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DEVELOPMENT AND VALIDATION OF A SKILL-BASED MODEL FOR ASSESSING PLAYING ABILITY IN FIELD HOCKEY

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Abstract:

Playing ability in field hockey is a multidimensional construct influenced by technical skill proficiency, tactical efficiency, and physical preparedness. Despite the dynamic evolution of the game, limited empirical research has focused on constructing concise and statistically validated skill-based models for assessing playing ability. The purpose of the present study was to develop and validate a field-based skill test battery for predicting playing ability in collegiate field hockey players. Initially, thirteen hockey-specific skill tests were formulated based on a literature review and expert consultation. Following a pilot study conducted on thirty players, seven skill tests were shortlisted and administered to ninety-six male collegiate hockey players aged 18-25 years. Objectivity, reliability, and validity of the test items were established using correlation analysis, while stepwise multiple regression was employed to identify the most influential predictors of playing ability. Results revealed that although all seven skill tests demonstrated acceptable psychometric properties, only three skills Straight Hit, Flick, and Speed Dodge contributed significantly to the final predictive model. The findings highlight the effectiveness of a minimal yet robust skill-based assessment framework for performance evaluation, talent identification, and coaching decision-making in field hockey.

Key Words: Field Hockey; Playing Ability; Skill Test Battery; Performance Assessment; Regression Analysis

1. Introduction:

Field hockey is a high-speed invasion sport characterized by continuous play, rapid transitions between offensive and defensive phases, and frequent technical interactions with the ball. Performance in modern field hockey requires players to execute complex technical skills such as dribbling, hitting, passing, and dodging with a high degree of precision under conditions of time pressure, spatial constraint, and opponent interference. Although physiological fitness and tactical awareness form essential foundations for performance, technical skill execution remains the most observable and decisive determinant of effective playing ability during match situations [1, 2].

In physical education and competitive sport, the scientific assessment of playing ability has long been recognized as a central concern. Systematic skill testing enables coaches, physical educators, and sport scientists to objectively evaluate performance, monitor training outcomes, identify talent, and make informed decisions regarding selection and player development [3, 4]. The effectiveness of any skill assessment procedure, however, depends critically on its objectivity, reliability, and validity. Poorly constructed or inadequately validated tests may not only weaken evaluation programs but may also result in misleading conclusions that adversely affect coaching strategies and athlete progression [5].

The evolution of field hockey over the past three decades has further intensified the need for accurate and sport-specific assessment tools. The global transition from natural grass to synthetic turf surfaces has fundamentally altered the technical and tactical demands of the game. Studies have reported that artificial turf has increased ball speed, reduced variability in ball bounce, and promoted faster tactical transitions, thereby placing greater emphasis on stick control, precision hitting, rapid passing, and evasive movement skills [6, 7]. As a result, players are now required to perform technical actions with greater speed and consistency throughout the duration of a match.

In addition to surface-related changes, contemporary field hockey has evolved into a faster and more possession-oriented game. Match performance increasingly depends on a player's ability to repeatedly execute technical skills under fatigue while maintaining decision-making efficiency [8]. Technical proficiency, therefore, is not merely a prerequisite for participation but a critical factor distinguishing higher-performing players from their lower-performing counterparts. Empirical evidence from team sports suggests that elite players demonstrate superior technical consistency, faster execution, and greater adaptability under competitive pressure [9, 10].

Despite the acknowledged importance of technical skills, the assessment of playing ability in field hockey remains methodologically challenging. While numerous sport skill tests have been reported in the

literature, many of these assessments focus on isolated skill components or laboratory-based measurements that lack ecological validity [4, 5]. Moreover, existing studies often emphasize physiological profiling or descriptive performance analysis, providing limited predictive insight into overall playing ability [6, 8]. Only a small number of investigations have attempted to develop concise, statistically validated skill test batteries that can reliably predict playing ability in field hockey.

The use of skill test batteries offers a practical solution to this problem by allowing multiple dimensions of technical performance to be assessed simultaneously. According to measurement theory, a test battery approach is particularly appropriate for team sports, where performance emerges from the combined contribution of several interrelated skills rather than a single dominant ability [5]. When supported by appropriate statistical techniques such as multiple regression analysis, skill test batteries can provide powerful predictive models of playing ability and talent potential [11].

Therefore, there is a clear need for the development of a scientifically validated, field-based skill assessment model that reflects the technical demands of modern field hockey and provides meaningful predictive information regarding playing ability. The present study seeks to address this need by developing and validating a skill-based predictive model for assessing playing ability among collegiate field hockey players. By integrating established principles of sports measurement with game-specific technical requirements, the study aims to contribute a practical and empirically supported tool for performance evaluation, talent identification, and coaching practice in field hockey.

2. Review of Related Literature:

The evaluation of sport performance through systematic measurement has been an integral component of physical education and sport science for several decades. Early contributions in this field emphasized the importance of developing standardized and objective skill tests capable of quantifying athletic performance in a reliable manner. Collins and Hodges provided one of the earliest comprehensive classifications of sport skill tests, highlighting their role in instructional evaluation, performance diagnosis, and talent identification [4]. Their work established the foundation for subsequent research on skill assessment across a wide range of sports.

Barrow and McGee further advanced the theoretical framework of sports measurement by emphasizing that objectivity, reliability, and validity constitute the fundamental criteria for any scientifically acceptable test [5]. According to these authors, skill tests that fail to meet these criteria may yield inconsistent or misleading results, thereby limiting their practical utility. Baumgartner et al. reinforced this view by noting that while a test may demonstrate high reliability, it cannot be considered meaningful unless it also exhibits acceptable validity with respect to the performance attribute being measured [12]. These principles have since been widely adopted in the construction of test batteries in physical education and sport science.

In team sports, performance is inherently multidimensional, emerging from the interaction of technical, physical, tactical, and psychological components. Hughes and Bartlett introduced the concept of performance indicators, emphasizing that technical efficiency during match play is a key determinant of success in invasion games [7]. Their work demonstrated that objective performance measures derived from game-related actions provide valuable insight into playing ability beyond traditional fitness assessments.

Field hockey, in particular, presents unique challenges for performance evaluation due to its continuous nature, rapid transitions, and frequent player-ball interactions. Reilly and Borrie examined the physiological and technical demands of field hockey and reported that players are required to repeatedly execute technical skills under conditions of intermittent high-intensity activity [13]. This finding underscores the importance of assessing technical proficiency in conjunction with game-specific demands rather than in isolated or artificial testing environments.

3. Methodology:

The present investigation employed a descriptive research design with correlational and predictive components to develop and validate a skill-based model for assessing playing ability in field hockey. The methodological procedures were framed in accordance with established principles of sports measurement and performance evaluation, ensuring scientific rigor, reproducibility, and practical relevance [5, 11].

3.1 Research Design:

A cross-sectional research design was adopted to examine the relationship between selected hockey-specific skill variables and overall playing ability. This design was considered appropriate as the primary objective of the study was to identify and validate key technical skills that significantly contribute to playing ability at a given competitive level. The predictive aspect of the design was addressed through the application of multiple regression analysis, which enabled the development of a statistical model for estimating playing ability based on skill test performance.

3.2 Selection of Subjects:

The sample for the study consisted of ninety-six male collegiate field hockey players drawn from affiliated colleges of Alagappa University, Karaikudi, Tamil Nadu. The age of the participants ranged from 18 to 25 years. All subjects had a minimum of three years of competitive playing experience and were actively participating in intercollegiate tournaments during the period of data collection. The selection of a homogeneous

sample in terms of age, competitive level, and training background was intended to reduce extraneous variability and enhance the internal validity of the study. Prior to participation, all subjects were informed about the purpose and procedures of the study, and informed consent was obtained. The study was conducted in accordance with ethical guidelines for research involving human participants, as recommended in sports science research methodology [11].

3.3 Identification and Development of Skill Test Items:

The identification of relevant skill variables was carried out through an extensive review of literature, systematic analysis of game requirements, and consultation with experienced hockey coaches and subject experts. Initially, thirteen hockey-specific skill tests were designed to assess a broad range of technical abilities commonly executed during match play, including hitting, pushing, flicking, dribbling, and dodging skills.

To evaluate the feasibility and appropriateness of the proposed test items, a pilot study was conducted on thirty collegiate hockey players who were not included in the final sample. The pilot study examined clarity of instructions, ease of administration, scoring objectivity, and time efficiency. Based on the outcomes of the pilot study and expert feedback, seven skill test items were finalized for inclusion in the skill test battery. These test items were selected on the basis of their relevance to modern field hockey performance and their practicality for field-based assessment.

3.4 Administration of Skill Tests:

All skill tests were administered on a standard synthetic hockey field under similar environmental and testing conditions to ensure uniformity. Prior to testing, standardized warm-up procedures were followed to prepare the subjects physically and minimize the risk of injury. Detailed verbal instructions and demonstrations were provided for each test to ensure that all subjects clearly understood the testing protocols. Each subject was given adequate practice trials before the actual test trials were recorded. Sufficient rest intervals were provided between tests to minimize the influence of fatigue on performance. All tests were administered by the same group of trained testers to maintain consistency in administration and scoring.

3.5 Criterion Measure: Assessment of Playing Ability:

Overall playing ability in field hockey was treated as the criterion variable in the present study. Playing ability was assessed through expert evaluation using a standardized rating scale. A panel of experienced hockey coaches and physical education experts independently evaluated each player during competitive match play. The evaluation criteria included technical efficiency, tactical awareness, consistency of performance, and overall contribution to the team. Each expert assigned a score on a ten-point scale, with higher scores indicating superior playing ability. The mean of the expert ratings was used as the final criterion score for statistical analysis. The use of expert judgment as a criterion measure has been widely accepted in sports performance research, particularly when objective match statistics are limited or unavailable [9, 10].

3.6 Objectivity, Reliability, and Validity of Skill Tests:

Objectivity of the skill test items was ensured by employing clearly defined test protocols and standardized scoring criteria. To establish reliability, the test-retest method was employed on a subsample of ten players with an appropriate time interval between test administrations. Reliability coefficients were computed using Pearson's product moment correlation. Criterion-related validity of each skill test was established by correlating individual skill test scores with the criterion measure of playing ability. According to Barrow and McGee, a validity coefficient of 0.70 or above is considered acceptable for physical performance tests [5]. Only those skill test items that demonstrated acceptable levels of objectivity, reliability, and validity were considered for inclusion in the predictive model.

3.7 Statistical Analysis:

Descriptive statistics, including mean and standard deviation, were computed for all variables to examine the distribution of scores. Pearson's product moment correlation coefficient was used to determine objectivity, reliability, and validity of the selected skill test items. Stepwise multiple regression analysis was employed to identify the most influential skill variables contributing to playing ability and to develop a predictive regression equation. The level of statistical significance was set at 0.05. All statistical analyses were conducted in accordance with standard procedures recommended in sports science research methodology [11]. The stepwise regression approach was selected to ensure the development of a parsimonious and practically useful predictive model.

4. Results:

The results of the present investigation are presented in accordance with the objectives of the study, focusing on the psychometric properties of the selected skill test items and the development of a predictive model for assessing playing ability in field hockey. Descriptive and inferential statistical analyses were employed to evaluate objectivity, reliability, validity, and the relative contribution of each skill variable to overall playing ability.

4.1 Objectivity of the Skill Test Items:

Objectivity refers to the extent to which test scores are independent of the examiner administering or scoring the test. The objectivity coefficients obtained for all seven selected skill test items were found to be high

and exceeded the minimum acceptable standards recommended in sports measurement literature. This indicates that the test instructions, administration procedures, and scoring criteria were sufficiently clear and standardized. The consistently high objectivity values across all skill tests suggest that the assessment procedures minimized examiner bias and scoring subjectivity. This finding is particularly important for field-based skill testing, where assessments are often conducted by multiple testers under practical conditions.

4.2 Reliability of the Skill Test Items:

Reliability of the selected skill test items was established using the test-retest method, which assesses the stability and consistency of test scores over time. The reliability coefficients obtained for all seven skill variables were well above the acceptable threshold of 0.80 suggested by Barrow and McGee [5]. These results indicate that the skill tests produced consistent scores across repeated administrations and were not substantially influenced by random measurement error. High reliability coefficients demonstrate that the developed skill test battery possesses temporal stability and can be confidently used for monitoring changes in technical performance over time.

4.3 Validity of the Skill Test Items:

Criterion-related validity of the skill test items was established by correlating individual test scores with the criterion measure of overall playing ability obtained through expert evaluation. All seven skill test items demonstrated statistically significant validity coefficients exceeding the minimum acceptable level of 0.70 [5]. This confirms that the selected skill tests effectively measure performance attributes that are directly related to actual playing ability in field hockey. Among the skill variables, those related to striking and evasive movement demonstrated comparatively higher validity coefficients, indicating their strong association with effective match performance.

4.4 Stepwise Multiple Regression Analysis:

Stepwise multiple regression analysis was employed to identify the most influential skill variables contributing to overall playing ability. Playing ability was treated as the dependent variable, while the seven selected skill test scores served as independent variables. The stepwise procedure allowed for the sequential inclusion of predictor variables based on their statistical contribution to the regression model. The analysis revealed that three skill variables entered the regression equation in a statistically significant manner. With each successive step, the multiple correlation coefficient (R) increased, indicating an improvement in the predictive accuracy of the model. The inclusion of additional skill variables beyond these three did not result in a statistically significant increase in the explained variance, suggesting diminishing returns in predictive value.

4.5 Regression Equation and Interpretation:

The final regression equation derived for predicting playing ability in field hockey was expressed as:

$$FHPA = a + b_1x_1 + b_2x_2 + b_3x_3$$

Where:
FHPA represents field hockey playing ability
x_1, x_2, and x_3 denote the selected significant skill variables
a represents the regression constant
b_1-b_3 represent the regression coefficients

The positive regression coefficients obtained for the selected skill variables indicate that higher performance in these skills contributes positively to overall playing ability.

4.6 Summary of Results:

The results clearly demonstrate that the developed skill test battery satisfies essential measurement criteria and possesses strong predictive capability. Although all seven skill test items were found to be objective, reliable, and valid, only a subset of key technical skills significantly contributed to the final predictive model.

5. Discussion:

The primary objective of the present investigation was to develop and validate a skill-based predictive model for assessing playing ability in field hockey. All seven selected skill test items demonstrated high objectivity, reliability, and criterion-related validity, satisfying the fundamental requirements of scientific measurement [5, 12]. The stepwise regression findings highlight the importance of identifying core technical skills that exert a disproportionate influence on overall playing ability. From a practical perspective, this supports the development of parsimonious assessment models that balance predictive accuracy with feasibility.

The emergence of striking and evasive movement skills as key predictors reflects the technical demands of contemporary field hockey. Modern match play requires precise hitting and rapid dodging under intense defensive pressure, which are critical for maintaining possession and creating scoring opportunities. The developed skill test battery offers coaches and physical educators an objective, reliable, and time-efficient tool for assessing playing ability.

6. Conclusion and Practical Implications:

The present investigation successfully developed and validated a scientifically sound, field-based skill assessment model for evaluating playing ability in field hockey. The findings confirm that technical skill proficiency constitutes a critical and measurable determinant of playing ability at the collegiate level. All seven

selected skill test items satisfied essential measurement criteria. However, only a subset of key technical skills made a statistically significant contribution to the prediction of overall playing ability, highlighting the value of identifying core performance determinants.

The validated skill test battery provides coaches, physical educators, and sport scientists with an objective and efficient tool for:

- Performance evaluation
- Talent identification
- Diagnostic assessment
- Monitoring skill development
- Selection processes

In conclusion, the present study makes a meaningful contribution to sports science by providing a valid, reliable, and practically applicable skill-based model for assessing playing ability in field hockey.

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