

Sports Physiotherapeutic Benefits of Plyometric versus Swiss Ball Push-Up on Amateur Cricket Fast Bowlers

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Abstract: Over the past decade, there has been an increase in interest & participation in sports like cricket. Throwing plays an important role in cricket. Numerous accurate powerful throws are made during the course of the match. To be a successful cricket player it is necessary for the athlete to be capable of throwing ball with power & accuracy from one point to the next point of play. The Objective of the study to find out the Sports Physiotherapeutic Warm-up Benefits Of Plyometric versus Swiss Ball Push-Up Amateur Cricket Bowlers the results In group A for throwing distance the calculated paired 't' value is 14.52 and 't' table value is 2.861 at 0.005 level. Since the calculated 't' value is more than 't' table value above study shows that there is significant difference in throwing distance following plyometric pushup among Amateur Cricket fast Bowlers. The calculated paired 't' value is 1.98 and the paired table 't' value is 2.861 at 0.05 level of significance. Hence, the calculated 't' value is less than the table 't' value there is no significant difference in accuracy following swiss ball push-up in Amateur Cricket fast Bowlers. The results from the present study are very encouraging and demonstrate the benefits of plyometric push-ups in improving throwing distance as compared ball push-ups. Thus, plyometric push-ups can be incorporated into training programs of fast bowlers in cricket for enhancing their performance levels.

Keywords: Plyometric Push-Up, Swiss Ball Push-Up, Amateur Cricket Fast Bowlers.

1. INTRODUCTION

Over the past decade, there has been an increase in interest & participation in sports like cricket. Throwing plays an important role in cricket. Numerous accurate powerful throws are made during the course of the match¹. To be a successful cricket player it is necessary for the athlete to be capable of throwing ball with power & accuracy from one point to the next point of play. An effective throw is the result of a combination of good technique & the contribution of several physical factors, including the core stability, range of motion, limb length, anthropometric measurements, & isokinetic factors². Cricket player needs more momentum & more power because the ball travels at much faster speed & over a much further distance

It has been assumed previously that increasing muscle strength will increase throwing speed³. The strength of shoulder adductors, wrist extensors and elbow extensors had predicted throwing speed. The overhead motions such as throwing, javelin throw, servicing in tennis etc. are highly skilled movements. Such movements require flexibility, muscular strength, coordination, synchronization and neuromuscular control of arm⁴.

Amateur Cricket Bowlers can suffer from a range of overuse injuries associated with all aspects of the game including running, throwing, batting and bowling. Throwing involves repetitive twisting, extension and rotation in a short period while body tissues and footwear must absorb large ground reaction forces. However, it is the speed and the force of the action that singles throwers out as being particularly prone to injury⁵. The throwers use one of two bowling techniques

or a combination of these, known as side-on, front-on or mixed bowling. Therefore, training Amateur Cricket Bowlers for strength is essential. In the throw, neuromuscular timing of contractions occurs through specific coordinated links for concentric and eccentric muscle action. The sequence of motions causes the transfer of force from the lower extremities and trunk to the throwing arm, and through the shoulder and elbow, and eventually to the ball at release. The shoulder and elbow joints should be able to control and accelerate the ball, and also endure the forces that are produced after the release of the ball⁶.

The throwing action may be divided into three distinct phases, namely the winding-up phase, the cocking phase, and the follow-through phase. Sound technique and a well-adjusted neuromuscular system are needed for a well-coordinated, powerful throw.

Winding-up phase

In the winding-up phase, which is the first stage of the throwing cycle, the muscles initially fire at low intensity. When the shoulder gets into full elevation, more activity is seen. No consistent pattern of muscle activation was found in this stage of the throwing motion.

Cocking phase

In the arm-cocking phase the athlete reaches a maximum external rotation of the shoulder joint. In the forward phase, the abducted arm is rotated internally, while a degree of elbow extension, wrist flexion and spinal rotation also takes place. There is also some movement in the pelvis at the hip joint of the opposite limb, which results in medial rotation of the thigh.

Follow through phase

In the third or follow-through phase, the shoulder continues with internal rotation as well as horizontal flexion. This is the phase where all the muscles are the most active. The subscapularis is responsible for the internal rotation of the shoulder, and the remaining rotator cuff and deltoid muscles are decelerating the arm in space.

Dynamic push-ups (i.e., ballistic, with hand movement) required more muscle activation and higher spine load, whereas placing swiss balls under the hands only resulted in modest increases in spine load.

So this study will describe more specific, reliable & correct push-up technique which must be included in the strength training program in cricket to improve their performance. Comparisons thus made would be helpful to find out many functional limitations & weakness of individual technique of performing push-up which can be overlooked entirely when studied alone. Muscle power is considered as an important parameter responsible for successful rapid movements performed with maximum efforts such as throwing. This exercise program is designed to exercise the major muscles necessary for throwing including improving strength, power and endurance of the musculature of the shoulder complex⁷

Overhead throwing motion is a high velocity, extremely stressful athletic movement. Its repetitive nature places tremendous demands on the entire body, frequently resulting in injury to the throwing shoulder. A multi-phased approach beginning with exercises to restore muscle strength and proprioception and advancing to more demanding exercises to improve power, endurance and dynamic control. This program incorporates throwing motion specific exercises and movement patterns performed in a discrete series, utilizing principles of co-activation, high level neuromuscular control, dynamic stabilization, neuromuscular facilitation, strength, endurance and co-ordination which all serve to restore muscle balance and symmetry in overhead athletes⁸.

Objective of the study

- To find out the effectiveness of plyometric push-up in throwing distance among Amateur Cricket fast Bowlers.
- To find out the effectiveness of swiss ball push-up in throwing distance among Amateur Cricket fast Bowlers.
- To compare the effects of plyometric push-up and swiss ball push-up in throwing distance among Amateur Cricket fast Bowlers.
- To find out the effectiveness of plyometric push-up in throwing accuracy among Amateur Cricket fast Bowlers.
- To find out the effectiveness of swiss ball push-up in throwing accuracy among Amateur Cricket fast Bowlers.
- To compare the effects of plyometric push-up and swiss ball push-up in throwing accuracy among Amateur Cricket fast Bowlers.

2. METHODOLOGY

Selection of subjects

60 subjects were randomly selected to fulfill the inclusion criteria for the study and divided into 2 groups.

- Group A- Plyometric Push-up Training
- Group B- Swiss ball Push-up Training

Variables

Dependent variables

- Throwing Distance
- Throwing Accuracy

Independent variables

- Plyometric Push-ups
- Swiss ball Push-ups

Measurement tools

Variables	Tools
Throwing Distance	Medicine Ball Throw Test
Throwing Accuracy	Functional Throwing Performance Index

Study design

The study design was pre and post-test experimental design.

Inclusion criteria

- Amateur Cricket fast Bowlers being engaged in sports that require athlete's arm to be above shoulder height on a repetitive basis during throwing.
- Amateur Cricket fast Bowlers Duration of sporting activities for 2 years with at least 6 months a year and a frequency of minimum 40 minutes thrice a week.
- Amateur Cricket fast Bowlers Age between 20 to 26 year old males.

Exclusion criteria

- Amateur Cricket fast Bowlers with Any recent upper limb fracture
- Amateur Cricket fast Bowlers with Recent Rotator cuff tear
- Amateur Cricket fast Bowlers with Bone disease
- Amateur Cricket fast Bowlers with Any shoulder and neck surgery in recent year
- Amateur Cricket fast Bowlers with Spinal deformity
- Amateur Cricket fast Bowlers Cervical spine pathology
- Amateur Cricket fast Bowlers with Glenohumeral subluxation
- Amateur Cricket fast Bowlers with Glenohumeral dislocation
- Amateur Cricket fast Bowlers with any other significant joint pain in whole body.

Orientation of the subjects

Before the collection of data, subjects were explained about the purpose of the study. The investigators have given a detailed orientation about the various test procedures. Such as FTPI to measure the throwing accuracy and Medicine ball throw test to measure the throwing distance. The consent and full co-operation of each participant was sought after complete explanation of condition and demonstration of the procedures involved in the study.

Materials used

- Data collection sheet
- Client consent form
- Evaluation chart
- Swiss ball
- Exercise mat
- Medicine ball
- Measuring tape
- Standard leather cricket ball

Test Administration

Functional throwing performance index (FTPI)

Functional ability of the shoulder joint was assessed using FTPI. The subject stood 15ft from a target, a 1ftx1ft square on at a height of 4ft from the floor. The object of the test was to throw a standard leather cricket ball into the target as many times as possible over 30 second trails. Before testing, subject's performed 8 throws as a warm-up. Test began immediately after the warm-up consisted of the subject throwing the ball into the target, catching the rebound of the wall and repeating as many times as possible within 30 seconds. The FTPI was calculated as the number throws with in the target divided by total number of balls thrown. To avoid any discrepancies in judgments, the same examiner determined the accuracy of all throws.



Figure: 1 Cricket ball throwing to assess FTPI Medicine ball throw test

Medicine ball throw test was used to assess upper-body explosive power. Many athletic skills also involve generating or transferring explosive power through the upper extremities and trunk musculature. Throwing distance was measured by using the medicine ball throw test. In this test, participant were instructed to throw a medicine ball as far as they could, in a walk stand position, holding the ball overhead with the dominant hand. The medicine ball used had a mass of 2 kg and diameter 56cm each subject performed 5 trials with 1 min rest between trails. The distance in meter to which the subject threw the medicine ball was measured with the measuring tape. The best of 5 trials was taken and used for further analysis.



Figure: 2 Medicine ball throw to assess throwing distance

Treatment procedure

The SPU and PPU training programs were matched for repetitions, sets, progression, and rest intervals between the sets. Instructions included safety issues and subjects were advised to use an exercise mat for all training sessions. Most subjects trained in groups of 3–5 at a gym or on a stable surface.

Plyometric push-up

Made the subject do warm up for 5 minutes followed by flexibility exercises for chest and shoulder girdle musculature.

The subjects were started with push-up position with hands on the floor, placed slightly wider than shoulder width apart and their feet together. Keeping their back flat, slowly lowered the body toward the ground. Then in one explosive movement, push-up and away from the floor as quickly as possible, brought their hands off the floor. They were instructed to be careful to not allow the head to put forward. They landed with the hands back on the ground and repeated.

All subjects completed 18 training sessions, at a frequency of 3 sessions per week and with at least 48 hours between the sessions. Push-ups 3 sets with 10 repetitions in each set and 2 minutes rest between each set.



Figure: 3 Plyometric push-up

Swiss Ball push-up

Made the subject do warm up for 5 minutes followed by flexibility exercises for chest and shoulder girdle musculature.

The subjects were started with kneeling position so that they were facing the ball. Placed their hands on top of the ball so that they could bent their elbows towards the body. Straightened the legs out and raised themselves slightly higher so that they could be on their toes. Stayed in neutral position. Straightened their arms at the elbows, so that they could push themselves up from the ball. Their body were diagonal, with their head at the highest point and their feet at the lowest. Hold that position for a second or two, then bended their elbows again so they then returned to their original position.

All subjects completed 18 training sessions, at a frequency of 3 sessions per week and with at least 48 hours between sessions. Push-up 3 sets with 10 repetitions in each set & 2 minutes rest between each set.



Figure: 4 Swiss ball push-up

Collection of data

Subjects were randomly assigned to either Swiss Ball push-up (SPU) or Plyometric push-up (PPU) training programs i.e. 30 subjects in each group.

The subjects were given three trial sessions to ensure proper technique.

- In Group A (Plyometric push-up): Difference in throwing distance & accuracy
- In Group B (Swiss ball push-up): Difference in throwing distance & accuracy.

3. RESULTS

TABLE – 1: The table shows, mean difference, standard deviation and paired ‘t’ value between pre and post-test scores of throwing distance among group A

Measurement	Mean	Mean Difference	Standard Deviation	Paired ‘t’ Value
Pre-test	5.51	1.31	0.425	14.52*
Post-test	6.82			

* 0.005 level of significance

In group A for throwing distance the calculated paired ‘t’ value is 14.52 and ‘t’ table value is 2.861 at 0.005 level. Since the calculated ‘t’ value is more than ‘t’ table value above study shows that there is significant difference in throwing distance following plyometric pushup among Amateur Cricket fast Bowlers.

Graph: 1 Shows the pre-test mean, post-test mean and mean difference of throwing distance for Group A.

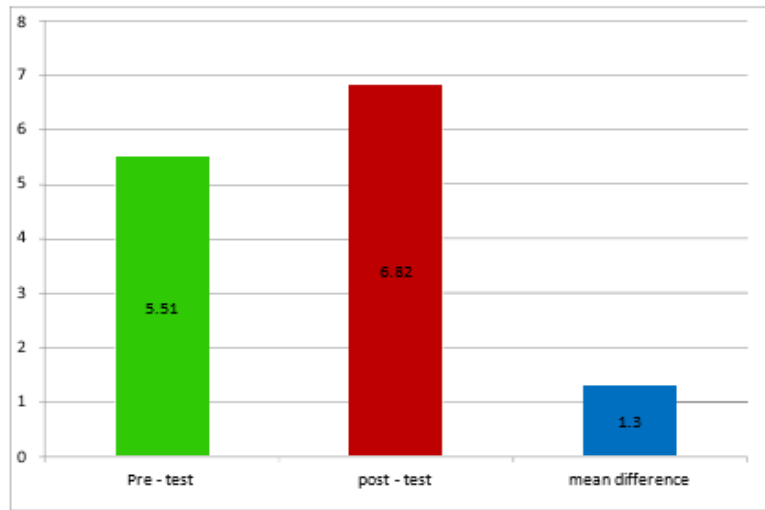


TABLE – 2: The table shows mean value, mean difference, standard deviation and paired ‘t’ value between pre and post-test scores of throwing distance for group B

Measurement	Mean	Mean Difference	Standard Deviation	Paired ‘t’ Value
Pre-test	5.23	0.19	0.097	8.76*
Post-test	5.42			

* 0.005 level of significance

In Group B for throwing distance the calculated paired ‘t’ value is 8.76 and ‘t’ table value is 2.861 at 0.005 level. Since the calculated ‘t’ value is more than ‘t’ table value above value that there is significant difference in throwing distance following swiss ball pushup among Amateur Cricket fast Bowlers.

Graph: 2 Shows the pre-test mean, post-test mean and mean difference of throwing distance for Group B.

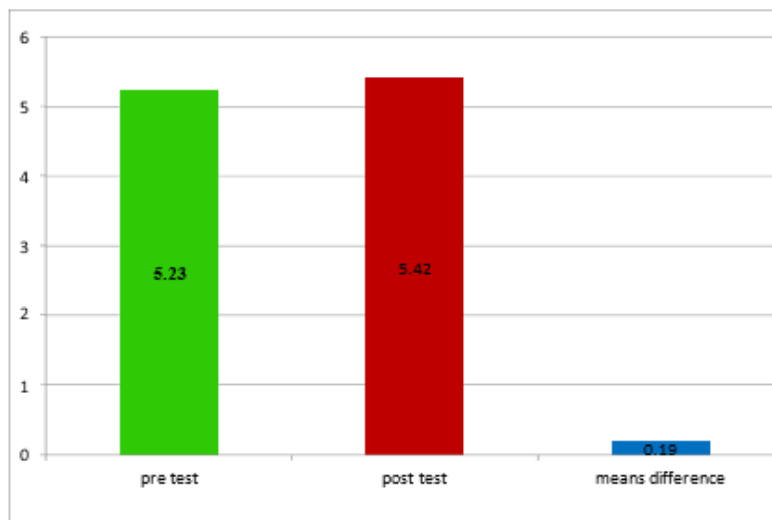


TABLE 3: The table shows the group A mean, group B mean, standard deviation and unpaired ‘t’ value for throwing distance

S.No	Variable throwing distance	Mean Difference	Standard Deviation	unpaired ‘t’ Value
1.	Group A	1.31	0.308	33.47*
2.	Group B	0.19		

* 0.005 level of significance

In Group A and B for throwing distance the calculated unpaired ‘t’ value is 33.47 and ‘t’ table value is 2.756 at 0.005 level. Since the calculated ‘t’ value is more than ‘t’ table value above results shows that there is significant difference between plyometric push-ups and swiss ball push-ups in throwing distance among Amateur Cricket fast Bowlers.

Graph: 3 Shows the group A mean, group B mean and mean difference for throwing distance

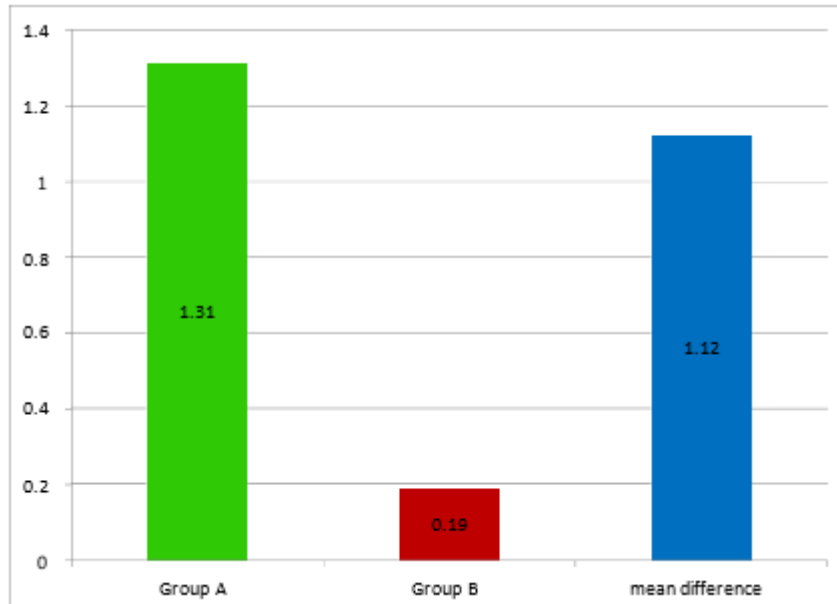


TABLE – 4: The table shows mean value, mean difference, standard deviation and paired ‘t’ value between pre-test, post-test scores of accuracy for group A

Measurement	Mean	Mean Difference	Standard Deviation	Paired ‘t’ Value
Pre-test	47.1	0.8	6.92	1.99
Post-test	47.9			

* 0.005 level of significance

In Group A, for accuracy the calculated paired ‘t’ value is 1.99 and ‘t’ table value is 2.861 at 0.005 level. Since the calculated ‘t’ value is less than ‘t’ table value above study shows that there is no significant difference in throwing accuracy following plyometric push-ups in Amateur Cricket fast Bowlers.

Graph: 4 Shows the pre-test mean, post-test mean and mean difference of accuracy for group A

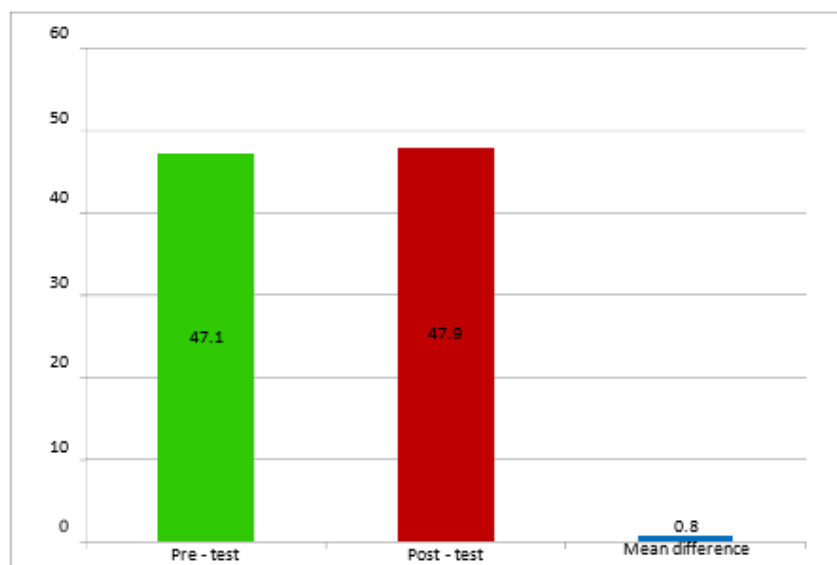


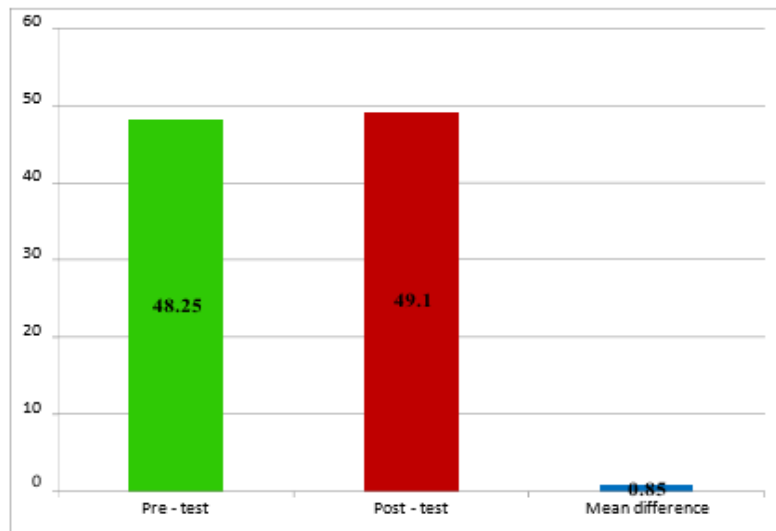
TABLE 5: The table shows mean value, mean difference, standard deviation and paired ‘t’ value pre-test and post-test score of accuracy for group B

Measurement	Mean	Mean Difference	Standard Deviation	Paired ‘t’ Value
Pre-test	48.25	0.85	6.83	1.98
Post-test	49.10			

* 0.005 level of significance

In Group B for accuracy the calculated paired ‘t’ value is 1.98 and the ‘t’ table value is 2.861 at 0.005 level. Since the calculated ‘t’ value is less than ‘t’ table value above study shows that there is no significant difference in throwing accuracy following swiss ball push-up in Amateur Cricket fast Bowlers.

Graph: 5 Shows the pre-test mean , post-test mean and mean difference of accuracy for group B



4. DISCUSSION

This discussion attempts to provide an objective review of different exercises such as plyometric push-ups & Swiss ball push-ups in terms of their definitions, contribution to athlete’s performances like throwing distance & accuracy among Amateur Cricket fast Bowlers.

The purpose of the study is to compare the effects of plyometric push-ups & Swiss ball push-ups on throwing distance & accuracy among Amateur Cricket fast Bowlers. Upper body strength training program is considered to be one of the key components for technical skill mastery in throwing. The deltoid, triceps, biceps & rotator cuff muscle play an important role in throwing⁷

The results of the present study have shown that plyometric push-ups have significantly improved the throwing scores in Amateur Cricket fast Bowlers. However, there was no significant difference on throwing accuracy.

More specifically, the results showed that plyometric push-ups group significantly improved throwing scores. We attribute this improved performance on the throwing scores to superior gains in strength & power that was developed as a result of both forms of push-ups i.e. plyometric push-ups & Swiss ball push-ups in each group individually.

Both throwing distance and accuracy in this study involve upper body strength and power. Only one intervention to each experimental group was given and that was push-ups i.e. plyometric push-ups & Swiss ball push-ups in both groups. So any improvements in performance of throwing scores can be considered as a result of improvement in upper body strength and power. In the overhead-throwing motion, the stress is centered on a muscle’s capacity to exert its maximal force output in a minimal amount of time. Historically, clinicians and coaches alike have employed weight training regimens and, more recently, plyometric routines to maximize power⁸.

The differences between conventional weight training and plyometric exercise on both concentric and eccentric muscular force production in both the upper and lower extremities and found that upper extremity plyometric training, when compared with conventional weight training, is neither superior nor inferior for increasing power output⁹.

a study to determine the effects of upper extremity plyometric training on shoulder proprioception, kinesthesia, isokinetic strength, and power of the shoulder internal rotators in female collegiate swimmers. The results of their study established that the plyometric training group significantly improved measures of proprioception and kinesthesia¹⁰.

The result of the present study also shows that swiss ball push-ups have significantly improved the throwing scores in Amateur Cricket fast Bowlers. However, there was no significant difference on throwing accuracy.

Results of the present study are in agreement with who studied plyometric push-ups along with isotonic push-ups & dynamic push-ups added to a strength training program. They used medicine ball put & chest press as their test & found that plyometric group demonstrated superior gains & thus concluded that the plyometric, when applied properly, will facilitate maximum power output in a minimal amount of time.

The comparative results shows that the plyometric push-ups is more effective than swiss ball push-ups in improving throwing distance among Amateur Cricket fast Bowlers. The justification of superior gain in plyometric push-up group is in line with studies done by did a study on that effects of high volume upper extremity plyometric training on throwing velocity and functional strength ratios of the shoulder rotators in collegiate baseball players which concluded that plyometric group demonstrated increase in throwing velocity as there were improvement in eccentric external rotation strength of shoulder.

Hence first and second hypotheses are accepted and others rejected.

5. CONCLUSION

The results from the present study are very encouraging and demonstrate the benefits of plyometric push-ups in improving throwing distance as compared ball push-ups. Thus, plyometric push-ups can be incorporated into training programs of fast bowlers in cricket for enhancing their performance levels.

The plyometric push-ups should be preferably administered in the players especially when performance is to be improved and there is limited time for preparation.

A training program that would be more likely to adopt (do not take lot of time or effort) as a regime with low risk of muscle and connective tissue. This can be used during the last preparatory phase before in-season competition for athletes.

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