



Effectiveness of Ladder Training on Agility in Kho-Kho Players of Vadodara District: A Pilot Study

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Background: Kho-Kho is a well-liked traditional sport in India that tests physical prowess, timing, reflexes, and endurance. It is an altered version of chase and run, primarily involving pursuing and making contact with the adversary rather than just sprinting quickly. One study revealed that young kho-kho players had a significant rate of injuries within a year (83.4%). Ladder training is a method of improving athletic performance by strengthening the player's footwork, which aids in catching, striking, blocking, and tackling the component. The goal of training sessions is to raise performance levels by enhancing footwork and rhythmic coordination.

Method: In this study, students between the ages of 18 and 25 who were enrolled at Parul University in Vadodara, Gujarat, were evaluated using the Illinois Agility Test to determine their level of agility. One group will engage in a 3-week training program that consists of five sessions per week and includes exercises such as side shuffles, hopscotch drills, lateral direction, jumping jacks, and scissors, while the other group will engage in a more traditional training program that consists of squats, lunges, and sprinting.

Result: The higher t-value and greater mean difference indicate that Group A's agility improvement was more significant than Group B's. These results show that the intervention was generally effective, with Group A being affected more strongly.

Conclusion: Both Group A and Group B showed notable increases in agility after the intervention, according to the findings of the Illinois Agility Test. A higher t-value and a larger mean difference indicated that Group A had improved more significantly. The findings' dependability is validated by the statistically significant p-values.

Keywords: Ladder Training, Kho-Kho, Agility

Introduction:

One of our nation's native games is kho kho. Physical fitness determines how well a sportsman performs in any game or competition. Physical fitness or condition refers to the key motor skills, namely neurophysiological aspects, and performance in all sports is heavily driven by these skills.(1) Sports training's primary goal is to

maintain and increase physical fitness. Strength, response time, movement speed, and muscular coordination are all necessary for agility, which is the capacity to quickly change the direction of the body or its components.(2)

Being physically fit has an impact on one's actions in life, influencing not just mental and physical health but also social and personal adjustment. Every athlete aspires to surpass past records since sport is inherently competitive, and records are broken more frequently these days. "Sports are a great way to help young people develop their character," he says. Sports by their very nature demand a certain level of talent and physical fitness.(3)

The ability to play kho kho in a variety of game situations requires agility. The majority of sports and games require quick reflexes. It is especially crucial for performance related to neurophysiological activities. Response time is the amount of time it takes to react to a stimuli. The interval between the stimulus's presentation and the movement of the body, body parts, or object is known as the grasped time. The properties of the stimuli and different nerve impulse circumstances affect reaction time. Athletes are valued for their ability to react quickly and with speed.(4).

Similarly, 133 kho kho players who were enrolled in school or college participated in a study conducted by Patil et al. Injury rates among adolescent athletes were found to be high (83.4%). Injuries to lower limbs were more prevalent. The lower extremities' most often damaged areas were the knee, ankle, and foot. Maximum in the upper limb. (5).

A research on 133 khokho players who were enrolled in school or college was also conducted by Patil et al. Injuries among young athletes were found to be highly prevalent (83.4%). There were more injuries to the lower limbs. The lower extremity's most often injured areas were the knee, ankle, and foot. Maximum Singh et al. surveyed Kho-Kho players to determine the frequency of upper limb injuries. It was observed that knee joint injuries accounted for 4.6% of kho kho players. This game is thought to entail intense knee joint movements, which is why these bursting motions may cause knee joint pain and muscle fatigue (6)

According to one research, eighty-four percent of young kho-kho players sustained injuries within a year, with lower limb injuries—such as those to the knee, ankle, and foot—being more common. (7)

Patho-anatomical features: The biceps femoris long head (BF_{lh})/semitendinosus (ST) muscles' shared proximal tendon is situated in the hamstrings on the posteromedial region of the ischial tuberosity. In the linea aspera, the biceps femoris short head (BF_{sh}) originates from the posterolateral part of the femur. Injuries to the distal calf muscles are the most prevalent. By integrating into the tendons of the two gastrocnemius heads, the distal tendon of the soleus forms the Achilles tendon.(8)

Enhancing footwork and improving athletic performance, ladder training is a multidirectional training method that enhances proprioception, strength, power, balance, agility, coordination, core and joint stability, speed, and mobility. The player will benefit from being able to catch, strike, block, or tackle the component in which training sessions aim to raise performance levels by practicing rhythmic footwork and coordination and teaching the body and mind different foot combinations to execute drills. (ladder training).(9)

The Illinois test verifies the assessed agility components of acceleration, deceleration, and balance control. To assess the test's validity and reliability, two trials were conducted one week apart following a ten-minute warm-up. The physical prowess of soccer players was assessed using the Illinois Agility Run Test, T-Drill, 20-meter sprint, change-of-direction, acceleration, agility, and skill. To finish each test, the same process was used. (10)

The test's objective is to finish the running course as quickly as feasible. The course is marked by cones. With their hands on the ground by their shoulders and their head toward the starting line, the subject begins the race face down. The subject runs the course without hitting any cones when the whistle sounds. Both meters and feet can be used to measure the course (10 m by 5 m or 30 ft by 15 ft). A common agility test used in sports and athletics to assess an athlete's capacity for rapid and efficient direction changes is the Illinois Agility Test. (11)

NEED OF THE STUDY:

The sport-specific demands of Kho-Kho necessitate this study since players must be exceptionally agile, have fast reflexes, and change direction quickly in order to thrive in both offensive and defensive tactics. Despite the existence of agility training techniques, ladder training is still not well studied in the Kho-Kho context. The purpose of this study is to validate ladder training as a scientific intervention to meet players' individual agility needs and improve performance measures including defending, tagging, and dodging. Additionally, there is little research on structured training techniques specific to Kho-Kho, which leaves a huge hole in evidence-based approaches. Since it assesses how well ladder training raises local training standards, the study has regional significance in the Vadodara district, where Kho-Kho is played.

A significant gap in evidence-based approaches is also left by the paucity of research on structured training methods specific to Kho-Kho. The study is regionally significant in the Vadodara district, where Kho-Kho is played, because it evaluates the extent to which ladder training improves local training standards.

MATERIALS AND METHODS:

The sample size was calculated using G*power (version 3.1.9.2). A total of 20 participants were included in the study. The inclusion criteria were students studying in Parul University, Vadodara, Gujarat aged between 18-25 years. The exclusion criteria for the study were 1) Any Lower limb related injuries. 2) History of any chronic disease. 3) Any Respiratory Complications. And 4) Congenital deformities which is approved by the Institutional Research Review Committee of the University. All the participants were assessed with Illionous Agility Test for checking agility in students.

To facilitate the test's administration, the 30-foot IAT was somewhat enlarged to 10 feet. Four cones, distributed 3.3 meters apart in the middle and 2.5 meters apart in each of the corners, served as markers for the IAT course (Figure 3). With his arms by his sides and his head tilted to the front or side, the test-taker started to lie prone on the ground behind the starting line. The athlete stood up and hurried to the first tape mark as soon as the "go" signal was given. For the participants to continue, they had to touch or step over the tape mark.

The tape mark had to be touched or stepped over by the contestants to continue. On to the second tape mark on the distant line, the participant ran or moved as quickly as they could. Participants were again required to plant their foot on or above the tape markers at the end of the line. Finally, the athlete crossed the finish line by running or moving as fast as they could. The time needed to complete each trial was measured in seconds. Any participant

who did not run the course as directed, did not cross the finish lines, did not finish the course, or moved any cones was disqualified. \

One Group will perform Ladder Training and other group will perform conventional training.

Ladder Training includes exercise: 3 sessions per week, 4 sets, Time duration 25 to 30 minutes, Rest 2 minutes

Ladder Training

- 1) Single Foot : Start behind the ladder Facing Down it. Lead with either foot stepping 1 foot per square.
- 2) Two Feet in Each: Start behind the ladder facing down it. Step with either Foot into the first square, followed by the second foot into the same square. Repeat the drill leading with the other foot
- 3) In lateral direction : Start by facing to the side by both feet outside the ladder. Step into the first square with the closest foot, followed by the second foot. Repeat the exercise leading with the other foot.
- 4). Jumping Jacks : These see you jump with both feet inside the ladder before springing forward, landing with both feet to either side of the next rung.
- 5) Leg In In Out Out: Start by facing ladder from the side. Step with the inside foot into the first square followed by the second foot. Step back out with the inside foot to the side of the second square followed by the other foot . Repeat the exercise leading with the other foot.

Conventional Training: : 3 sessions per week, 4 sets, Time duration 25 to 30 minutes, Rest 2 minutes

- 1) Squats
- 2) Lunges
- 3) Sprinting
- 4) Single Leg Balance

RESULTS :

Group A: Baseline (Week 0): At the beginning of the intervention, the average agility score was 27.81 ± 0.84 seconds, which demonstrated how long it took participants on average to finish the test. Week 4 post-test: The mean score dropped to 25.6 ± 1.07 seconds, indicating an increase in agility, after 4 weeks. A lower Illinois Agility Test score indicates superior performance.

Mean Difference: Week 0 minus Week 4 resulted in a 2.21-second change in the mean agility score over the four weeks. This notable improvement shows how successful the intervention was for Group A.

t-value: Group A computed t-value of 8.9 shows a considerable improvement over time and a big impact size.

p-value: At zero, the p-value falls below the conventional cutoff point of 0.05. This suggests that the agility gain that has been noticed is statistically significant and unlikely to be the result of chance.

Group B: Baseline (Week 0): At the beginning of the intervention, the mean agility score was 28.33 ± 0.74 seconds, which was somewhat less than Group A's baseline. Week 4 post-test: The mean score dropped to 27.19 ± 0.77 seconds at the end of the four-week period, indicating some agility improvement.

Mean Difference: Group B's mean agility score improvement was 1.14 seconds, which is less noticeable than Group A's. Although the intervention was successful, there was less of a change.

t-value: Group B's t-value of 5.85 shows that the intervention had a significant impact, albeit a smaller one than Group A's. p-value: Group B's p-value is 0, which is comparable to Group A's and indicates that the agility gain is statistically significant.

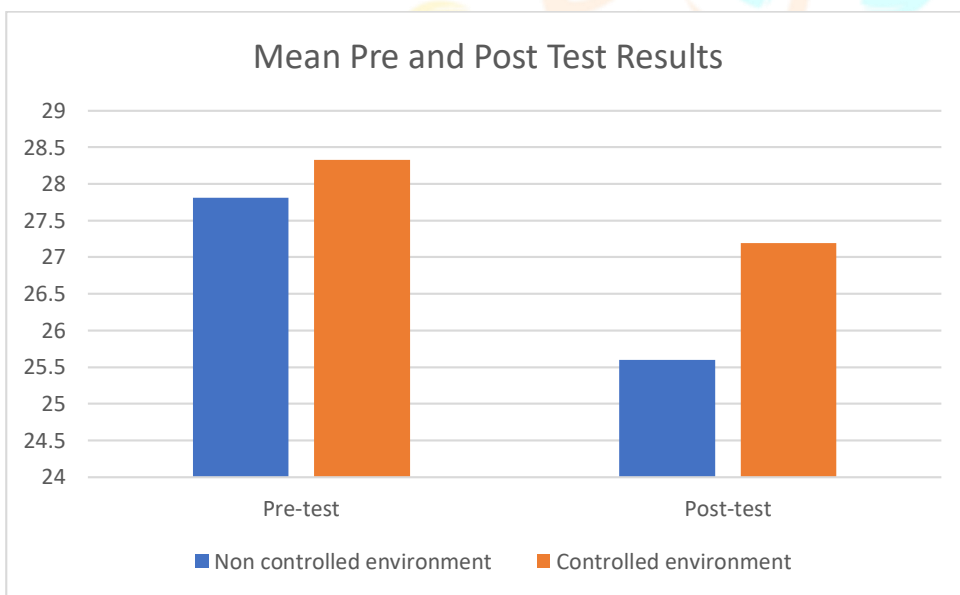
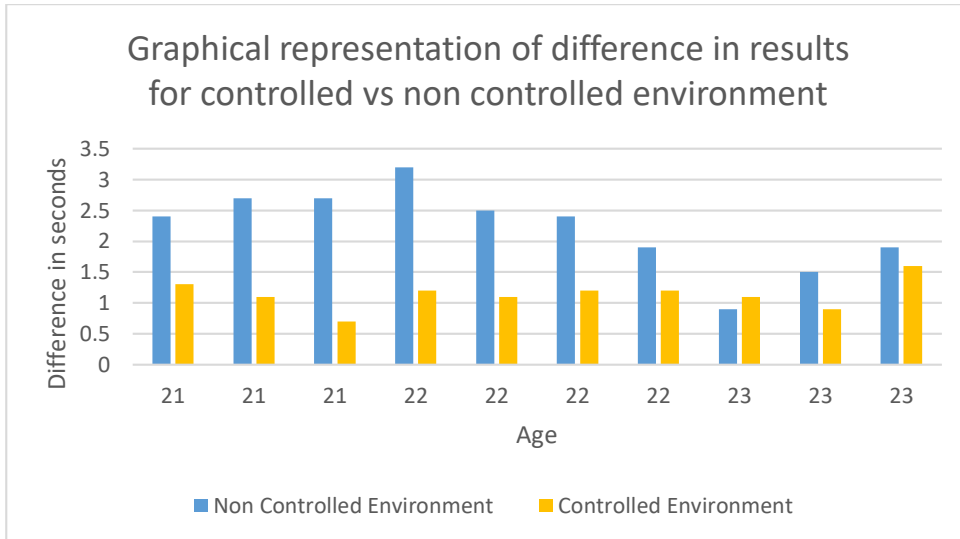
Between the pre and post tests, Group A and Group B's Illinois Agility Test scores declined. According to this, the intervention had an effect on both groups. Group A: The mean difference is 2.21 seconds, which is higher than the mean difference for Group B, which is 1.14 seconds. This suggests that Group A has improved their agility more significantly. The p-value of 0 validates the statistical significance of the improvement in agility, and the t-value of 8.9 (positive) shows a significant change over time. Group B: The average difference is 1.14 seconds, which indicates a slight increase in agility over Group A. This change is statistically significant, as shown by the t-value of 5.85 and the p-value of 0.

The larger mean difference and higher t-value revealed that Group A had improved agility more than Group B. According to the statistically significant results ($p < 0.05$ for both groups), both groups' agility scores were positively impacted by the interventions or conditions that were administered to them.

Group	variables	Mean±S.D	Mean±S.D	mean diff	t values	p values
		week0	week4			
A	Illinois Agility Test	27.81±0.84	25.6±1.07	2.21	8.9	0
B	Illinois Agility Test	28.33±0.74	27.19±0.77	1.14	5.85	0
paired T- test result in within Both Group						

An unpaired t-test comparing agility performance (as determined by the Illinois Agility Test) across groups A and B at two time points—Day 1 (pre-test) and Week 4 (post-test)—is shown in this table. At the beginning, Group A's agility scores were somewhat higher than Group B's (27.81 vs. 28.33 seconds). Scores increased for both groups, but Group A's improvement was greater (from 27.81 to 25.6 seconds) than Group B's (from 28.33 to 27.19 seconds). With Group A showing a higher improvement in agility, the unpaired t-test verifies a significant difference in performance improvement between the groups.

	Group A		Group B			
variables	Mean±S.D		Mean±S.D		t values	p values
Illinois Agility test	Day 1	week 4	day 1	week 4		
	27.81±0.84	25.6±1.07	28.33±0.74	27.19±0.77	6.61	0
unpaired T- test result in between groups						



Discussion:

Group A scored 27.81 seconds on average for agility at baseline (Week 0), with a standard deviation of 0.84 seconds. This score represents the contestants' starting degree of agility. Following four weeks of intervention, the average agility score increased to 25.6 seconds with a 1.07-second standard deviation. The 2.21-second mean difference suggests a significant improvement in agility. The statistical significance of this shift is confirmed by the p-value of 0, which implies that the observed improvement is not the result of chance. The t-value of 8.9 highlights the noteworthy improvement.

Group B baseline mean agility score was marginally higher than Group A, at 28.33 seconds with a standard deviation of 0.74 seconds. The average agility score dropped to 27.19 seconds by Week 4, with a 0.77-second standard deviation. Improvement is seen in the mean difference of 1.14 seconds, however not as much as in Group A. Although it is less than in Group A, the t-value of 5.85 shows a significant influence of the intervention. It is confirmed that this improvement is statistically significant by the p-value of 0.

From the pre-test to the post-test, both groups' agility scores decreased, indicating the efficacy of the intervention. But Group B's mean difference of 1.14 seconds was less significant than Group A's 2.21 seconds. This implies that the agility improvement in Group A was more pronounced. Group A's higher t-value (8.9) than Group B's (5.85), which suggests a larger effect size, supports the finding that Group A gained more from the intervention. The statistical significance of the improvements is confirmed by the p-values of 0 for both groups, which offers compelling proof of the effectiveness of the intervention.

CONCLUSION:

The mean difference between Group A's baseline agility score of 27.81 seconds and their improved score of 25.6 seconds was 2.21 seconds. It is confirmed that this improvement is statistically significant and not the result of chance by the t-value of 8.9 and the p-value of 0. At baseline, Group B's mean agility score was 28.33 seconds; by Week 4, it had improved to 27.19 seconds, with a mean difference of 1.14 seconds. Additionally, the p-value of 0 and the t-value of 5.85 show a statistically significant improvement. In contrast, the greater mean difference and higher t-value indicated that Group A had improved agility more significantly than Group B. These results show that the intervention was generally effective, with Group A being affected more strongly.

Limitations:

The findings' ability to be applied broadly is restricted by the limited sample size. Finding the elements causing Group A to perform better than the others is difficult due to the lack of specific information regarding the interventions in each group. No long-term follow-up data to determine whether the agility gains were maintained over time.

Future Recommendations:

- 1 A larger sample size is necessary for future research in order to improve generalizability.
2. Giving thorough explanations of the training procedures will facilitate replication and improve comprehension of their efficacy.
3. Research can look into whether helping kho kho players become more agile through focused training lowers their risk of getting hurt.
4. Analysing how well agility gains hold up over several months or years would yield insightful information.

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