Comparison of Ladder Training Versus Plyometric Training on Agility & Speed among Vadodara Cricket Players: An Experimental Study

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Abstract

Background: Cricket is the second most popular sport in the world, right behind football, and it is played between 105 nations that are members of the ICC. In cricket, speed plays an essential role as the faster the speed generation the more the number of singles taken & saved during fielding. Agility is required in the infield of cricket because fielders are closer to the batsmen and have less time to react. Ladder drills improve footwork & coordination in players performance level which makes players easy to catch, strike or block or tackle. In Agility Ladder, jumps are performed without obstacles & in multidirectional ways with fast ground contact time.

Aim: To compare the effect of Ladder Training versus Plyometric Training on agility & speed among cricket players.

Method: 38 male cricket players (under -19) were selected by convenient sampling. Participants who met the inclusion criteria were randomly allocated into two equal groups: Ladder Training group and Plyometric Training group. Baseline data was collected by Illinois agility test & 40m Sprint test. The training duration was 3 sessions/ week for 6 weeks.

Results: The data was analyzed using paired – t test for within group and Unpaired – t test for between group. Results showed that both the training methods produced significant improvement in agility & speed performance but ladder training method showed statistically significant difference in agility ($p<0.0001$) & speed ($p<0.0002$) than plyometric training.

Conclusion: The present study concludes that Ladder training has an added advantageous effect for improving speed and agility in cricket players over plyometric training.

Keywords: Ladder training, Plyometric training, Speed, Agility, Cricket.

Introduction

Cricket is the second most popular sport in the world, right behind football, and it is played between 105 nations that are members of the International Cricket Council. It has entertained spectators of all ages and genders. Athleticism, talent, and strategy are all required for the bat-and-ball game of cricket.[1]

Cricket is most prominently played in England,

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India, Australia, New Zealand, and South Africa. Cricket is played in three formats: test, one-day, and twenty-twenty (T20).[2] When compared to Test cricket, T20 and one day cricket players require approximately 50-100% more maximal sprints per hour.[2] As a result, speed in cricket is frequently focused on critical match situations such as running between the wickets for batsmen and delivery during fast bowling, so fielder speed is most important.[3] Agility, like flexibility, is required in the infield of cricket because fielders are closer to the batsmen and have less time to react, whereas outfielders require a strong fielding the balls back to the infield with a throwing arm.[3]

In cricket, prominent sites of injury are shoulder (22.85%), lumbar spine (17.14%), knee (11.42%), thigh (8.57%), out of which muscle injuries are 40%, fracture 28.6%, & ligament 11.42%. Injuries during fielding are 42.85% while bowling 40%. At age of 18-24 years injuries are more prone to occur such as 37.14% overuse injuries & 71.42% lumbar spine injury.[4]

In cricket, speed plays an essential role as the faster the speed generation the more the number of singles taken & saved during fielding.[5] Speed ladder drills can be used by all sports as they help to improve speed, agility, leg explosive strength & aerobic capacity.[6] Apart from this, plyometric training drills combined with resistance training also improve speed.[19]

Agility is defined as the ability to change directions while maintaining body control, balance, and speed.[7] Benefits of agility improvement is increase in body stability during quick moments, improved intramuscular control, reduce injury & re-injury risk.[8]According to Barnes & Attaway, (1996); Craig, (2004); Patteiger et al., (1999); Agility training works on motor programming re- enforcement which has effect on neuromuscular conditioning, muscle spindles neural adaptation, golgi tendon organs & proprioceptors in joints.[22-24]

In order to maximize athletic performance, ladder drills are used to improve footwork. It aids in enhancing foot speed, mobility, balance & coordination, agility, power, core and joint stability, strength, proprioception and reaction time.[9] Ladder drill training sessions are engaging when they are carried out rhythmically since this teaches the body and mind how to coordinate different foot movements.[10] A Ladder is composed of two nylon straps and plastic rungs spaced 15-18 inches apart, depending on the training objective. Rope and PVC pipe can be used for making a ladder at home and taping it to ground, just like an agility ladder. Ladder drills improves footwork & coordination in players performance level which makes players easy to catch, strike or block or tackle.[11] In Agility Ladder, jumps are performed without obstacles & in multidirectional ways with fast ground contact time.[12]Basic skills of ladder training are of 4 types: running through ladder, skips, shuffles & jumps/hops also linear & lateral movements.[6]

Plyometric Training (PT) is characterized by rapid muscle stretching (eccentric action) followed by short amortization phase, lastly explosive concentric movement, which enables the synergistic muscles to engage the myotatic – stretch reflex during stretch – shortening cycle. The three phases of plyometric movement are known as the stretch- shorten cycle of muscle work, and they are characterized by two patterns. The first phase of plyometric movement is primarily stretching or eccentric muscle activity, which is marked by a high concentration of elastic muscle energy. The second phase is called the amortization phase and starts at the end of the first phase and ends with the beginning of the concentric muscle action. Finally, the third phase is the final phase of muscle contraction, which is primarily manifested as the jump, hit or throw. These phases of plyometric movement are referred to as the stretch-shorten cycle of muscle work.[13] PT improves agility, stability, balance, speed as athletes aid to increase speed strength ratio which generates more force during quick start & faster propelling off ground.[5]

Although cricket is the most popular sport in India, young players at national level lack a sense of fitness. While skill- related fitness alone is insufficient to perform at a high level as every cricket player concentrates on it. Due to this lack in skills or expertise, Indian trainers continue to use traditional training programs. While globally, ladder training and plyometric training are crucial training techniques of games to improve players speed and agility. However, ladder training and plyometric

training among young cricket players has not been the subject of any research. Thus, the aim of the present study was to compare the effect of ladder training and plyometric training on agility and speed among cricket players of Vadodara.

Materials and Methodology

The 38 players were recruited from Youth Service Center Academy, Vadodara for the study. Convenient & Purposive sampling technique method was adopted. Players were selected based on inclusion and exclusion criteria. Ethical approval was obtained from the Institutional Ethical Committee of KPGU(Reference no. KPGU/KSPR/EC/23/03/27.16, 04/03/2023) and permission was taken from Youth Service Center Academy, Vadodara for the study. Prior to the study, written informed consent signed by participants with their voluntary acceptance & interest. Participants were allocated randomly by chit method in 1:1 ratio either to Ladder Training group or Plyometric Training group. Baseline data was collected and each participant was tested by Illinois Agility Test and the 40-meter Sprint Test prior to the beginning of training and at the end of six weeks with the results recorded in a sheet. Both groups were given Intervention for 18 sessions for 6 weeks. (3 days/week)

Inclusion criteria was under 19-year players, Semi Professional, Male, who were practicing every week for at least 8-10 hours, not enrolled in any kind of research project & fitness program for 6 months and the participants who were willing to participate. While participants who had any history of previous or recent surgery or injuries, any orthopedic deformity, any neurological disorders, recent infection and cancer/ malignant condition were excluded from the study.

Intervention:[2,14-18]

Group A: Participants received Ladder Training

Group B: Participants received Plyometric Training

In Ladder training, the length of the ladder was 520 cm & width 50 cm, distance between blades was 50 cm & number of blades 15.

In Plyometric Training, Cones of 20 cm height were used& the spacing between the cones was 50 cm, number of cones- 15 pieces.

Both the groups carried out 10 minutes warm up & 10 minutes cool down exercises, 20 minutes of Ladder Training or Plyometric Training respectively.

Warm up[2]

Muscles stretched were - gastrocnemius, hamstrings, hip flexor, hip extensor, quadriceps, adductors.

General warm-up consisted of 5 minutes of jogging at a normal pace, followed by a combination of static and dynamic stretching of the subject. The above muscles were given static stretches for 30 seconds and then dynamic stretches for 30 seconds 5 times & 1 set each with a 20-second interval rest for 5 minutes in total.

Cool Down [18]

5 minutes slow jogging followed by static stretching of above muscles for 5 minutes with 5 repetition each 1 set.

The following table shows the exercise intervention for 6 weeks of both Group A and Group B as follows:

Table 1. Exercise Intervention. Group A – Ladder training, Group B- Plyometric training.

Number of weeks	Group A	Group B	No. of repetition
Week 1 & 2	Straight run	Side jump	6 repetition × 2 sets
	Hopscotch	Jump & squat	30 second recovery between repetition
	Single foot hops zigzag pattern	Single leg hop	
	Linear hops	Single leg slalom	60 second recovery between sets
	90 rotations	Ankle hop	

Continue.....

Week 3 & 4	Two-foot run Backward Hopscotch Single foot lateral in & out hops Front to back Serpentine	Double leg lateral cone jump (35 cm) Single leg lateral cone jump (25cm) Scissor jump Front jump Alternate lunges jump	6 repetition × 2 sets 30 second recovery between repetition 60 second recovery between sets
Week 5 & 6	Bunny hops Hopscotch variation Two -foot hops zigzag pattern V pattern 2 in, 2 out lateral run	Double leg hurdle jump (50cm) Single leg hurdle jump (25cm) Single leg forward hop Single leg 2 forward & 1 back Single 90 degree	6 repetition × 2 sets 30 second recovery between repetition 60 second recovery between sets

Outcome Measures

- ILLINOIS AGILITY TEST
- 40 M SPRINT TEST

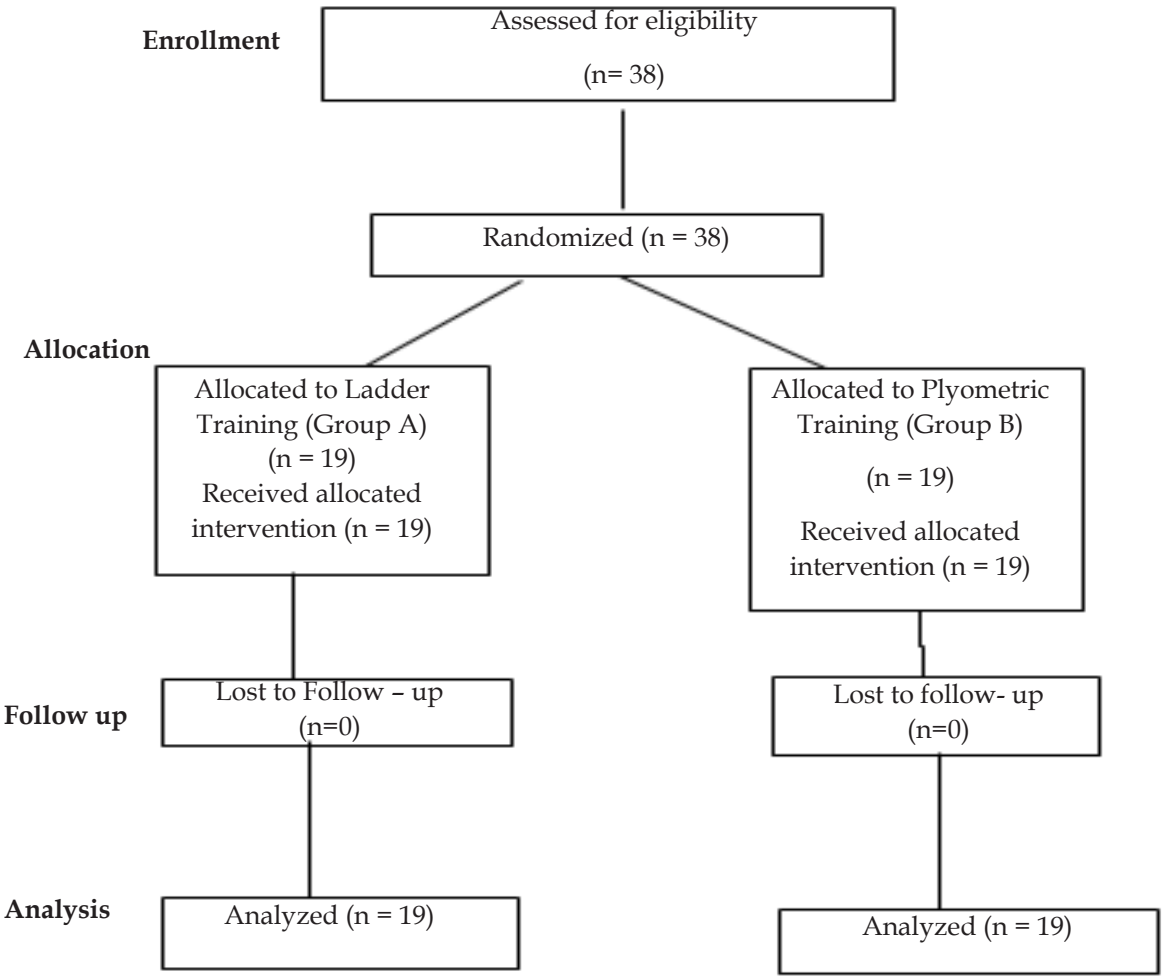

Figure 2: CONSORT Flowchart of the methodology.

Statistical Analysis

Descriptive statistical analysis obtained by using frequency, percentage, mean, SD, median and IQR. Paired t – test was used for the comparison of pre and post data within the group. Unpaired t – test was used for the comparison of data between group A and group B. All the statistical analysis was performed by using IBM SPSS version 29.0.0.

Result

The Group A pre mean value of Speed was 10.53± 1.20 and post mean value 8.97± 0.95 where p< 0.0001, pre mean value of Agility was 13.8± 1.39 and post mean value 11.25± 1.34 where p<0.0001. The Group B pre mean value of Speed was 11.02± 1.16 and post mean value 10.24± 0.93 where p< 0.0001, pre mean value Agility was 14.64± 0.62 and post mean value 13.13± 0.83 where p< 0.0001

Post – intervention, the average Speed in Group A was 8.97 ± 0.95, while the average Speed in Group B was 10.24 ± 0.93. The average Agility in Group A was 11.25 ± 1.34, while in Group B was 13.13 ± 0.83 as per Table 2. The unpaired 't' test showed statistically significant difference in between group analysis.

Table 2: Data represents comparison of post intervention parameters of the Group A and Group B after 6 weeks.

PARAMETERS	Group A Mean & SD	Group B Mean & SD	t – value	p – value
Speed	8.97 ± 0.95	10.24 ± 0.93	4.15	0.0002
Agility	11.25 ± 1.34	13.13 ± 0.83	5.17	0.0001

Discussion

The study was aimed to compare the effectiveness of ladder training and plyometric training on agility & speed among cricket players.

38 male cricket players (under -19) were allocated into two equal groups randomly. Group A were given Ladder Training and Group B was given Plyometric Training.

When compared to both the groups, group A showed significant improvement in improving Agility than group B. In group A, the post mean Agility value was 11.25 ± 1.34, & In group B, the post mean Agility value was 13.13 ± 0.83. Improved Agility in group A could be possible due to several factors i.e during exercise, the muscle becomes more elastic and improves joint mobility which allows leg to swing in the steps. Muscle flexibility also enhances muscle extension, allows stronger and faster muscle contraction which helps to complete the steps quickly. Including dynamic balance in training aids body control during movements and improves agility. The way the body adjusts to training and how the brain processes movement both contribute to gains in agility enhancement. The speed at which muscles contract increases due to changes in muscle fiber or quick twitch. The muscle fibers enhance the muscular contraction speed leading to rise in agility level.[20]

Our study's findings were confirmed to be in line with those of K Venkata Surya Prakash et al. (2021). An experimental and control group of sixty kabaddi players participated in the research. Performance, speed, and agility were the main training objectives for both groups. Comparing ladder training to other regular training methods like plyometric training, they suggested that ladder training can be beneficial, efficient, and performance-oriented.[9]

When compared to both the groups, group A showed significant improvement in improving Speed than group B. In group A, the post mean Speed value was 8.97 ± 0.95, & in group B, the post mean Speed value was 10.24 ± 0.93 had shown statistically improvement. Improved Speed in group A could be possible due to several factors i.e there is an innervation adaptation which is based on the extent to which the muscles can be recruited by the CNS and the pace at which the muscles can be excited by motion.[19]

Increased neural drive to agonist recruitment, better neuronal firing rates and more synchronization in the timing of neural discharge (intermuscular coordination, reduction in inhibitory processes) are the ways in which the neurological system can produce more force. Potential neural adaptation

locations that may lead to an enhanced neural drive, neuronal firing rate or synchronization include: the motor cortex, descending corticospinal tract, golgi tendon organ and the neuromuscular junction. Both learning new motor skills and aiming to exert maximum force cause an increase in motor cortex activity. The agonist and antagonist may be more synchronized as a result of motor learning via ladder training (LT), which would ultimately improve performance.LT workouts mimic sprint and change of direction (COD) performance motions, which could have improved change of direction (COD) and sprint performance. The descending corticospinal tract adjusts by myelinating neurons to speed up neural input. The rate of force development (RFD) may increase if the information from the motor cortex reaches the targeted muscle more quickly. The acetylcholine receptors, perimeter length and total length of nerve terminal branching all increase as the neuromuscular junction adapts. This adaptation might speed up and increase the amount of neuronal input which would result in a contraction with more force and higher RFD.[21]

Hence, the study concluded that Group A is more effective than Group B, as during ladder training exercises may have produced more applicable and useful motor programs that manage the complex intramuscular coordination needed for the speed and agility.

Conclusion

The Objective of the study was to compare the effectiveness of Ladder training versus Plyometric training on agility & speed in cricket players. Study concludes that Ladder Training was more effective than Plyometric training in improving agility & speed in cricket players. Hence, the alternate hypothesis was accepted and the null hypothesis was rejected. Both the techniques are almost equal in their clinical effectiveness for improving agility & speed and that either of the techniques may be used in clinical practice for improving agility & speed.

The limitation of the present study was sample size was small so couldn't be generalized to the whole cricket players population, smaller geographical area was covered, smaller age group was taken, only male cricket players were included and no long term follow up was taken.

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