Frontiers in Health Informatics
ISSN-Online: 2676-7104
www.healthinformaticsjournal.com
2024; Vol 13: Issue 3
Open Access

Effects of Combination of Unilateral and Plyometric Exercise in Comparison to Bilateral Exercise on Performance-Related Components of Male Kho-Kho Players

Ku .Ritu Sharma[1] Dr. Rakesh Bhart[2] ,Dr. Devendra Prakash[3] ,Dr. Sunil Kumar[4], Dr Ajay Kumar[5], Dr Jaipal[6]

[1]Research Scholar, Lovely Professional University, Phagwara Punjab, India
[2]Associate Professor, Lovely Professional University, Phagwara Punjab, India
[3]Gandhi Smarak Degree College,Surjan Nagar Moradabad,India
[4]Associate professor ,RMP College ,University of Lucknow UP
[5]Assistant Professor ,Chhotu Ram College of Education Rohtak
[6]Assistant Professor of Physical Education ,Government college Sampla,Rohtak Haryana
Corresponding Author – Dr. Rakesh Bharti
ORCID - https://orcid.org/0000-0002-3831-6460
Mail Id – dr.raakeesh@gmail.com

Cite this paper as: Ritu Sharma, Rakesh Bhart , Devendra Prakash ,Sunil Kumar, Ajay Kumar, Jaipal (2024) Effects of Combination of Unilateral and Plyometric Exercise in Comparison to Bilateral Exercise on Performance-Related Components of Male Kho-Kho Players . *Frontiers in Health Informatics, 13* (3), 10200-10213

Background *–Plyometrics is defined as the exercises that enable a muscle to reach maximum force in a short period of time. Plyometric training is a series of explosive body weight resistance exercises using the stretch-shortening cycle (SSC) of the muscle fibre to enhance physical capacity such as increasing musculotendinous stiffness and power(Dick 2014). A unilateral exercise movement is when each limb works independently of the other to create the desired movement. Unilateral training is any form of movement that trains one limb at a time, rather than both arm or leg simultaneously (Avetisya 2022)".*

Aim *-In contrast to a traditional bilateral-based training program, the current study intends to investigate the effects of unilateral and plyometric exercises on performance-related components (power, speed, and agility) of male Kho-Kho players.*

Methodology *-Thirty male Kho-Kho players, ages 19 to 24, who were enrolled in Bareilly City colleges, UP ,India were among the participants. They were grouped in three group off and assigned at random to either a bilateral , unilateral , control group eight-week training program. Before and after the eight-week training, there were pre- and post-tests.*

Result -*After eight weeks of training, athlete's double leg side jump, 50-meter sprint, and T-Agility Test scores improved in comparison to the pretest results.The main findings of this study suggests that the use of a unilateral plyometric exercises and bilateral exercises as part of a comprehensive eight week offseason strength and conditioning program can improve power measured double leg side jump, 50 meter sprint speed, and Agility T-Test for agility of Kho-Kho players.*

Key Words *– Unilateral , Bi Lateral , Plyometric Exercise*

INTRODUCTION

Physical activity is defined as any bodily movement produced by skeletal muscles that results in energy

expenditure. Physical activity in daily life can be categorized into occupational, sports, conditioning, household, or other activities. Exercise is a subset of physical activity that is planned, structured, and repetitive and has as a final or an intermediate objective the improvement or maintenance of physical fitness (Farley & Stein 2020)

"A specific set of attributes possessed by an individual, which allows her/him to perform physical activity with energy, and in the absence of undue fatigue,". There are components of physical fitness that are related to performance. These six elements, which include (1) agility, (2) coordination, (3) balance, (4) power, (5) reaction time, and (6) speed, are used to measure particular skill sets (Westerterp 2018).

Ferreira (2014) The indigenous people's symbolic patrimonial heritage includes indigenous games. The Latin term "indigena," which meaning "native," is exactly where the word "indigenous" originates. The term "indigenous" actually refers to a particular physical region, which may or may not be very large. This also applies to live things that are born or develop in environments where they truly belong. When it comes to humans, it has a feeling of connection to the first known occupants of a certain location, particularly one that was colonized. The Merriam-Webster dictionary defines indigenous as not simply something that is native, but also something that has never been imported. Therefore, games created in a particular location or culture might be referred to as indigenous games.

With origins in the state of Maharashtra (Marathi Kho-Kho), Kho-Kho is a team sport in which opponents must avoid making contact. The game, which was once called Rathera because it was played on Indian chariots (raths), has evolved into a variation of tag, a modified version of "run-and-chase," where the object is to chase, pursue, and touch the opponent (Saha 2022). Due to the intense and combative character of the game, individual Kho-Kho players need to possess the following qualities: stamina, endurance, strength, and agility, as well as the ability to dodge, feint, and burst into speed. The sport requires endurance and strength, which can be maintained through running, skipping, and weightlifting. Because the game is complex and tactical, players with mesomorphic somatotypes, good muscle development, and superior anaerobic and aerobic fitness outperform other games players (Roy, Ashim 2017). The reason the game has gained popularity is that it only requires wooden posts, string, a measuring tape, and a stop watch, and it still develops strength, stamina, and agility—all of which are put to the test during the game's 45-minute duration.

In India, Kho-Kho is a well-liked sport, particularly in rural areas and in schools. It's an inexpensive, simple-to-play game that needs very little space and equipment. Additionally, it is a game that nurtures social skills, cultural values, mental clarity, and physical fitness (Ravindra, Gouda &Virupaksha, 2016). With a sizable and devoted fan base, Kho-Kho hosts numerous competitions and events at all levels, from district to national. The government and the sports authorities have also acknowledged and supported Kho-Kho, and numerous steps have been made to advance and grow the game. For instance, the Kho-Kho Federation of India (KKFI) was established in 1955 with the goals of policing the game, holding both domestic and international tournaments. In order to find and develop young talent, the KKFI has also started a number of initiatives and leagues, including the Kho-Kho Excellence Center, Kho-Kho Premier League, Kho-Kho Talent Hunt, and Kho-Kho Scholarship Scheme.

“A unilateral exercise movement is when each limb works independently of the other to create the desired movement. Unilateral training is any form of movement that trains one limb at a time, rather than both arm or leg simultaneously (Avetisya 2022)”. Unilateral training is the performance of a movement or an exercise using a single arm or a single leg. Many of our go-to exercises, like a bench press, have both limbs doing the same movement at the same time. While this can be a great muscle

strengthening exercise, it does not replicate real-life movements. Unilateral training involves the performance of physical exercises using one limb instead of two. Such exercises should be considered as being distinct from bilateral, two limbed, exercises. For example, unilateral squats use one leg, and bilateral squats use two legs. A unilateral bench press uses one arm and a bilateral bench press two arms. Depending on the exercise, this may also entail using different equipment i.e. a dumbbell instead of a barbell. Unilateral exercise is commonly involved in comprehensive training regimes and especially those of professional sports people and athletes. Usually it is used in addition to bilateral training as opposed to instead of it. Unilateral training can yield numerous benefits including improving a person's muscle balance between the left and right sides of their body, improving their sense of balance, and helping to avoid or rehabilitate injury.

Bilateral means "both sides." Bilateral coordination is using both sides of the body together in an activity. A bilateral exercise movement is when both limbs are used in unison to contract the muscles, which creates force, and subsequently moves a given load (Avetisyan ,2022).

Plyometrics is defined as the exercises that enable a muscle to reach maximum force in a short period of time. Plyometric training is a series of explosive body weight resistance exercises using the stretch-shortening cycle (SSC) of the muscle fibre to enhance physical capacity such as increasing musculotendinous stiffness and power(Dick 2014). It is a quick, powerful movement involving pre-stretching the muscle tendon unit followed by a subsequent stronger concentric contraction. This process of muscle lengthening followed by rapid shortening during the SSC is integral to plyometric exercise (Zatsiorsky ,Kraemer , Fry , 2020). The SSC process significantly enhances the ability of the muscle-tendon unit to produce maximal force in the shortest amount of time. These benefits have prompted the use of plyometric exercise as a bridge between pure strength and sport-related power and speed. Plyometric exercise is a popular form of training used to improve athletic performance (Chmielewski, Myer, Kauffman, Tillman 2006).

Power is the amount of work produced by the body per unit of time and can be calculated as the product of force and velocity (Hedrick, 1993).

Strength is the ability to exert force under a given set of conditions defined by body position, the body movement by which force is applied, movement type (concentric, eccentric, isometric, plyometric) and movement speed (Harman, 1993).

Speed is the magnitude of a velocity irrespective of direction.

Agility is the ability to quickly change direction of motion while maintaining proper balance.

Measures and Instruments

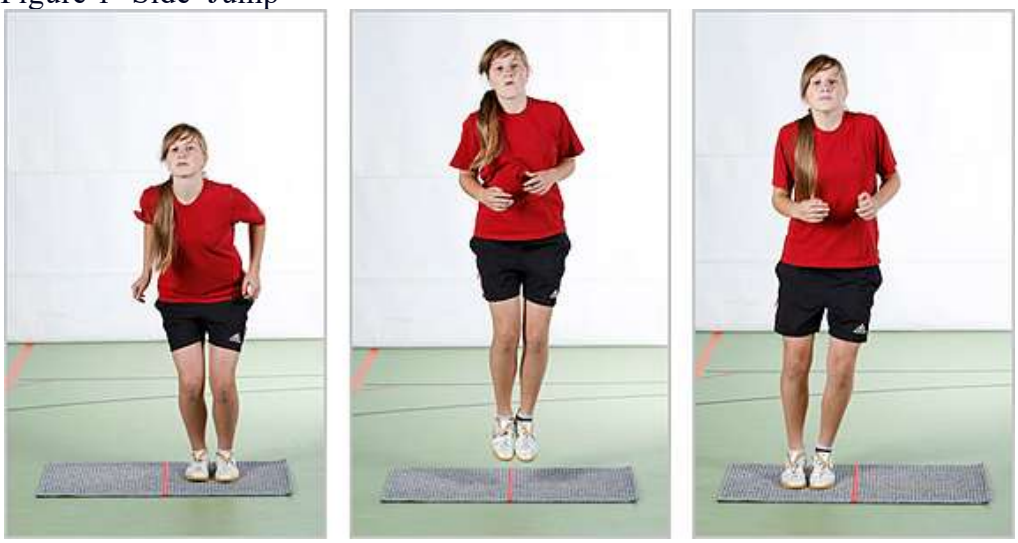
The single leg side jump, which measures power output, the 50-meter sprint, which measures acceleration and maximal sprinting speed, and the T-Test, which measures agility, were the particular variables and tests that were used. A more detailed description of the measurement methods is given below.

Side Jump

For this study, we conducted a side jump test. The players hopped from side to side on both limbs . Hands were placed behind their back. The object of this test is to jump back and forth sideways across the center line of a carpet mat with both legs at the same time as quickly as possible within 15 seconds. The center line is not to be touched or crossed. Five trial jumps will be allowed prior to the start of the test. The test person has two test attempts. There is a break of one minute between the test attempts. The number of jumps performed in two valid attempts, each lasting 15 seconds, is recorded. The average of both attempts is evaluated. Space requirements for side jump: 2 m2

with stopwatch, non-slip carpet mat (2 cm x 50 cm x 50 cm) with center line, double-sided tape or armor tape to attach the carpet mat.

Figure 1- Side Jump



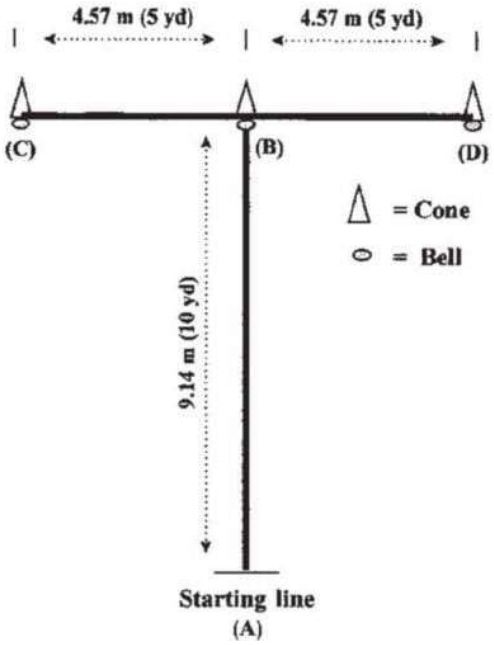
50 Meter Sprint

We used stopwatch for the speed and agility components of this study. In this particular study, the researchers measured the distance of 50 meters across the field and marked it with cones to measure the 50-meter sprint. After three sprints, the fastest time was recorded for each student-athlete.

T-Test Agility Test

The T-Test agility test was used to measure agility in this research (Figure 2). A popular test known for measuring 4-dimensional agility and body control—that is, the capacity to quickly change directions while maintaining balance and maintaining speed—is the T-Test. The test is set up in the form of a "T," with three cones spaced five yards apart, and a starting point ten yards away. Starting at the starting line, the competitors run forward 10 yards to touch the cone, shuffle left 5 yards to touch the cone, shuffle right 10 yards to touch the cone, shuffle back 5 yards to the left to touch the middle cone, and then run backwards.

Figure 2 - T-Test Agility Test



METHODOLOGY

Study Design

This study was a quasi-experimental, quantitative design that assessed two different training programs on athlete's speed, power, and agility that have been demonstrated to have a significance to on-field Kho-Kho performance.

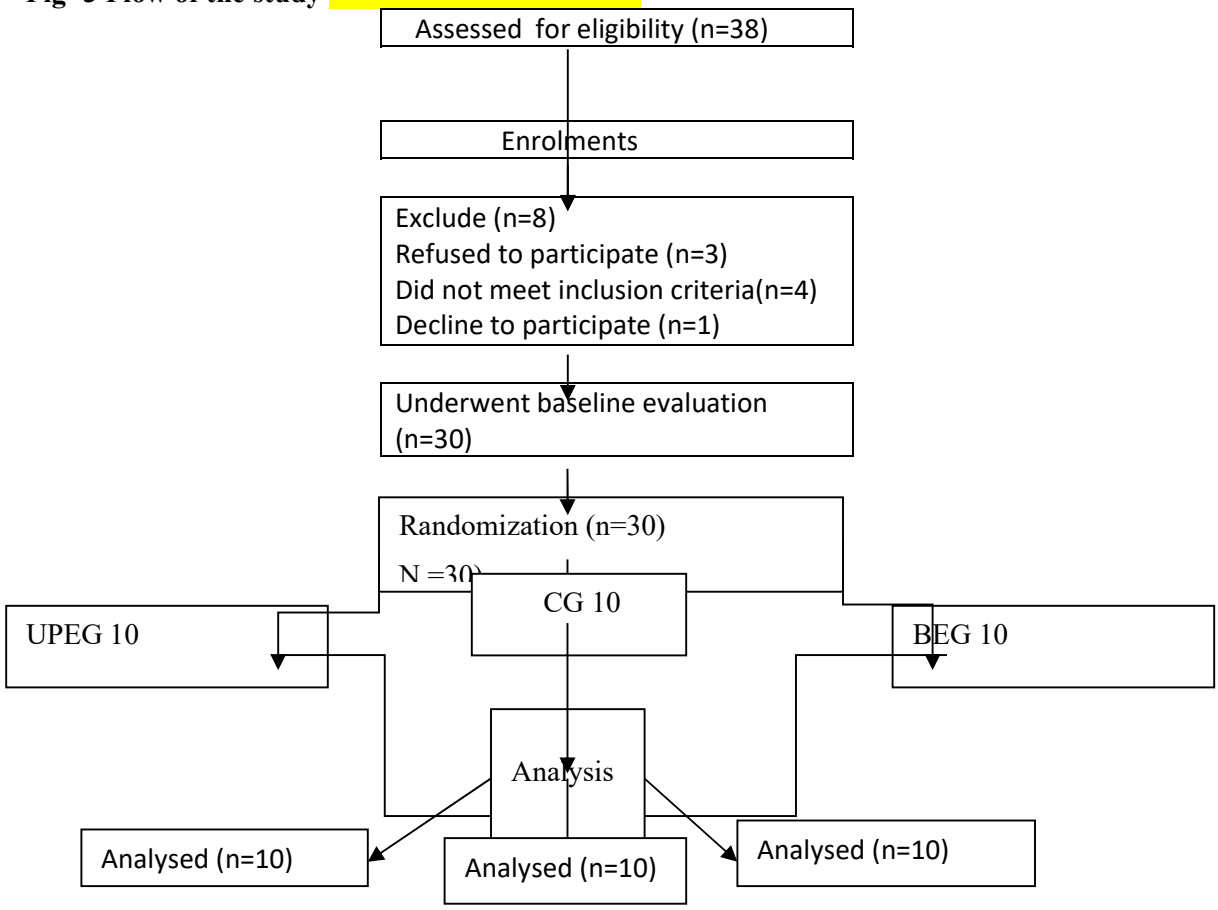
Participants

38 male Kho-Kho players, ages 19 to 24, who were enrolled in Bareilly City colleges, volunteered to take part in the study. The predetermined inclusion criteria included having a body mass index (BMI) of more than 25 kg/m2, not smoking, not having any cardiovascular conditions, such as diabetes, not having a history of liver dysfunction, renal impairment, endocrine disorders, or using weight-loss pills, and not engaging in regular, systematic physical exercise (more than one session per week). Due to their failure to meet the inclusion criteria, eight participants were not included in the study.

In our study, participants underwent a detailed initial screening process, after which they were allocated to one of three groups of n=10 each: unilateral and plyometric exercise group (UPEG), bilateral exercise group (BEG) and control group. The exclusion of 8 participants was due to their inability to complete the training program for various personal reasons, including time constraints, logistical challenges in attending the training center, and loss of interest in the program. While we recognize that this deviates from the intention-to-treat analysis framework, we believe it was necessary to ensure the accuracy and reliability of our data. This exclusion has been carefully

considered in the context of the study's internal validity, and we have already taken measures to mitigate participant's attrition from negatively impacting on the trial's outcomes. The figure 1 further explains the flow of the study.

Fig -3 Flow of the study



Procedure

Specifically, we examined power with a double leg side jump and, speed with the 50 meter sprint, and agility with the T-Test Agility Test. All of these variables were assessed before and after the training cycle to measure the results and compare the two groups. We then analyzed the percentage of change between the pre-tests and post-tests on all of the metrics and then determined which training group had the most improvement in relationship to their strength and power program. To control for the other factors, the player's age, training age and playing experiences were collected through a questionnaire as auxiliary variables. The training programs for the unilateral and bilateral groups are detailed below, sharing identical intensity and duration

Training Program

The training program for this study lasted 8 weeks long and took place during the offseason for the Kho-Kho teams. The participants followed the specified lifting/plyometric programs 3 days a

week for the first 4 weeks and then 2 times per week the second 4 weeks when they start to have team Kho-Kho practice. Each training session included a total-body lift with the lower body portion being completed in the beginning of the workout so that the individuals were fresher and since the lower body development has been determined as more critical for Kho-Kho performance. For each lift day, the dynamic warm-ups included the same for both groups with a combination of hip mobility, glute activation, knee stability, and ankle mobility exercises. Once the dynamic warm up is completed, the groups moved onto the main movements. The unilateral and plyometric exercise group training programme movements are described in table 1 and in table 2 bilateral exercise group training programme are described

Table- 1

EIGHT WEEK'S PROGRAMME PLYOMETRIC AND UNILATERAL WORK

20 Yard DYNAMIC WARMUP	Jog - Walking Butt Kick - Walking HighKnee - Skip for Height- Lateral Hop - Arms Extended Rotation - Sprint 10 meter sprint x 5

DURATION	PLYOMETRIC EXERCISE	SETS	REPETITION	RECOVERY BETWEEN THE SETS	INTENSITY	TRAINING METHOD
1 & 2 WEEK	1. Lateral Jump 2. Burpee 3. Single Leg tuck jump	3	20 - 25	120 SECONDS	100%	
3 & 4 WEEK		3	20 - 25	120 SECONDS	100%	Isotonic Method: Lateral Jump, Burpee
5 & 6 WEEK		3	25-30	60 SECONDS	100%	Isometric Method: Leg tuck jump
7 & 8 WEEK		3	25-30	60 SECONDS	100%	

DURATION	UNILATERAL EXERCISE	SETS	REPETITION	RECOVERY BETWEEN THE SETS	INTENSITY	TRAINING METHOD
WEEK 1 & 2	1.Trap Bar Deadlifts 2.Bridge / Hip	3	20 - 25	60 SECONDS	50% to 60%	

WEEK 3 & 4	Thrusts 3.Barbell Front Squats	3	20 - 25	60 SECONDS	60% to 70%	Isotonic Method: Trap Bar Dead lifts; Barbell Front Squats
WEEK 5 & 6		3	25-30	120 SECONDS	60% to 70%	Isometric Method: Bridge / Hip Thrusts
WEEK 7 & 8		3	25-30	120 SECONDS	70% to 80%	

Note: 1. Before Training Dynamic warm – up and after training cool – down is compulsory.
2. Slightly Changes in load and volumes according to the fitness level of the subjects.

Table 2

EIGHT WEEK'S PROGRAMME BILATERAL WORK

20 Yard DYNAMIC WARMUP	Jog - Jumping Jacks- Walking Knee Hugs- Lunges with a Twist - Lateral Hop - Arms Extended Rotation - Sprint 10 meter sprint x 5

DURATION	UNILATERAL EXERCISE	SETS	REPETITION	RECOVERY BETWEEN THE SETS	INTENSITY	TRAINING METHOD
WEEK 1 & 2	1.Push-Ups 2.Pull- Ups 3.Over Head Press	3	20 - 25	60 SECONDS	100%	Isotonic Method: Push-Ups; Pull- Ups; Over Head Press
WEEK 3 & 4		3	20 - 25	60 SECONDS	100%	
WEEK 5 & 6		3	25-30	120 SECONDS	100%	
WEEK 7 & 8		3	25-30	120 SECONDS	100%	

Note: 1. Before Training Dynamic warm – up and after training cool – down is compulsory.

2. Slightly Changes in load and volumes according to the fitness level of the subjects.

Table 3- Unilateral and Plyometric exercise group training programme

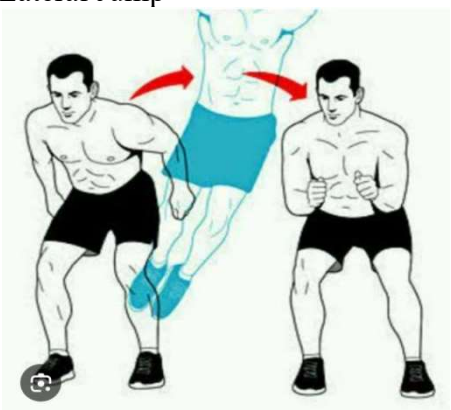
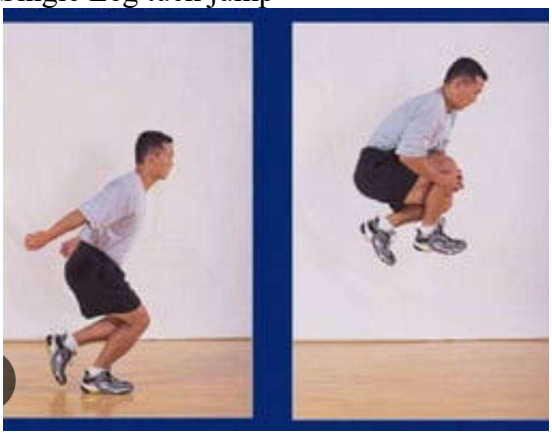
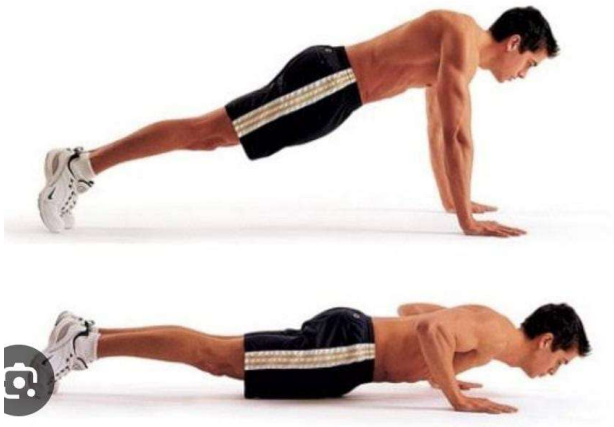
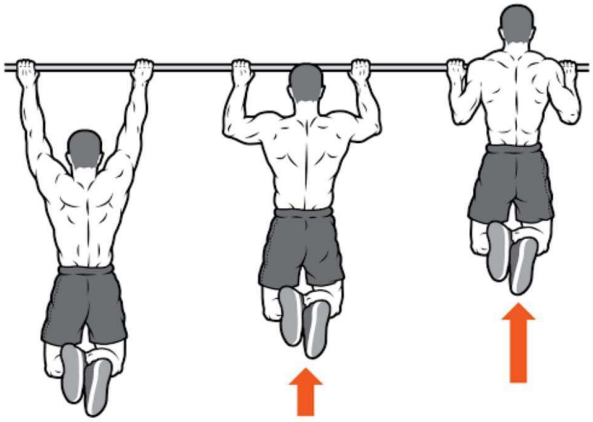
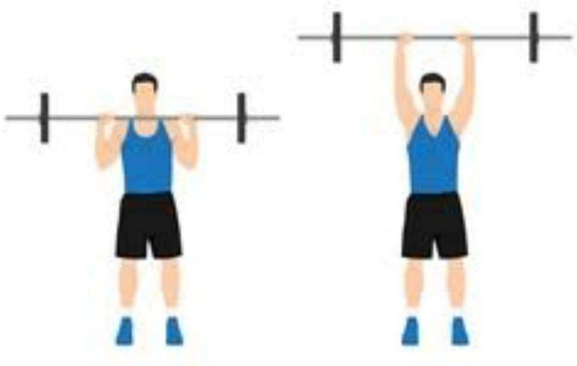
Unilateral exercise	Plyometric exercise
Trap Bar Deadlifts 	Lateral Jump 
Glute Bridge / Hip Thrusts 	Burpee 
Barbell Front Squats 	Single Leg tuck jump 

Table 4- Bilateral exercise group training programme

Push-Ups 
Pull- Ups 
Barbell front Squat 

DATA ANALYSIS

The following data analysis techniques were used. First, a descriptive data analysis was conducted to report the player's background as well as performance data and normality and variability of the variables. Secondly, a correlation analysis was conducted to check the level of correlation between the dependent variables- agility, power, and speed.

RESULTS

The purpose of the present study was to examine the effects of a unilateral and plyometric exercise group (UPEG) versus bilateral exercise group (BEG) versus control group program implemented into an offseason program for collegiate Kho –Kho players players. It was hypothesized that a unilateral and plyometric exercise program would increase power measured in the double leg side jumps, speed measured in the 50 meter sprint, and agility in the T-Test compared to a bilateral exercise group utilizing bilateral-based program and control group.

Prior to experimental treatment, all the subjects were measured in the performance-related fitness components, such as, agility (T-Test agility test), speed (50 M Run) which formed pre-test scores. After the 8th week, all the three groups were tested on the variables selected, which formed post-test scores. The control group was not given any training. The difference between pre and post-test scores were considered as the effect of the selected experimental treatments. To test the statistical significance of the difference, the obtained pre and post test scores of all the three groups were analyzed using ANCOVA. In all cases, 0.05 level was considered as the level of significance.

Table 5
The ANCOVA results for the study variables

Training Groups	Variables		Pre test			Post test	
		Mean	SD	F ratio	Mean	SD	F ratio
UPEG	Speed	7.73	0.43	1.38*	7.78	0.43	1.89*
BEG		7.76	0.48		7.83	0.37	
CG		7.69	0.53		7.70	0.52	
UPEG	Power	1.45	0.23	2.39 *	1.52	0.22	2.40*
BEG		1.49	0.29		1.51	0.27	
CG		1.43	0.25		1.43	0.25	
UPEG	Agility	10.42	0.58	2.90*	10.67	0.68	2.94*
BEG		10.56	0.54		10.71	0.51	
CG		10.48	0.42		10.48	0.42	

Figure 4. Side Jump results in meter pre and post-test following the 8 week

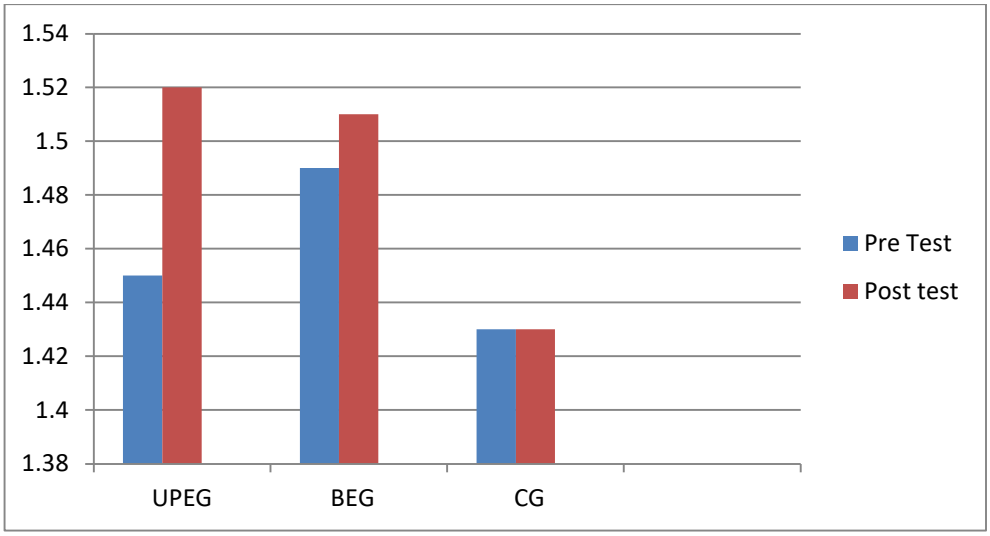


Figure 5. 50 meter sprint (seconds) pre and post-test following the 8 week

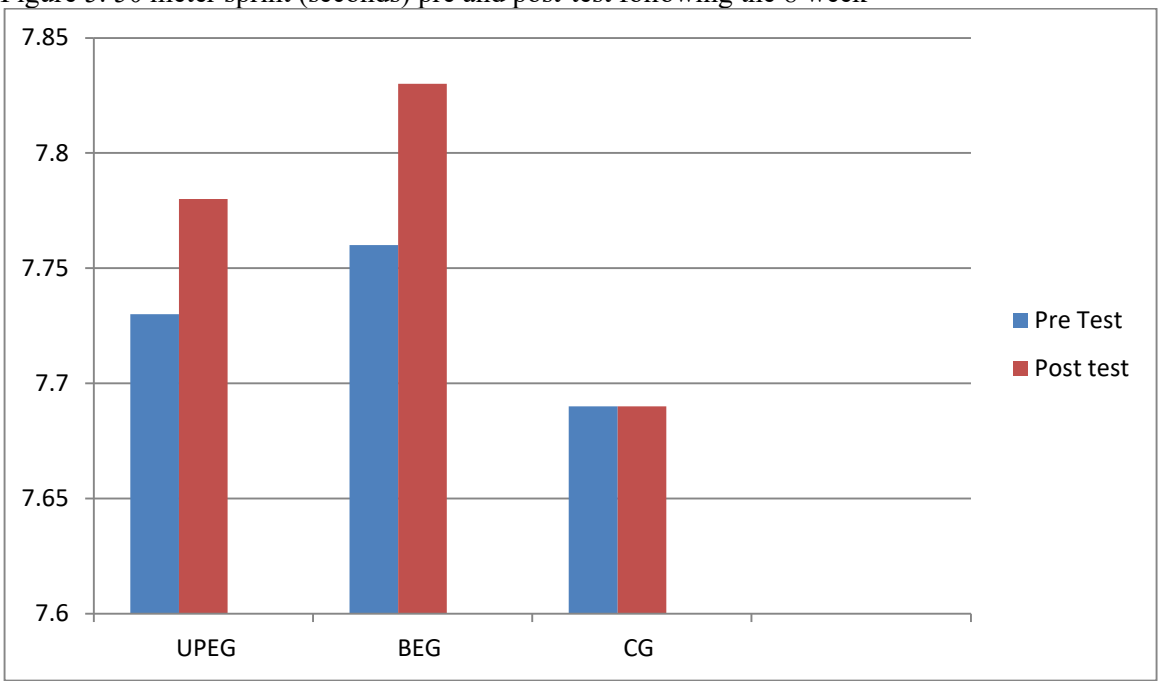
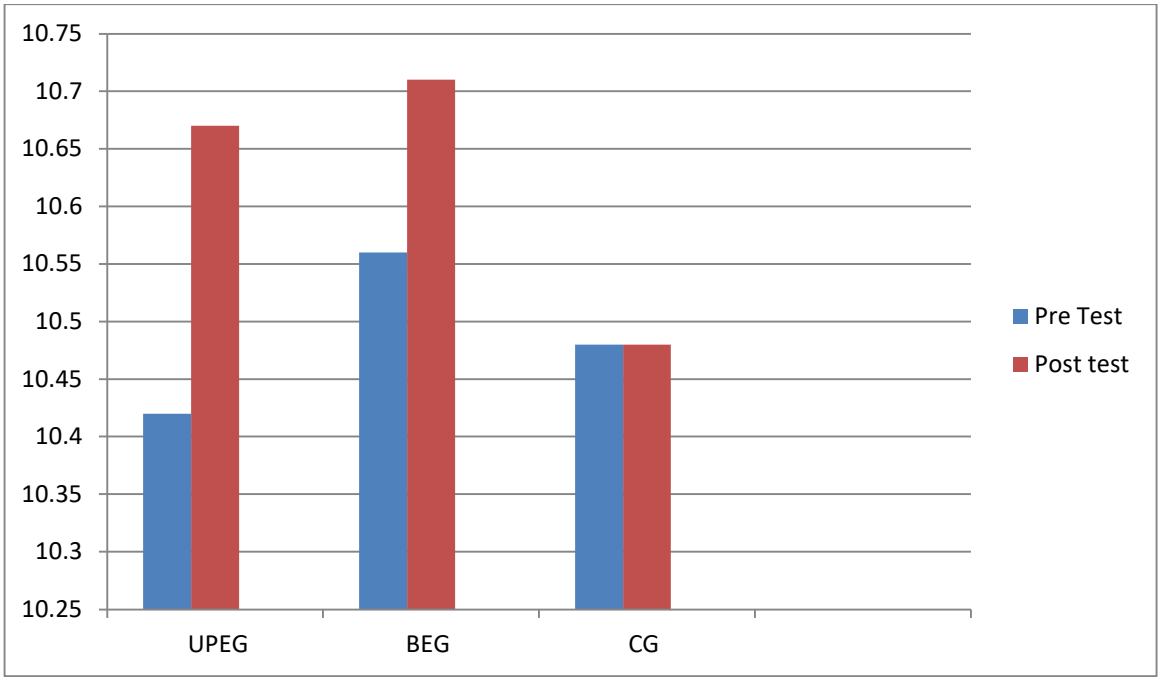


Figure 6. T-Test (seconds) pre and post-test following the 8 week



The data reveals the pre-test mean (M) + Standard Deviation (SD) on speed of UPEG, BEG, CG which was 7.73+0.43; 7.76+0.48; 7.69+0.53 respectively. The obtained F ratio was significant which indicates significant difference in the means of the groups at the initial stage. The post-test M+SD on speed of UPEG, BEG, CG was 7.78 + 0.43; 7.83 + 0.37, 7.70 + 0.52 respectively. The obtained F ratio of 1.89 showed significant difference in the means of the groups after the experimental treatment.
. The data reveals the pre-test mean (M) + Standard Deviation (SD) on power of UPEG, BEG, CG which was 1.45+0.23; 1.49+0.29; 1.43+0.25 respectively. The obtained F ratio was significant which indicates significant difference in the means of the groups at the initial stage. The post-test M+SD on speed of UPEG, BEG, CG was 1.52+ 0.22; 1.51+ 0.27, 1.43+ 0.25 respectively. The obtained F ratio of 2.40 showed significant difference in the means of the groups after the experimental treatment.
The data reveals the pre-test mean (M) + Standard Deviation (SD) on agility of UPEG, BEG, CG which was 10.42 +0.58 ; 10.56 +0.54 ; 10.48+0.42 respectively. The obtained F ratio was significant which indicates significant difference in the means of the groups at the initial stage. The post-test M+SD on speed of UPEG, BEG, CG was 10.67 + 0.68 ; 10.71 + 0.51 , 10.48 + 0.42 respectively. The obtained F ratio of 2.94 showed significant difference in the means of the groups after the experimental treatment

SUMMARY

Results of the eight week intervention using both unilateral-based and bilateral-based lifting and plyometric programs showed an increase in all the performance measures of side jump, 50 meter run, and T test. Both UPEG, BEG showed an increase in power, speed, and agility in comparison to control group . There were significant differences between the pre-test and post-test that could conclude a unilateral plyometric exercises and bilateral exercises training program was effective in improving power, speed, and agility.

CONCLUSION

The main findings of this study suggests that the use of a unilateral plyometric exercises and bilateral exercises as part of a comprehensive eight week offseason strength and conditioning program can improve power measured double leg side jumps, 50 meter sprint speed, and Agility T-Test for agility of Kho-Kho players.

RECOMMENDATION FOR FUTURE RESEARCH

Future studies involving a unilateral training-based lifting and plyometric program for Kho-Kho players, or any athlete, should take into account the following factors in light of the investigation's findings. First, the training program's duration needs to be extended.

Secondly, the frequency of exposure to unilateral (as opposed to bilateral) training should be increased in future research.

Third, different exercises with comparable movement patterns—the only distinction being whether they involve a single or double leg variation—should be used in future studies.

REFERENCES

1. Avetisyan. A. (2022). Effect of cross fit-trainings on the heart rate of adolescent judokas Journal of Sports Medicine, 7,16-18.
2. Chmielewski TL, Myer GD, Kauffman D, Tillman SM. Plyometric exercise in the rehabilitation of athletes: Physiological responses and clinical application. J Orthop Sports Phys Ther. 2006;36(5):308-319.
3. Dick FW. Sports training principles: an introduction to sport science [Internet]. Bloomsbury Sport. 2014
4. Farley JB, Stein J, Keogh JW, Woods CT, Milne N. The relationship between physical fitness qualities and sport-specific technical skills in female, team-based ball players: A systematic review. Sports medicine-open. 2020 Dec;6(1):1-20.)
5. Ferreira, M.B.R. 2014. Indigenous games: A Struggle between past and present. Bulletin: International Council of Sports Science and Physical Education (ICSSPE). 67: 48-54.
6. Gopa Saha.(2022). A Comparative Study on Explosive Strength and Reaction ability between Female Kabaddi and Kho-Kho Players, J Adv. Sport PhysEdu ISSN 2616-8642 (Print) |ISSN 2617-3905 (Online)
7. Harman, E. (1993). EXERCISE PHYSIOLOGY: Strength and Power: A Definition of Terms. Strength & Conditioning Journal, 15(6), 18-21.
8. Hedrick, A. (1993). Strength Training: Literature Review: High Speed Resistance Training. Strength & Conditioning Journal, 15(6), 22-30.
9. Ravindra. S. M, Gouda &Virupaksha,. N. D. (2016) . Psychological Thoughts Of Indian Traditional Games, International Journal of Multidisciplinary Research and Modern Education (IJMRME) ISSN (Online): 2454 - 6119 Volume II, Issue I, pp.116-119
10. Roy, Ashim. (2017). Games and Sports in Ancient India, International Education and Research Journal, Vol. 3(5), May, pp.607-609
11. Westerterp, K, R. Exercise, energy balance and body composition. Eur J Clin Nutr, 2018 ; 72, 1246–50.
12. Zatsiorsky VM., Kraemer WJ., Fry AC. Science and Practice of Strength Training [Internet]. Human Kinetics. 2020