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A Pilot Study on the Physical Parameters and Skill Performance Analysis among Pakistani Elite Male Field Hockey Players

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Abstract

This study aimed to analyze the physical parameters and skill performance of elite male field hockey players in Pakistan. Explore a pilot method for developing reliable physical and skill performance parameters. This study surveyed 16 elite players aged 19 to 23 years in Faisalabad Hockey Training Club in 2023. The mean ± standard deviation between groups was measured by descriptive statistics, and the reliability of the research tool was established by test-retest. Test-retest is establishing the reliability of the research tool. Intraclass correlations for all variables are between 0.886 and 0.963. This is the first study of physical parameters and skill performance analysis among elite male field hockey players in Pakistan. It was confirmed that the test procedure had high reliability and accurately reflected the performance of the participants. This will provide future researchers with a way to accurately measure. Furthermore, the methods and tests used in this study are conveniently and affordably applicable at training facilities. These conditions are necessary to enhance the performance and growth of hockey athletes, particularly in countries with low levels of economic investment.

Keywords: Field Hockey, Fitness Variables, Skills Performance, Elite Players, Reliability.

Introduction

The long-standing sport of field hockey has seen rapid and significant transformation over the past ten years. The introduction of synthetic surfaces has altered the game's tactical, technical, and physiological needs at every level, but especially at the elite level. Field hockey in Pakistan has a fantastic track record at the Asian Games, World Cup, Olympic Games, Champions Trophy, and Sultan Azlan Shah Hockey Tournament, according to the Pakistan Hockey Federation (2013). This sport's regulations add to the thrill of a highly dynamic and

demanding game. Hockey is a high-intensity team sport where players must repeatedly execute short sprints, tackles, ball strikes, accelerations, decelerations, and direction changes while playing (Elferink-Gemser et al., 2007; Lythe & Kilding, 2011).

There are various interpretations of the term "physical fitness for performance." Though it has a more precise definition, physical fitness in sports has been studied performance in previous research (American College of Sports Medicine, 2014; Deprez et al., 2015; Johnston et al., 2015; Nikolaidis, 2011; Nikolaidis, 2014; Opstoel et al., 2015). Thus, to play hockey at a high level of performance, a few essential elements are technical skills; endurance of the spine's stabilizing muscles to maintain the adopted posture during practice; efficiency of recovery between sprints; and agility to perform quick direction changes without losing speed (Lemmink et al., 2004; Keogh et al., 2003).

It has been suggested to use sport-specific evaluations to look into the technical profile and skill set of hockey players at various levels. For instance, Chapman (1982) created a test unique to their sport to evaluate ball control on an indoor gymnasium floor. However, the introduction of artificial grass-like sports surfaces affected players' skills and methods; as a result, new skill assessments that were more appropriate for contemporary hockey were required (Sunderland et al., 2006). Lemmink et al. (2004) developed sport-specific tests as a result of evaluating players' agility and dribbling skills on modern synthetic surfaces. The slalom dribbling test, which involves a standard slalom, is a valid sport-specific assessment tool for research and talent discovery. Hockey-specific tests were suggested by Keogh et al. (2003) as a means of measuring shooting accuracy and speed. Ball speed was determined by the push technique while shooting accuracy comprised push and hit shots from five distinct goal area positions. The aforementioned tests have been tested in recent research to determine the physical and specific skill parameters of elite athletes. Elferink-Gemser et al. (2004) observed variations in the activity patterns of matches between players from clubs and elite teams. According to Keogh et al. (2003), elite female collegiate players had noticeably better percentages of precise shots in comparison to club players.

In comparison to sub-elite players, elite players exhibit superior dribbling performances (Elferink-Gemser et al., 2004) and lower-body power (Sharma & Kailashiya, 2018). Indeed, several studies have examined the anthropometric, physiological, and sport-specific traits of athletes participating in various national championships (Wassmer & Mookerjee, 2002; Elferink-Gemser et al., 2004; Manna et al., 2009; Sharma et al., 2012). The examination of the physical and skill-related characteristics of Pakistani male hockey players at the elite level has not been the subject of any research yet.

Accordingly, particular data regarding these factors are essential and could support the monitoring, prescription, and enhancement of hockey players' physical performance (Singh et al., 2010). Research has been conducted regarding the relationships between physical fitness and specific ability tests in several sports, such as handball (Alvares et al., 2014), volleyball (Cabral et al., 2016), basketball (Gomes et al., 2015), and soccer (Silva et al., 2015). In this regard, Koley et al. (2012), Singh et al. (2010), and Keogh et al. (2003) also aimed to measure hockey players' performance. The physical and particular skill performance parameters of hockey players employing low-cost procedures, however, remain unproven.

It is therefore imperative to confirm the hockey players' physical and skill performance indices and to ascertain whether these variables are associated with any particular performance task. To better understand the physical performance parameters (agility, speed, endurance, flexibility) and skills assessments (shooting accuracy, dribbling) of elite male hockey athletes, the current study looked into these areas.

Methodology

Subjects

The Ethics Committee from Govt College University Lahore Human Research of Punjab Province approved the measurement scheme of this study. The ethical license number is GCU-IIB-2186. The data was collected with the assistance of coaches from a field hockey training club in the Faisalabad region. Before the data collection, subjects volunteered, and their parents submitted written informed consent. Volunteers for this study were recruited from the clubs of registered athletes. In the Faisalabad training club, 16 were randomly selected as research objects. Players were randomly assigned to the experimental group (n = 8) and the control group (n = 8). The subjects (19–23 years) of this study were young athletes who had participated in regular hockey training for at least three years. The study excluded participants who utilized alimentary supplementation and attended fewer than two sessions per week. Two weeks later, the measurements were repeated to check their reliability.

Anthropometric Measurements

The basic measuring instruments of the human body measure the height and weight of athletes. Before the measures, players were told to void their bladders and abstain from food for four hours. Body mass, body fat percentage (BF%), and fat-free mass were measured with a manual tape measure and multiple-frequency bioelectrical impedance equipment (Tanita MC-780 MA, Seoul, South Korea). Weight measurement ranged from 8 to 200kg with an index value of 0.1kg, while height measurement ranged from 60 to 200cm with an index value of 0.5cm. Participants were asked to remove their shoes and lean their hips, shoulders, and heads against the device. Participants were asked to bow their heads and stretch their spines to measure their height and weight. The anthropometric characteristics of the participants are shown in Table 1.

Table 1
Participant Characteristics

	Age (years)	**Weight (kg)**	**Height (cm)**	**BMI**
Experimental group (Mean ± SD)	20.500 ±1.772	68.000 ±3.545	175.125 ±3.270	22.187 ±1.399
Control group (Mean ± SD)	20.875 ±0.834	67.250±5.946	175.250 ±3.822	21.900 ±1.200

Procedure and Measurements of other variables

Physical Performance Parameters

The following tests were administered to the athletes using a randomized design to analyze physical performance parameters: a) agility (Illinois agility test; T-test); b) speed (30-meter sprint test); c) endurance (push-ups); and d) flexibility (sit and reach test). When evaluating the subjects' athletic performance, test batteries were used. The athletic performance test batteries were retested after two weeks. A record was kept of the three best attempts. Following Gelen's (2010) suggestions, a dynamic warm-up technique was used to prepare the subjects before the measurements.

Skills Performance Parameters

Specific skills performance was evaluated in the following tests: a) the shooting accuracy test (SAT); and b) the slalom dribble test (SDT). Each test was followed by ten minutes of passive recovery.

Shooting accuracy: The goal area was chosen for this test. Eight shots were available to each participant, all from the predetermined five places facing the goal: four hits from positions 1 to 4, two pushes from positions 2 and 3, and two flicks from position 5. Each successful shot received 1 point, while missed shots received 0, for a total of 0 to 8 points. The participants were not required to have any speed or strength (Keogh et al. 2003). A hockey ball is placed at five different locations in the goal-scoring area (also referred to as "D") to assess shooting accuracy. Four hits (Shots 1-4), two pushes (Shots 5–6), and two flicks (Shots 7–8) are performed by the players (Figure 1, a and b).

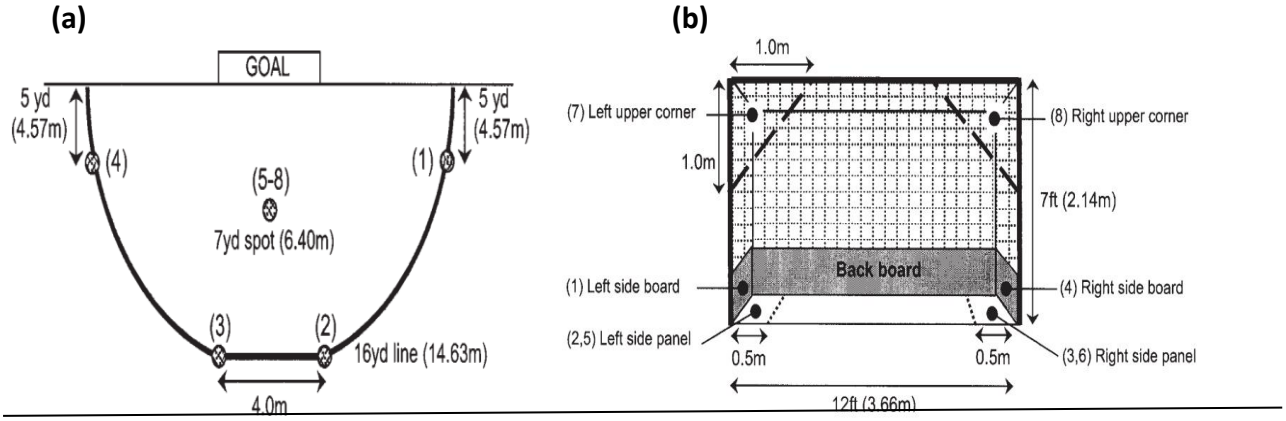

Figure 1: (a) The shooting accuracy test's top-view schematic. The locations of the shots are shown by the four circles. All eight shots are indicated by the numbers in parentheses. Shots 1-6 are pushes; shots 7-8 are flicks; and shots 1-4 are hits. (b) The goal's frontal view was used to measure shooting accuracy. The target zone for each shot is indicated by numbers in parentheses.

Dribbling: Since the slalom dribble test assesses change-of-direction speed ball control (i.e., executing the test with a ball), it was utilized as the standard for evaluating construct validity. As seen in Figure 2, players must sprint or dribble forward around twelve cones in a zigzag pattern to complete the slalom dribble test (Lemmink, et al., 2004). The clock began at point A and stopped at point B after the players finished. An observer kept track of time with a stopwatch. Two trials in each condition were required of the participants, and the fastest time was recorded.

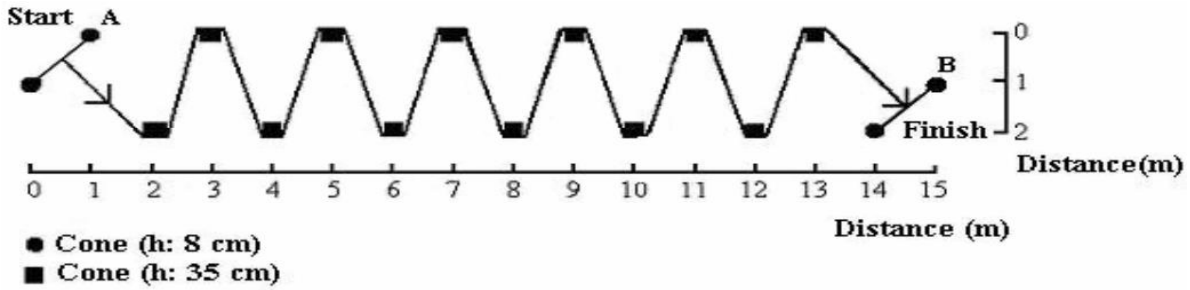

Figure 2: Slalom Dribble Test Strategy (Lemmink et al., 2004).

Data Analysis

SPSS version 25.0 for Windows (SPSS Inc., IBM, Armonk, NY, United States) was used to conduct the statistical analysis. Data were checked for normal distribution (Shapiro-Wilk Test) and independent T-tests before data processing. This study employed test-retest reliability,

which is well-known among social science researchers. The higher the coefficient, the higher the reliability. In exploratory analysis, if 0.70 to 0.98 is acceptable, less than 0.35 must be rejected (Bolarinwa, 2015).

Results

Normal Distribution and Variance

Homogeneity

The homogeneity of groups for demographic characteristics and performance parameters, which were normally distributed in both groups, was assessed using independent T-tests before data analysis. The results showed that the experimental group (EG) and control group (CG) were not significantly different in age [t(16) = -0.541, p = 0.597], height [t(16) = -0.070, p = 0.945], weight [t(16) = 0.510, p = 0.618], and BMI [t(16) = 0.441, p = 0.666]. Regarding variance homogeneity, physical performance parameters: Illinois agility test: [t(16) = -2.605, p=0.986]; T agility test: [t(16) = 0.334, p=0.7431]; 30m sprint: [t(16) = -0.914, p = 0.376]; push-ups: [t(16) = 1.401, p = 0.182]; and sit and reach test: [t(16) = 3.800, p = 0.257] were homogenous in variance. And skills performance parameters: shooting accuracy test: [t(16) = 0.599, p = 0.559]; slalom dribble test: [t(16) = -0.257, p = 0.787], indicating that the variances of variables were not different.

Reliability of Instruments

The confidence interval technique and the intraclass correlation coefficient for each test were added. According to the analysis of the results, a correlation was found between selected variables of physical performance: the Illinois agility test (ICC = 0.787–0.970), the T agility test (ICC = 0.902–0.962), 30m speed (ICC = 0.646–0.962), endurance (ICC = 0.896–0.985), and flexibility (ICC = 0.930-0.991). The selected variables for skills also found a high correlation between shooting accuracy (ICC = 0.681–961) and dribbling (ICC = 0.763–0.972).

Discussion

The purpose of the study was to analyze the physical performance and specific skill performance parameters among Pakistani elite male field hockey players. The following are discussion of the findings.

Physical Performance Parameters

There are four variables used to define physical performance: agility, speed, endurance, and flexibility. In this study, the researcher evaluated the physical performance of Pakistani elite young athletes. How to evaluate accurately and effectively physical performance, the author refers to literature. It can be proven in the literature that this study also supports the content of the existing research on physical performances. While several studies have evaluated some of the physical performance qualities of hockey athletes, no comprehensive study has tested all of these variables on field hockey players of varied levels. In our study, the ICC across the trials was 0.89 (95% CI, 0.65–0.96) in 30 m. Nigro, Bartolomei, and Merni (2016) report that among male hockey players, the 30-meter sprint test measurement also has a high-reliability value (r = 0.94 to 0.98). In agility tests, the ICC across the trials was in IAT: 0.91 (95% CI, 0.78–0.97) and TAT: 0.93 (95% CI, 0.90–0.96). These findings are consistent with most previous studies on other team sports reported in agility tests (Raya et al., 2013; Hachana et al., 2013; Haj-Sassi et al., 2011; Pauole et al., 2000). The endurance test's ICC for the two trials was 0.94 (95% CI: 0.79–0.98) in PU. This number was within the range of relative reliability value indices

that have been reported for endurance testing (Fawcett & DeBeliso, 2014; Hashim et al., 2018). In the flexibility test, the ICC across the trials was SAR: 0.96 (95% CI, 0.93–0.99). When compared to our findings, Gabbe et al. (2004) showed similar sit-and-reach intra-rater reliability, ICC 0.97–0.98. According to the study of Waldhelm and Li (2012), the traditional sit-and-reach test had the highest reliability (0.98), whereas the flexibility tests demonstrated moderate to very high reliability (0.62–0.98).

These assessments observed four different components that contribute to physical performance. Among the groups, the flexibility test revealed the most accurate measurements, with endurance tests the second most reliable, followed by agility and speed assessments. The main findings of this study demonstrated that the physical fitness parameters are reliable in elite male field hockey players.

Skill Performance Parameters

Two variables were defined for skill performance: shooting accuracy and dribbling. In this study, the researcher evaluated the skill performance of Pakistani elite young field hockey players. How to evaluate accurately and effectively skills performance, the author refers to a large number of literature. It can be proven in the literature that this study also supports the content of existing research on skill performance. Whereas a few studies have evaluated hockey players' skill-related traits, no comprehensive research has examined these variables in players of varying standards.

This study used a reasonably simple test that required the subjects to deliver their best hit. This contrasts with a standard test, which conquers more frequently for the repeat of a skill test to improve consistency. The shooting accuracy test, according to Keogh et al. (2003), was created to evaluate shooting accuracy from multiple locations, utilizing techniques regularly used in professional hockey to score goals. The average shot accuracy rate for hockey players was 37.5%, which was less than the 74.8% accuracy rate for county players reported by Reilly and Bretherton in 1986. Nevertheless, hockey players can benefit greatly from the shooting accuracy test used in this study.

The measurement's reliability is evidenced by considerably faster dribble timings from groups with higher playing levels (Thomas et al., 2015), as this measure has a comparable level of group discrimination to the concept of hockey-specific dribbling. Additionally, the ICC results show significant reliability for the slalom dribble (ICC; 0.91) results to be utilized in further testing. These findings are consistent with previous studies on field hockey players that reported high reliability (ICC = 0.98; 0.98) (Lemmink et al., 2004). According to the recent study by Tapsell et al. (2022), the other dribbling test-retest reliability analysis is 0.88 among national field hockey. To assess the fitness of female hockey players, Reilly and Bretherton (1986) created two field-based skill tests: the "T"-dribbling test and the dribbling and accuracy test. Anaerobic power (r = 0.6; stair run test) and aerobic fitness (r = 0.48; estimated V^O2max and physical functioning ability) were shown to be associated with the T-dribbling test. The accuracy was correlated with ectomorphy (r = -0.63). The skill tests include useful field testing; however, the "T"-dribbling test is limited because it does not allow players to use reverse sticks, which is a necessary component of the game and thus is not a good way to assess hockey proficiency in and of itself. However, hockey players can greatly benefit from the slalom dribble test used in this study.

Conclusions

This is the first study of physical and skill performance parameters among elite male field hockey players in Pakistan. The study's objective was to provide and evaluate the reliability of physical and skill-related measurements that examined different components of performance. Through combining the literature, the test method is accurate and reliable and can truly reflect the physical parameters and skills performance level of elite field hockey players. Overall, sit and reach, push-ups and slalom dribble tests were the most reliable measurements, respectively. Furthermore, the methods and assessments used in this study are simply and affordably applicable at training facilities. These requirements are crucial for enhancing the growth and performance of hockey players, particularly in nations with low levels of financial investment.

Limitations

This research had a few limitations. Each group's sample size (n = 8) was small, which might have limited the external confirmation of our results. Nonetheless, hockey is a national team sport in Pakistan, and the male athletes assessed in this study have frequently competed at high levels at the national level. Pakistan has a very large population, and it is difficult to select samples from young people in many cities. However, the samples in this paper are all young male field hockey players with a three-year training background whose physical fitness and skill level are comparable and can represent the level of young athletes in Pakistani national field hockey training clubs.

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