OPEN ACCESS

Saudi Journal of Humanities and Social Sciences

Abbreviated Key Title: Saudi J Humanities Soc Sci
ISSN 2415-6256 (Print) | ISSN 2415-6248 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com

Original Research Article

An Ability Referenced Comparison of Speed, Agility, and Leg Explosive Strength in Female Kho-Kho Players

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DOI: https://doi.org/10.36348/sjhss.2026.v11i09.009 | **Received:** 20.07.2026 | **Accepted:** 14.09.2026 | **Published:** 16.09.2026

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Abstract

Background. Kho-Kho is a high intensity, intermittent pursuit sport in which explosive acceleration, rapid change of direction, and lower limb power are widely assumed to underpin competitive success. Whether these generic attributes actually discriminate between ability strata within an already selected squad remains empirically unresolved, and female players at the state tier are largely absent from the peer reviewed record. ***Purpose.*** To compare speed, agility, and leg explosive strength among high, medium, and low ability state level female Kho-Kho players. ***Methods.*** Sixty-seven female state level players (18–23 years) were purposively sampled from Purba Medinipur, North 24 Parganas, South Kolkata, and Hooghly districts, West Bengal, and classified into three ability groups. Speed was assessed by the 50-yard dash, agility by the 4 × 10 yard shuttle run, and leg explosive strength by the standing broad jump. Data were analysed by descriptive statistics and one way ANOVA ($\alpha = 0.05$) using IBM SPSS Statistics 26. ***Results.*** No significant differences emerged for speed, $F(2, 64) = 1.06$, $p = 0.352$, $\eta^2 = 0.03$; agility, $F(2, 64) = 0.197$, $p = 0.822$; or leg explosive strength, $F(2, 64) = 0.744$, $p = 0.479$. Descriptively the high ability group was fastest (8.01 ± 0.552 s), jumped furthest (1.84 ± 0.165 m), and showed markedly lower variability. ***Conclusion.*** These components function as a performance threshold rather than a discriminator at state level; selection should additionally assess reactive agility, technical skill, and tactical decision making.

Keywords: Kho Kho, physical fitness, speed, agility, explosive leg strength, female athletes.

INTRODUCTION

Kho Kho, one of India's oldest indigenous pursuit sports, has evolved from a village recreation into a codified, internationally contested discipline whose demands read like a laboratory checklist of anaerobic performance: explosive starts, repeated sub second decelerations, low body "proximity" dives, and near continuous change of direction within a 27 x 16 m rectangle. It is a sport that is won in fractions of a second, and it is precisely this temporal economy that makes speed, agility, and leg explosive strength the currency of competitive success. Contemporary evidence confirms that Kho-Kho is a high intensity, intermittent activity characterised by rapid directional changes, relay-based movement patterns, and sustained postural demand, requiring well developed agility, balance, and functional movement capacity (Kumar *et al.,* 2026). Yet, despite its cultural centrality and recent inclusion in multi-sport programmes, the sport remains comparatively under researched in the sports science literature relative to its global counterparts (Mahapatra *et al.,*2023).

Physical fitness is not a monolith; it is a constellation of relatively independent motor abilities that combine differently in every sport. Sheppard and Young (2006) reframed agility as a whole-body change of direction executed in response to a stimulus, distinguishing it decisively from pre-planned change of direction speed a distinction later reinforced empirically by Young, Dawson, and Henry (2015), who demonstrated that agility and change of direction speed are statistically independent skills. Brughelli, Cronin, Levin, and Chaouachi (2008) further showed that change of direction ability is governed by a mosaic of strength, technique, anthropometric and neural determinants rather than by sprint speed alone. Consistent with this, Little and Williams (2005) reported that acceleration, maximum speed, and agility are specific, only modestly related qualities in professional footballers, while Salaj

and Markovic (2011) found jumping, sprinting, and quick change of direction to represent largely distinct motor abilities. Nimphius, Callaghan, Bezodis, and Lockie (2018) have since cautioned that conventional field tests may conflate these constructs, urging careful interpretation of composite time-based scores an admonition directly relevant to the shuttle run and dash protocols employed in Kho-Kho research.

Lower limb explosive strength occupies a similarly pivotal position. Cronin and Hansen (2005) identified power based lower body qualities as meaningful predictors of sprint performance in team sport athletes, and Cormie, McGuigan, and Newton (2011) mapped the neuromuscular determinants through which maximal power expresses itself in athletic tasks. Meta analytic evidence indicates that plyometric loading meaningfully enhances both vertical jump capability (Markovic, 2007) and sprint performance (Saez Saez de Villarreal, Requena, & Cronin, 2012), while Vescovi and McGuigan (2008) documented the relationships and the limits of those relationships between sprinting, agility, and jumping in female athletes specifically. The standing broad jump has therefore endured as a pragmatic, low-cost field surrogate for lower limb power, with population referenced norms established for youth cohorts by Saint Maurice, Welk, Finn, and Kaj (2015) and percentile values reported by Ortega *et al.,* (2020). Its methodological credentials in physical education measurement are long established (Johnson & Nelson, 1988; Baumgartner, Jackson, Mahar, & Rowe, 2015).

Within Kho Kho, an emerging body of Indian scholarship has begun to quantify these attributes. Mahapatra, Sahu, and Patra (2023) demonstrated a significant correlation between speed and agility in Kho-Kho players, with gender exerting a measurable influence on that association. Comparative work has repeatedly positioned Kho-Kho players favourably against allied combat invasion sports: Mamgain (2021) reported agility differences between Kho-Kho and Kabaddi players, and studies of motor and anthropometric components have highlighted overlapping but non identical fitness profiles across the two disciplines (Kalpana, Cherian, & Khanna, 2022). Positional analyses have shown that even within Kho Kho, runners and chasers present measurably distinct physical and anthropometric signatures (Sultana & Rahaman, 2024), while correlational modelling has established that physical, physiological, and anthropometric measures jointly determine Kho-Kho skill performance (Sudhakara Babu & Kumar, 2014). Talent identification frameworks in team sport, most influentially that of Reilly, Williams, Nevill, and Franks (2000), argue that such multidimensional profiling rather than any single test should underpin selection decisions; Pyne, Gardner, Sheehan, and Hopkins (2005) similarly linked fitness test batteries to subsequent career progression, and Gabbett (2002) showed that fitness profiles differentiate competitive levels in collision team sport.

Critically, however, the assumption that superior physical fitness automatically discriminates between ability strata within a homogeneous, already selected squad is far from settled. Hoffman (2006) observed that once athletes are filtered by competitive level, between group variance in generic fitness attributes often compresses, and skill, tactical intelligence, and decision making assume greater explanatory weight. Bangsbo, Mohr, and Krustrup (2006) made an analogous point regarding elite footballers, where physical capacity becomes a threshold rather than a discriminator. Where the discipline has been slower to progress is in the study of female Kho-Kho players at the state competitive tier a population that is numerically substantial in West Bengal yet almost absent from the peer reviewed record, and for whom no ability referenced fitness norms currently exist. Reporting standards further demand that non-significant outcomes be interpreted alongside effect size estimates rather than dismissed (Cohen, 1988), a practice still inconsistently applied in Indian physical education research. The present investigation therefore addresses a genuine and specific gap: it profiles and statistically compares speed, agility, and leg explosive strength across high, medium, and low ability state level female Kho-Kho players, offering coaches an evidence-based answer to a deceptively simple question do these three fitness components actually separate the good from the very good?

Statement of the Problem

The problem of the study was stated that A comparative study of selected physical fitness components speed, agility, and leg explosive strength among high, medium, and low ability state level female Kho-Kho players.

OBJECTIVES OF THE STUDY

The following objectives were considered for the present research study

i. To find out the status of speed ability of state level kho-kho players.
ii. To find out the status of agility of state level kho-kho players.
iii. To find out the status of leg explosive strength of state level kho-kho players.

Significance of the Study

i. The study will provide necessary information regarding the physical fitness components status of State level kho-kho players.
ii. The result of the study will be useful for the coaches and physical trainers to prepare an effective training schedule for improving physical fitness components of the State level kho-kho players scientifically.

iii. The study will help to bring the focus of the physical education teachers, coaches, and physical trainers to find out the potentiality and promote them in the respective field for higher achievement.

Delimitation of the Study

i. Only kho-kho players were selected.
ii. Only State level kho-kho players was selected for the present study.
iii. Only Female kho-kho players was selected for the study.
iv. The present study was conducted on 67 state level kho-kho players.
v. Purba Medinipur, North 24 parganas, south kolkata & Hooghly District Kho-Kho players was selected.
vi. The age of the kho-kho players was ranged between 18 to 23 years.

Limitation of the Study

i. Since the subjects was belong from different socio economical background, their influence was considered as a limiting factor.
ii. The certain factors associated with the study like diet, training schedule, life style, daily routine and habits was not be taken into consideration.
iii. During the administration of tests, motivation, interest, environment and attitudes of the subjects was treated as limiting factors.

HYPOTHESIS

On the basis of the review of literature, it was hypothesized that there would be no significant relation of physical fitness components of state level Kho-Kho players.

METHODOLOGY

Selection of the Subject

A total 67 female state level Kho-Kho players were selected as subjects for the present study. Their age was ranged from 18 to 23 years. State level and subjects for the present study were selected of Purba Medinipur, North 24 parganas, south Kolkata & Hooghly district of West Bengal.

Selection of Variables

To fulfil the purpose of the study, the following parameters were considered as variables for the present investigation.

Physical fitness variable

- Speed
- Agility
- Leg explosive strength

Criterion Measures

To measure the above mentioning variables, the following criterion measures were undertaken.

Table 1:

Criterion Measure Variables	Measuring Tools/Techniques	Unit of Measurement
Speed	50-yard dash	sec
Agility	(4 x 10) yard shuttle run	sec
Leg explosive strength	Standing broad jump	c.m

Administration of the Test

In this study the subjects were selected considering the purposive sampling technique.

1. Speed 50 Yard dash

Purpose: To measure Speed.
Equipment: Two stopwatches. A suitable running area to allow the 50 +10-meter run extension.
Procedure: It is advised that two subjects run at the same time. Both start from a standing position. The commands. "Are you ready?" and "Go!" are given. At the command to go the starter drops his arm so that the timer at the finish line can start the timing. The subjects run as fast as possible across the finish line.
Scoring: The elapsed time from the starting signal until the runner crosses the finish line is measured to the nearest tenth of a second.

2. Shuttle run (Agility)

Purpose: The purpose of the test was to measure the agility.
Equipment: Smooth surface test course, scorecards, electronic stopwatch, and two wooden blocks.
Procedure: To lines parallel to each other was marked on the floor 10 yard apart the subject shall stand behind one of the lines with the blocks at the other line on the signal "start". The subject runs to the blocks takes on block, and returns to starting line and takes other block which was carried across the starting line on the way back. Two trails were given and the best trail was taken into account.
Scoring: The score was the elapsed time recorded in seconds and one tenth of seconds for the better of 2 trails.

3. Standing broad jump (Leg Explosive Strength)

Purpose: The objective of this test is to measure the Explosive Strength of the legs.
Equipment: Tape measure to measure distance jumped, non-slip floor for take-off, and soft-landing area preferred. Commercial Long Jump Landing Mats are also available. The take off line should be clearly marked.

Procedure: The athlete stands behind a line marked on the ground with feet slightly apart. A two-foot take-off and landing is used, with swinging of the arms and bending of the knees to provide forward drive. The subject attempts to jump as far as possible, landing on both feet without falling backwards. Three attempts are allowed.

Scoring: The measurement is taken from take-off line to the nearest point of contact on the landing (back of the heels). Record the longest distance jumped, the best of three attempts.

Procedure of Data Collection

Initially the researcher communicated with the teacher of different colleges of North 24 Parganas and Purba Medinipur, Kolkata and Hooghly district different college and Club of west Bengal. There are mainly three types physical fitness components and one psychological variable. They were being informed about the importance of the study and convinced by the researcher. After getting their approval, researcher personally meet with the subjects and came to know about their concern to be the respondent in the present investigation spontaneously. Before administration of the test an orientation programmed was arranged for the testers in the presence of supervisor. The testing procedures were explained to the subjects in detailed, so that there was no doubt in their mind regarding the efforts and strain had to. Sufficient interval was given as recovery in between all the tests. Mainly the researcher take data from different institution and club of state level Kho-Kho players. In this study there are at first clear the total process for the subject and then collected the data with the help of some sports equipment. Data were collected from different institute and club of west Bengal state.

Design of the Study

A descriptive, cross sectional, ex post facto comparative design in which 67 purposively sampled state level female Kho-Kho players (18 23 years) were classified into high, medium, and low ability groups and compared on speed, agility, and leg explosive strength using one way ANOVA (alpha = 0.05).

Statistical Procedure

The study aimed to compare between the one group. For that purpose, the data had been collected and statistically analysed. The spread of the data was presented through Graphical Representation. All the analyses were done through the IBM SPSS Statistics 26 software.

- Descriptive Statistics.
- One way ANOVA.

Analysis and Interpretation of the Data

Table 2: Descriptive statistics of Physical fitness components of Kho-Kho Players

Speed				Agility			Explosive leg Strength		
	High	Medium	Low	High	Medium	Low	High	Medium	Low
Mean	8.01	8.53	8.51	11.9	11.9	11.7	1.84	1.77	1.78
SD (±)	0.552	1.261	1.213	0.936	0.810	0.837	0.165	0.177	0.169

Table 2 presents the descriptive statistics for three physical fitness components across high, medium and low ability Kho-Kho players. For speed, the high ability group recorded the fastest mean time (8.01 ± 0.552 s) compared with the medium (8.53 ± 1.261 s) and low (8.51 ± 1.213 s) groups, and also displayed markedly lower dispersion. Agility scores were near identical across the three groups (11.9 ± 0.936, 11.9 ± 0.810 and 11.7 ± 0.837 s respectively), indicating negligible differentiation on this component. For explosive leg strength, the high ability group again recorded the highest mean (1.84 ± 0.165 m) relative to the medium (1.77 ± 0.177 m) and low (1.78 ± 0.169 m) groups.

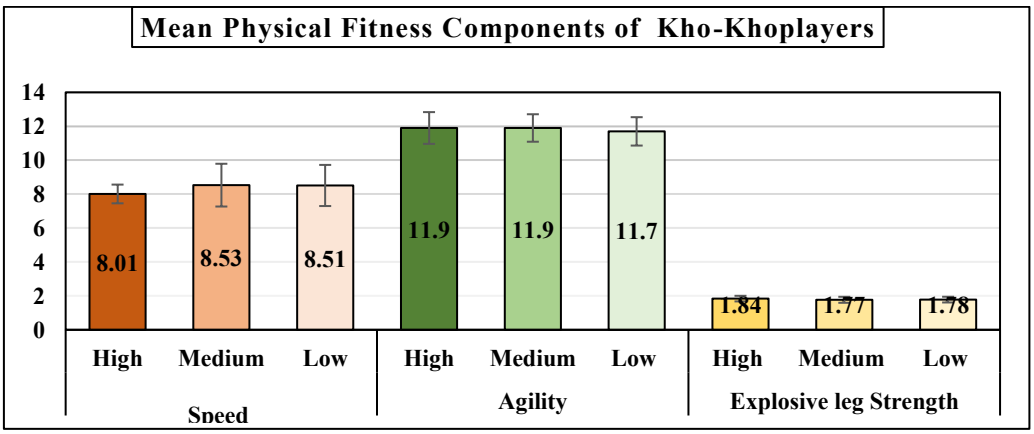

Fig. 1: Graphical Representation of Descriptive statistics of Physical fitness components of Kho-Kho Players

The bar graph illustrates the mean values of selected physical fitness components among Kho-Kho players across the high, medium, and low groups. The mean speed values were 8.01, 8.53, and 8.51, respectively, while agility showed mean values of 11.9, 11.9, and 11.7**.** For explosive leg strength, the corresponding mean values were 1.84, 1.77, and 1.78**.** Overall, the mean values across the three groups were relatively comparable, indicating only minor variations in speed, agility, and explosive leg strength among the Kho-Kho players.

Analysis of Variance

The result of one-way ANOVA is presented in Table 03 to Table 04 & 05 The comparison between the physical fitness of state level Kho-Kho Players.

Table 3: Analysis of variance (speed)

One Way ANOVA (Fisher's)				
Variable	**F**	**df1**	**df2**	**p**
Speed	1.06	2	64	0.352

**** P > 0.05 level of significance**

Table 3 Showed that one way analysis of variance revealed no statistically significant difference in speed among the high, medium and low ability groups of Kho-Kho players, $F(2, 64) = 1.06$, $p = 0.352$, $\eta^2 = 0.03$. As the obtained F value was lower than the critical value required for significance at the 0.05 level. Hence the hypothesis of a significant difference in speed across ability levels was not supported.

Table 4: Analysis of variance (Agility)

One Way ANOVA (Fisher's)				
Variable	**F**	**df1**	**df2**	**p**
Agility	0.197	2	64	0.822

****P > 0.05 level of significance**

Table 4 Showed that the one-way ANOVA results indicated that there was no statistically significant difference in agility among the groups, $F(2, 64) = 0.197$, $p = 0.822$. Since the p value was greater than the 0.05 level of significance, the null hypothesis was retained. Thus, the groups demonstrated comparable agility performance, suggesting that the grouping factor did not have a significant effect on agility

Table 5: Analysis of variance (Explosive leg strength)

One Way ANOVA (Fisher's)				
Variable	**F**	**df1**	**df2**	**p**
Explosive Leg Strength	0.744	2	64	0.479

****P > 0.05 level of significance**

Table 5 Showed that the one-way ANOVA revealed no statistically significant difference in explosive leg strength among the groups**,** $F (2, 64) = 0.744$**,** $p = 0.479$**.** Since the p value was greater than the 0.05 level of significance, the null hypothesis was retained. Thus, the groups exhibited similar levels of explosive leg strength**,** indicating that the grouping factor did not produce a significant effect on this variable.

DISCUSSION OF FINDINGS

The one-way analyses of variance returned a consistent verdict: none of the three selected physical fitness components differentiated the high, medium, and low ability groups of state level female Kho-Kho players speed, $F(2, 64) = 1.06$, $p = 0.352$, eta squared = 0.03; agility, $F(2, 64) = 0.197$, $p = 0.822$; and explosive leg strength, $F(2, 64) = 0.744$, $p = 0.479$. The stated hypothesis was accordingly retained across all three variables. Descriptively, the direction of the means was nonetheless coherent: high ability players were fastest (8.01 +/ 0.552 s vs. 8.53 +/ 1.261 s and 8.51 +/ 1.213 s) and jumped furthest (1.84 +/ 0.165 m vs. 1.77 +/ 0.177 m and 1.78 +/ 0.169 m), while agility was virtually indistinguishable (11.9, 11.9, 11.7 s). The trend therefore favoured the high ability group without reaching statistical significance a pattern that warrants interpretation rather than dismissal (Cohen, 1988).

The most parsimonious explanation is competitive homogeneity. All 67 participants had already survived selection to state level, so the sample represents a pre filtered, right tail slice of the performance distribution. Hoffman (2006) argued that in such populations generic fitness attributes behave as thresholds rather than discriminators, and Bangsbo, Mohr, and Krustrup (2006) reached the same conclusion for elite footballers, in whom physical capacity ceases to explain within level performance differences. Gabbett (2002) demonstrated that fitness profiles separate between competitive tiers far more reliably than within them, which aligns closely with the present null findings.

A second explanation lies in the construct specificity of the tests employed. The near identical

agility scores are unsurprising given that the 4 x 10 yard shuttle run measures pre planned change of direction speed, not reactive agility a distinction Sheppard and Young (2006) established conceptually and Young, Dawson, and Henry (2015) confirmed empirically as statistically independent skills. Kho-Kho ability is overwhelmingly expressed through reactive skill: anticipating a runner's feint, timing a pole dive, reading a chaser's approach. A closed skill shuttle protocol cannot capture this perceptual cognitive layer, so the very quality that most plausibly separates high from low performers went unmeasured. Nimphius, Callaghan, Bezodis, and Lockie (2018) explicitly warned that total time field tests conflate distinct qualities and can mask meaningful differences; Brughelli, Cronin, Levin, and Chaouachi (2008) likewise showed that change of direction ability is multiply determined and only loosely coupled to linear speed.

Third, the relative independence of the motor abilities themselves limits how strongly any single component can track composite playing ability. Little and Williams (2005) reported that acceleration, maximum speed, and agility are specific and only modestly interrelated; Salaj and Markovic (2011) similarly found jumping, sprinting, and quick change of direction to be largely distinct. Vescovi and McGuigan (2008), working specifically with female athletes, documented that sprint, agility, and jump measures share limited common variance meaning a three-test battery is unlikely to reconstruct the multidimensional profile that actually underpins Kho-Kho ability. This is precisely why Reilly, Williams, Nevill, and Franks (2000) advocated multidimensional talent identification models incorporating technical, tactical, anthropometric, and psychological indices alongside physical testing, and why Pyne, Gardner, Sheehan, and Hopkins (2005) found composite batteries, not isolated tests, predictive of career progression.

The descriptive trend in explosive leg strength nonetheless deserves attention. Cronin and Hansen (2005) established lower body power as a meaningful predictor of sprint capability, and Cormie, McGuigan, and Newton (2011) detailed the neuromuscular mechanisms linking maximal power output to athletic expression. The 7 cm advantage of the high ability group in standing broad jump, though non-significant here, is directionally consistent with that literature and may well achieve significance in a larger or more heterogeneous sample. Notably, the high ability group also showed markedly lower dispersion in speed (SD 0.552 vs. 1.261 and 1.213), suggesting that consistency of performance, rather than mean level, may be the more informative discriminator a subtlety that mean-based ANOVA is structurally unable to detect.

Finally, the findings sit within a Kho-Kho evidence base that has itself produced mixed results. Mahapatra, Sahu, and Patra (2023) reported significant speed agility correlations in Kho-Kho players with gender moderated effects, and Sudhakara Babu and Kumar (2014) found physical, physiological, and anthropometric measures collectively predictive of Kho-Kho skill yet both employed correlational rather than group comparison designs, which are more sensitive to graded relationships than categorical contrasts. Sultana and Rahaman (2024) demonstrated that positional role (runner vs. chaser) produces measurable physical differentiation in Kho Kho, raising the possibility that the present ability-based grouping obscured genuine positional variance by pooling tactically dissimilar athletes. Intervention research further shows these qualities to be highly trainable: short term functional strength and balance training improved agility, balance, and functional movement in national level Kho-Kho players (Kumar *et al.,*2026), while plyometric loading reliably enhances jump (Markovic, 2007) and sprint (Saez Saez de Villarreal, Requena, & Cronin, 2012) outcomes. Where all players in a state squad follow broadly similar training regimens, trainable attributes will naturally converge a strong candidate explanation for the homogeneity observed. Uncontrolled factors acknowledged by the study, including nutrition and energy availability, may compound this; Kalpana, Cherian, and Khanna (2022) documented substantial RED S risk among Indian Kho-Kho players, a condition known to blunt power and speed expression irrespective of skill level.

CONCLUSIONS

Within the limitations of the present investigation, No statistically significant difference existed in speed among high, medium, and low ability state level female Kho-Kho players, No statistically significant difference existed in agility among the three ability groups, No statistically significant difference existed in leg explosive strength among the three ability groups. The null hypothesis was therefore retained for all three physical fitness components; state level female Kho-Kho players constitute a physically homogeneous population in respect of speed, agility, and standing broad jump performance. Descriptively, the high ability group recorded the fastest mean speed, greatest mean jump distance, and lowest variability, indicating a consistent but statistically non-significant performance advantage suggesting that superior physical fitness is a necessary threshold for, rather than a discriminator of, state level Kho-Kho ability.

Practical implication: coaches and trainers should not rely on the 50-yard dash, shuttle run, and standing broad jump alone to differentiate or select among already selected state level players; ability at this tier is more plausibly governed by reactive agility, technical skill, tactical decision making, and positional specialisation, which warrant direct assessment.

Recommendation: future research should employ reactive agility protocols, larger and multi-tier samples, position specific grouping (runners vs. chasers), and effect size-based reporting, and should control for training load, nutrition, and energy availability.

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