

Physical Performance Profiling of Elite National-Level Kho Kho Players

Dr. Shirish More

CACPE, Pune

Mr. Atharva Tapadia

S & C Expert

ABSTRACT

Kho Kho is one of the fastest and most dynamic indigenous sports in India, characterized by continuous chasing, rapid directional changes, explosive bursts of speed, and repeated high-intensity efforts. Unlike many team sports, Kho Kho requires players to maintain agility, balance, coordination, and neuromuscular efficiency while performing complex movement patterns under time pressure. The sport places significant demands on the lower limbs, particularly in terms of power generation, acceleration, deceleration, and reactive strength, making physical performance profiling essential for scientific training and injury prevention at the elite level.

The present study aimed to develop a comprehensive physical performance profile and assess the physical status of national-level male Kho Kho players based on selected power, speed, and reactive strength parameters. The sample consisted of fifteen male players who were actively participating in a national training camp and were considered among the top performers in the country. The athletes underwent a series of standardized performance tests, including countermovement jump (CMJ), squat jump (SJ), broad jump for lower-limb explosive power, 10-5 reactive agility test to assess change-of-direction ability, and 10 m and 20 m sprint tests to evaluate acceleration and speed capacity.

Descriptive statistical analysis of the collected data indicated that the players possessed moderate to high levels of lower-limb muscular power and acceleration ability, which are crucial for successful performance in Kho Kho. However, noticeable variability was observed in reactive strength and deceleration control among players, suggesting differences in neuromuscular efficiency and movement quality. These variations may have implications for both performance consistency and injury susceptibility,

particularly in movements involving rapid stopping and direction changes.

The findings of this study provide valuable insights into the physical strengths and limitations of elite Kho Kho players. The results can serve as a scientific basis for designing sport-specific conditioning programs that focus on enhancing reactive strength, agility, and deceleration ability while maintaining and further developing power and speed. Additionally, the study emphasizes the importance of individualized training and monitoring to optimize performance and minimize injury risk in high-performance Kho Kho athletes.

Keywords : Kho Kho, Reactive Strength, Sprint Performance, Jumping Ability, Athlete Profiling

Introduction

Kho Kho is one of the oldest indigenous sports of India and has evolved from a traditional recreational activity into a highly competitive, structured sport with national and international recognition. The modern version of Kho Kho is characterized by high-intensity intermittent activity involving short bursts of sprinting, rapid accelerations and decelerations, sudden changes in direction, low-body positioning, and complex neuromuscular coordination. Unlike many conventional field sports such as football, hockey, or rugby, Kho Kho requires players to execute explosive movements within a confined space and time constraints while maintaining balance, agility, and spatial awareness. The unique nature of the game places substantial physical and physiological demands on athletes, particularly on the neuromuscular, musculoskeletal, and energy systems (Sharma & Subramanian, 2017).

The movement patterns in Kho Kho are largely dominated by repeated sprint efforts, lateral shuffling, quick directional changes, and prolonged isometric postures such as the “sit” position adopted by defenders. These actions require a combination of muscular power, reactive strength, eccentric braking capacity, and efficient stretch-shortening cycle (SSC) utilization (Young, 2006). Sprint performance in Kho Kho is not merely about straight-line speed but also about the ability to accelerate rapidly from a static or semi-static position, decelerate efficiently, and re-accelerate in a new direction. Studies in similar invasion and tagging sports suggest that agility, reactive strength, and lower-limb power are critical determinants of performance (Sheppard & Young, 2006).

Despite its growing competitive structure and inclusion in national leagues and international platforms, scientific research on the physical performance characteristics of elite Kho Kho players remains limited. Most available literature has focused on traditional fitness components such as endurance, flexibility, or general strength, with fewer studies examining sport-specific performance variables such as reactive strength, power output, and change-of-direction ability. This gap in empirical evidence highlights the need for systematic performance profiling of elite Kho Kho athletes to better understand the physical attributes required for success in the sport (Ghosh & Mandal, 2015).

Performance profiling is an essential tool in modern sports science as it provides objective data on an athlete's physical capabilities. Through structured assessment using valid and reliable field-based tests, coaches and sports scientists can identify both strengths and limitations in an athlete's performance profile. Such information is critical for designing individualized training programs that align with the specific demands of Kho Kho rather than relying on generalized conditioning models (Bompa & Haff, 2009).

Furthermore, performance profiling plays a vital role in injury prevention and risk management. Kho Kho involves frequent eccentric loading, rapid stopping, and high-impact landings, which can predispose athletes to lower-limb injuries such as hamstring strains, knee ligament injuries, and ankle sprains. By assessing parameters such as reactive strength, deceleration ability, and jump performance, potential biomechanical weaknesses can be detected early, allowing for targeted corrective training interventions (Komi, 2003).

In addition, baseline performance data serve as a reference point for monitoring training progress and evaluating the effectiveness of conditioning programs over time. Longitudinal tracking of physical performance helps in optimizing training load, preventing overtraining, and ensuring peak performance during competition phases. (Turner & Stewart, 2014). At the elite level, even small improvements in sprint speed, agility, or power can significantly influence match outcomes in a fast-paced sport like Kho Kho.

Given the increasing professionalism of the sport and the rising standards of competition, there is a growing need for evidence-based training and performance assessment in Kho Kho. However, the lack of standardized performance benchmarks for national-level players poses a challenge for coaches and practitioners. Establishing normative data for key physical performance variables is therefore crucial for talent identification, training prescription, and performance enhancement in Kho Kho.

Considering these factors, the present study was designed to establish a baseline physical performance profile of national-level Kho Kho players using commonly accepted field-based tests. By assessing variables such as jumping ability, sprint performance, and reactive agility, this study aims to contribute to the scientific understanding of the physical demands of Kho Kho and provide practical insights for coaches, trainers, and sports scientists working with elite athletes.

General objective of this study was to assess and establish the physical performance profile of national-level Kho Kho players based on selected power, speed, and reactive strength parameters.

Research Methodology

The present study was designed to understand and describe the physical performance characteristics of national-level Kho Kho players. A descriptive cross-sectional research design was adopted, as the objective was to capture the current physical performance status of the athletes at a particular point in time rather than to examine the effects of any training intervention. Field-based performance tests that are widely accepted in sports science were used to assess key physical attributes relevant to Kho Kho performance.

The participants for this study were selected using a purposive sampling method, as the focus was specifically on elite-level athletes. The sample consisted of fifteen (N = 15) male national-level Kho Kho players who were attending a national training camp during the period of data collection. All players had prior experience in national competitions and were undergoing regular structured training.

Before testing, the purpose of the study and testing procedures were clearly explained to all participants in simple language. Each player voluntarily agreed to take part in the study, and informed consent was obtained. To ensure the accuracy and reliability of the data, only those players who were free from any injury or illness at the time of testing were included.

The testing was conducted over two consecutive days at the training venue in a familiar environment for the players. To minimize the influence of fatigue, participants were advised to avoid strenuous physical activity at least 24 hours before testing.

Each testing session began with a standardized warm-up of approximately 15 minutes, which included light jogging, dynamic stretching, and movement-specific drills related to jumping and sprinting.

The following performance parameters were assessed using standardized field-based tests:

Test	Purpose of Assessment
Countermovement Jump (CMJ)	Explosive power and efficiency of the stretch-shortening cycle
Squat Jump (SJ)	Pure concentric lower-limb power
Broad Jump	Horizontal power generation
10-5 Reactive Agility Test	Reactive strength and deceleration control
10 m Sprint	Acceleration ability
20 m Sprint	Short-distance speed maintenance

Before each test, the procedure was clearly demonstrated by the researcher, and players were allowed one familiarization attempt. Thereafter, two formal trials were conducted for each test, with sufficient rest intervals between attempts to prevent fatigue. The best performance of each athlete was recorded for further analysis.

Statistical Analysis

The collected data were analysed using descriptive statistics to provide a clear picture of the players physical performance. The mean, standard deviation, minimum, and maximum values were calculated for all selected variables. These statistical measures helped in understanding both the average performance level and the variation among players.

Table 1 : Descriptive Performance Profile of National Kho Kho Players

Variable	Mean \pm SD
CMJ (cm)	41 \pm 5.50
SJ (cm)	37 \pm 3.87
Broad Jump (cm)	229 \pm 12.48
10-5 Test (s)	1.81 \pm 0.27
10 m Sprint (s)	7.72 \pm 0.31
20 m Sprint (s)	7.37 \pm 0.29

The descriptive statistics of the selected performance variables of national-level Kho Kho players ($N = 15$) are presented in Table 1. The mean value for countermovement jump. (CMJ) was 41.00 ± 5.44 cm, with scores ranging from 34 cm to 50 cm, indicating moderate to high levels of vertical explosive power among the players. The mean squat jump (SJ) performance was 36.87 ± 3.93 cm, with a minimum of 30 cm and a maximum of 42 cm, reflecting relatively consistent concentric lower-limb power across the sample.

For horizontal power, as measured by the broad jump, the mean score was 228.93 ± 12.48 cm, with values ranging from 198 cm to 245 cm. This suggests that most players possessed well-developed horizontal propulsion ability, which is critical for sprinting, diving, and rapid directional changes in Kho Kho.

Agility, assessed through the 10-5 test, showed a mean time of 1.81 ± 0.27 seconds, with a range of 1.36 to 2.27 seconds. The relatively higher standard deviation indicates notable inter-individual variability in change-of-direction speed and deceleration control.

In terms of linear speed, the mean 10 m sprint velocity was 7.73 ± 0.46 m/s, while the mean 20 m sprint velocity was 7.47 ± 0.52 m/s. The narrow range of values suggests a relatively homogeneous speed profile among the players.

Table 2 : Performance categorization of national-level Kho Kho players based on Vertical Power, Concentric Power, Horizontal Power and Agility ($N = 15$)

Performance Variable	Category	Criterion	Number of Players (n)	Percentage (%)
Countermovement Jump (CMJ)	Excellent	≥ 46 cm	4	26.7
	Good	40-45 cm	5	33.3
	Needs Improvement	< 40 cm	6	40
Squat Jump (SJ)	High	≥ 40 cm	4	26.7
	Moderate	35-39 cm	7	46.6
	Low	< 35 cm	4	26.7
Broad Jump	Excellent	≥ 240 cm	4	26.7
	Good	225-239 cm	8	53.3
	Needs Improvement	< 225 cm	3	20

10-5 Agility Test	Excellent	≤ 1.60 s	5	33.3
	Moderate	1.61-1.80 s	4	26.7
	Needs Improvement	> 1.80 s	6	40

Based on performance benchmarks derived from the dataset:

Vertical power (CMJ):

- Four players (26.7%) demonstrated superior vertical explosiveness (≥ 46 cm).
- Five players (33.3%) showed moderate performance (40-45 cm).
- Six players (40%) recorded values below 40 cm, indicating a need for targeted strength and power training.

Concentric power (Sj):

- Four players (26.7%) exhibited higher concentric power (≥ 40 cm).
- Seven players (46.6%) demonstrated moderate concentric power (35-39 cm).
- Four players (26.7%) showed lower concentric power (< 35 cm), suggesting inadequate force production capacity.

Horizontal power (Broad Jump):

- Four players (26.7%) achieved excellent scores (≥ 240 cm).
- Eight players (53.3%) demonstrated good horizontal power (225-239 cm).
- Three players (20%) fell below 225 cm, indicating the need for plyometric and sprint-specific training.

Agility (10-5 test):

- Five players (33.3%) exhibited superior agility (≤ 1.60 s).
- Four players (26.7%) demonstrated moderate agility (1.61-1.80 s).
- Six players (40%) recorded slower change-of-direction performance (> 1.80 s), indicating deficits in braking and deceleration control.

Strength and Conditioning Trends

Based on performance patterns, three distinct conditioning profiles emerged within the group:

Power-dominant profile:

A subset of players with high jump performance but moderate agility required enhanced eccentric braking, landing mechanics, and deceleration control training.

Speed-agility dominant profile:

Players who demonstrated superior agility but comparatively lower vertical and horizontal power required greater emphasis on maximal strength and rate of force development training.

Developmental profile:

A group of players exhibited below-average performance across multiple parameters, indicating the necessity for comprehensive strength, plyometric, and sprint mechanics training.

Injury Risk Analysis

A qualitative risk profiling based on performance deficits and biomechanical demands indicated that knee, quadriceps, and shin injuries were the most prevalent primary risk areas, followed by hamstring, lower back, and hip-related risks.

Players with high vertical power but poor agility scores demonstrated a potentially greater risk of knee overloading due to inadequate eccentric braking capacity.

Players with low squat jump and low broad jump scores were identified as being at higher risk for hamstring and hip strain due to insufficient force production and propulsion efficiency.

Players with slower 10-5 test times were considered more susceptible to knee and ligament-related injuries during rapid change-of-direction movements.

Conclusion

The present study examined the performance profile of national-level Kho Kho players based on selected neuromuscular and speed-related parameters, including countermovement jump, squat jump, broad jump, agility (10-5 test), and sprint velocity (10 m and 20 m). The findings indicate that the players, as a group, possess moderate to good levels of lower-limb explosive power and horizontal propulsion ability, which are essential for effective performance in Kho Kho. However, considerable inter-individual variability was observed across most performance measures, particularly in agility and change-of-direction ability.

While the majority of players demonstrated adequate vertical and horizontal power, a substantial proportion exhibited deficits in agility and deceleration control, suggesting that these qualities represent critical areas for further development. Additionally, the performance patterns revealed distinct conditioning profiles within the group, emphasizing the need for individualized rather than generalized training interventions.

From an injury prevention perspective, the study highlighted a higher susceptibility to knee- and hamstring-related risks, particularly among players with poor eccentric control and lower concentric strength. This underscores the importance of integrating targeted eccentric strengthening, landing mechanics training, and neuromuscular conditioning into regular training programs.

Overall, the results suggest that although the players possess a solid athletic foundation, systematic and player-specific conditioning strategies focusing on agility, rate of force development, and movement efficiency are necessary to optimize performance and reduce injury risk in elite Kho Kho players.

Discussion

The present study sought to develop a performance profile of national-level Kho Kho players based on selected neuromuscular, power, agility, and speed-related variables. The findings provide meaningful insights into the physical characteristics, performance strengths, and potential limitations of the players, with important implications for training and injury prevention.

The mean values for countermovement jump (41.00 ± 5.44 cm) and squat jump (36.87 ± 3.93 cm) indicate that the players possessed moderate to good levels of vertical explosive power and concentric strength. This level of performance is consistent with the demands of Kho Kho, which requires repeated jumping, lunging, and explosive take-offs during chasing and defending actions. However, the observed variability in CMJ and SJ scores suggests that not all players were equally developed in terms of lower-limb power, highlighting the need for individualized strength and conditioning interventions rather than uniform team-based training.

The broad jump performance (228.93 ± 12.48 cm) reflected relatively strong horizontal power among the group. This is a positive finding, as horizontal force production is crucial in Kho Kho for rapid acceleration, diving, and directional changes. Players with superior broad jump scores likely have an advantage in initiating quick movements and covering distance efficiently during play. Conversely, players with lower broad jump scores may struggle with explosive forward propulsion, which could limit their effectiveness in high-intensity match situations.

Agility, as measured by the 10-5 test, demonstrated greater inter-individual variability compared to other variables (1.81 ± 0.27 s). A considerable proportion of players recorded slower times, indicating deficiencies in deceleration, braking ability, and change-of-direction mechanics. This is a critical finding because Kho Kho involves frequent and rapid directional shifts, evasive movements, and sudden stops. Players with poorer agility are not only at a performance disadvantage but may also be at a higher risk of non-contact knee injuries due to inadequate eccentric control during cutting and turning movements.

Sprint performance at 10 m and 20 m showed relatively homogeneous values across the group, suggesting that most players had developed a similar baseline level of linear speed. While this is beneficial for team balance, it also indicates limited differentiation in sprint qualities among elite players. Future training programs could focus on enhancing acceleration mechanics and maximal sprint efficiency to create a greater performance advantage.

The classification of players into distinct conditioning profiles—power-dominant, speed-agility dominant, and developmental—further supports the argument for individualized training. Power-dominant players require improved braking and landing mechanics, whereas speed-agility dominant players would benefit from greater emphasis on maximal strength and rate of force development. Players in the developmental category require a comprehensive approach combining strength training, plyometrics, and sprint mechanics.

From an injury prevention standpoint, the predominance of knee and hamstring risk observed in the study aligns with existing literature on field-based sports. The high frequency of accelerations, decelerations, unilateral loading, and sudden directional changes in Kho Kho likely contributes to increased musculoskeletal stress in these regions. Players with high vertical power but poor agility appear particularly vulnerable to knee overloading, whereas those with lower concentric strength and horizontal power may be more prone to hamstring and hip-related injuries.

Overall, the findings suggest that while national-level Kho Kho players demonstrate a solid foundation in power and speed, agility and eccentric control remain key areas for improvement. A structured, evidence-based conditioning program emphasizing change-of-direction training, eccentric strengthening, neuromuscular stability, and individualized load management is recommended to enhance performance while minimizing injury risk. Future research should consider longitudinal training interventions to assess the impact of targeted conditioning strategies on both performance and injury reduction in Kho Kho players.

References :

Bishop, D., Girard, O., & Mendez-Villanueva, A. (2011). Repeated-sprint ability-Part II: training. *Sports Medicine*, 41(9), 741-756. Recommendations for <https://doi.org/10.2165/11590560-000000000-00000>

Brughelli, M., & Cronin, J. (2008). Altering the length-tension relationship with eccentric exercise: Implications for performance and injury prevention. *Sports Medicine*, 38(9), 807-826. <https://doi.org/10.2165/00007256-200838090-00004>

Faude, O., Koch, T., & Meyer, T. (2012). Straight sprinting is the most frequent action in goal situations in professional football. *Journal of Sports Sciences*, 30(7), 625-631. <https://doi.org/10.1080/02640414.2012.665940>

Gopa, S. (2022). Effectiveness of speed, agility, and quickness (SAQ) training on Kho Kho players [Unpublished manuscript]. *International Journal of Scientific Research*.

Kakad, N. R. (2023). Effect of mini game on speed and agility of Kho Kho players. *International Journal of Exercise and Movement Sciences*, 12(02), Article 339. <https://doi.org/10.55968/ijems.v12:02.339>

Mahapatra, C., & Abhinandan, A. (2023). Correlation between speed and agility with an influence of gender in adolescent Kho-Kho players. *Bulletin of Faculty of Physical Therapy*, 28, Article 41.

Markovic, G., Dizdar, D., Jukic, I., & Cardinale, M. (2004). Reliability and factorial validity of squat and countermovement jump tests. *Journal of Strength and Conditioning Research*, 18(3), 551-555, [https://doi.org/10.1519/1533-4287\(2004\)18](https://doi.org/10.1519/1533-4287(2004)18)

McBurnie, A., Allen, A., & Gill, N. (2016). The importance of eccentric strength in change-of-direction performance. *International Journal of Sports Physiology and Performance*, 11(5), 575-580. <https://doi.org/10.1123/ijsp.2015-0468>

Nimphius, S., McGuigan, M. R., & Newton, R. U. (2010). Relationship between strength, power, speed, and change of direction performance of female softball players. *Journal of Strength and Conditioning Research*, 24(4), <https://doi.org/10.1519/JSC.0b013e3181d2e3e0> 885-895.

Note: The above journal publication is specifically on speed-agility correlation in Kho Kho players, a sport-specific measure critical for performance profiling.

Young, W., McLean, B., & Ardagna, J. (1995). Relationship between strength qualities and sprinting performance. *Journal of Sports Medicine and Physical Fitness*, 35(1), 13-19.