. After that, all the valid video during the hit skilled performed were analysed using Kinovea software to measure the speed of the ball.

For the accuracy test, participant were evaluated through score by scale labelled in figure 1 during the first single hit. The scale were consist of three scoring which is 10, 5 and 0 point. 10 point was given when participant manage to score a goal during the execution of the skill. 5 points when the ball get outside of the goal below 4.975 meters that was marked as red line in figure 1. No point was given when players missed to score and passed the red line area.
Figure 1. Ball Speed and Accuracy Test Procedure

2.3. Data and Statistical Analyses
Using Statistical Package for the Social Sciences (SPSS) version 21, Pearson correlation was used to analysed the relationship between ball speed and accuracy and relationship between years of involvement with both of ball speed and accuracy.

3. Result
Table 1 showed Mean and standard deviation participant’s anthropometry profile such as height, weight and BMI.

| Participants | Height (cm) | Weight (kg) | BMI (kg/m²) |
|--------------|-------------|-------------|-------------|
| Male         | 168 ± 3.97  | 65.71 ± 7.85| 23.14 ± 2.41|

Table 2 showed mean and standard deviation for ball speed (14.87±5.79) and accuracy (8.93±2.13). There was no significant difference (r=.024, p = .936) between ball speed and accuracy for hitting performance among recreational hockey players.

| Variables | Ball speed (m/s) | Accuracy | Correlation | Sig. |
|-----------|------------------|----------|-------------|------|
|           | 14.87 ± 5.79     | 8.93 ± 2.13 | .024        | .936 |

Table 3 showed mean and standard deviation for years of involvement (3.64±3.57 years) and ball speed (14.87±5.79 m/s). There was a strong positive correlation (r=.672, p= .008) between years of involvement and ball speed for hitting performance among recreational hockey players.

| Variables | Years of Involvement | Ball speed | Correlation | Sig. |
|-----------|----------------------|------------|-------------|------|
|           | 3.64 ± 3.57          | 14.87± 5.79| .672        | .008 |

Table 4 showed mean and standard deviation for years of involvement (3.64±3.57 years) and accuracy (8.93±2.13). There was no correlation (r=.250, p= .389) between years of involvement and accuracy for hitting performance among recreational hockey players.

| Variables | Years of Involvement | Accuracy | Correlation | Sig. |
|-----------|----------------------|----------|-------------|------|
|           | 3.64 ± 3.57          | 8.93 ± 2.13 | .250        | .389 |

4. Discussion and Conclusion
The test performed in this research was very simple which only demand for a single best hit from the participant. This is unlike a standard test that conquers more frequently for the repetition for a skill test to enhance reliability. However, the researcher well aware and reconsider of that factor based on a related reason which is the level of the participant involved in this research. This study was specifically on recreational player which majorities were very low in every aspect of physical and mental that important or a better skill performance. Ironically, recent studies have shown the negative impact of mental and muscle exhaustion on performance which success during goal-driven movements [8]. According to Newell's constraints-led approach, the efficiency of motors is determined by the interactions between the task at hand, the environment and the person involved which performance in sports resulting from the interaction of various factors [9]. Besides, team sports that are marked by intermittent high-intensity exercise bouts frequently require motor skills and cognitive functioning contributions [10]. This is be the reason why researcher only limits it to a single hit for a better result of the finding.

The primary findings of this study suggest there was no significant difference found between ball speed and accuracy after assessing the skill test by recreational players (p=0.936). This finding was in opposition to the past studies which most of them found that ball speed and accuracy in a skill involve hit or drive was associated. Look back to Belkin and Eliot [11] finding which appear to confirm the presence of speed and accuracy trade-off in skill acquisition, and indicate that demands for accuracy can hinder the development of efficient motor patterns. This research finding misinterpretation can be related to small number of participants which is only 14 players. Besides, prior studies recruited a higher level of player in field hockey but this research only involved recreational player with average of experience only 3 years. In fact, the most crucial part of the research was manually performed and the skill test conducted was not standardize with a valid test used in previous study. Other than that, the finding revealed there was a significant difference between years of involvement and ball speed (p=.008) meanwhile there is no significant between years of involvement and accuracy (p=936). This finding can be concluded that similar with Marriot et al. [12] suggestion that players of different experience levels were affected differently and Schmidt and Lee [13] who stated the competitive performance criteria skills differed across age groups on his research regarding experience. In agreement of this finding was a research did by [14] who examined the attention mechanisms regulating the efficiency of sensorimotor skills at all levels of expertise. In this research, Beilock et al. [14] conducted two experiments to compare the performance between novice and expert. They stated that in accordance with skill acquisition and automaticity theories, novice performance is improved by conditions that allow online attention monitoring compared to conditions that prohibit explicit attention control of skill execution. On the other hand, experts proceduralized skills benefit from conditions that restrict commitment to execution rather than facilitate it. In conclusion, this study proves that players from different experience may have similarity yet small divergence. Coaches are to be vies in choosing kind of approach or training in develop this group of players. Determining and emphasizing this fundamental element will help coaches and players to improve adaption while enhance performance. This finding also showed that players should remove the gap and neglect the level of performance but focus on improving essential skills.

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