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"A COMPARATIVE STUDY TO EVALUATE THE EFFECTIVENESS OF PLYOMETRICS ALONE AND PLYOMETRICS WITH WEIGHT TRAINING ON IMPROVING THE AGILITY AND POWER IN LOWER LIMB PERFORMANCE AMONG COLLEGE LEVEL CRICKETPLAYERS"

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ABSTRACT

Introduction: Plyometric is a set of drills designed to stimulate the series elastic Component over and over again during the movements that are required by the athlete duringsports. Complex training is a very effective program, and it is a combination of weightTraining and plyometric movements.**Objective:** To evaluate and compare the efficacy of plyometrics alone and plyometrics withweight training on improving the agility and power of the lower limbs performance amongcollege-level cricket players. **Method:** 80 participants were included in the study only after completing the inclusion andexclusion criteria and a written consent forms were taken from each participants. Theparticipants were allocated in Group A and Group B using sealed opaque envelopes by atherapist. They were divided into two groups, Group A (n=40), Group B (n=40).Group A performed the Depth jump, the split squat, the Rim jump, the Box to box depthjump.Group B performed a combination of the two training programs, plyometrics- Depth jump,the split squat, the Rim jump, the Box to box depth jump and weight training-squat ,leg pressand leg extension. **Results:** Our study showed significant results in Illinois test scores when Group A and Group B were compared, whereas, the Vertical Jump Height scores showed highly significantresults when the between group comparison was done. **Conclusion:** Thus, according to our study, plyometrics with weight training showed betterresults when compared to plyometrics alone in improving agility and power in lower limbperformance of college-level cricket players.

KEYWORDS: Plyometrics, weight training, complex training, cricket, agility, vertical jump Height

INTRODUCTION:

Plyometrics is basically a set of drills intended to excite the series elastic componentover and over again – preferably during movements that mimic those in the athlete'ssport. A wide variety of training studies shows that plyometrics can improveperformance in vertical jumping, long jumping, sprinting and sprint cycling.Cricketers, like any athlete today, need to train harder, for long, and tocommence at an earlier age, if they need to do well at the elite level. It is therefore notsurprising that physicians are diagnosing an increasing number of overuse injuries, asthe hours of repetitious practice produce a gradual deterioration in the functionalcapacity of the body. Training, technique, footwear, surface, rehabilitation, warm-upand conditioning are all factors which can contribute to overuse injuries.[1,2]Bowling (40%) and fielding and wicket-keeping (33%) accounted for the majority ofthe injuries, with batting accounting for 17% of the injuries sustained. Of the bowlinginjuries, 55% were lower-limb injuries and 33% were back and trunk injuries. Of the39 stress fractures, 79% were overuse bowling injuries, with the younger playerssustaining 74% of the stress fractures.The primary mechanism of injury was the delivery and follow-through of the fast bowler (25%), running, diving, catching and throwing the ball when fielding (23%) and overuse (17%). Untrained college level athletes are more prone to these injuries.Hence, we believe that plyometrics and weight training can be used as a part oftraining regime to reduce the risk of sustaining the above injuries.[3] The comparison of plyometric exercises and weight-training protocols has producedcontroversial results. The combination of plyometric exercises and weight trainingincreased maintained or unaffected vertical jumping performance. Adams et al.suggested that this combination may provide a more powerful training stimulus for thevertical jumping performance than either weight training or plyometric training alone.There has been no conclusion made regarding the relative effectiveness of plyometrictraining and weight training or the combination of both in the development of verticaljump ability.[4]As far as we know, there have been no studies done to compare plyometric versusplyometric weight training for agility.[5]Therefore, the purpose of the present study is to determine how vertical jumpperformance and agility are affected by a typical 6-week plyometric training programand a combination of plyometric and weight training.

MATERIAL AND METHODOLOGY

Subjects were briefed about the study after their consent was taken. Subjectswere underwent physical examination. Each subject were underwent measurements ofhis verticaljumping performance and agility. Training in the form of plyometricsand weight training weredone for 2 sessions per week for 6 weeks.[6]The outcome measures used are vertical jump height to assess the power andIllinois test to assess the agility of the subjects

INCLUSION CRITERIA:

- Male cricket college level players.
- Age group between 18-26 years.
- Players willing to participate in the study.

EXCLUSION CRITERIA:

- Female players.
- Cricket players on medications like muscle relaxants.
- Cricket players who are involved in any type of plyometric training at thetime of study.
- Cricket players with any recent fracture or lower limb injury.

RESULTS

Table 1: Comparison of two groups (Plyometrics and Plyometrics with WT) withmean age by t test

GROUPS	Mean	SD	SE	t-value	p-value
GROUPA	20.30	1.60	0.25	0.5921	0.5555
GROUPB	20.10	1.41	0.22		
TOTAL	20.20	1.50	1.50		

Table 2: Comparison of two groups (Plyometrics and Plyometrics with WT) with BMIscores by t test

GROUPS	Mean	SD	SE	t-value	p-value
GROUPA	21.86	2.34	0.37	0.8117	0.4194
GROUPB	21.47	1.85	0.29		
TOTAL	21.66	2.10	0.23		

Table 3: Comparison of pre-test and post-test Illinois test (sec) scores in two groups(Plyometrics and Plyometrics with WT) by paired t test.

GROUPS	Time	Mean	SD	Mean Diff	SD Diff	% of change	Paired t	p-value
GROUPA	Pretest	20.24	1.15	0.48	1.37	2.35	2.2031	0.0336*
	posttest	19.76	1.35					
GROUPB	Pretest	19.84	1.12	0.81	0.54	4.09	9.4353	0.00001*
	posttest	19.03	1.00					

*p<0.05

Table 4: Comparison of pre-test and post-test values of the two groups(PlyometricsandPlyometrics with WT) with Illinois test (sec) scores by t test

Variables	Groups	Mean	SD	t-value	p-value
Pretest	Group A	20.24	1.15	1.5818	0.1177
	Group B	19.84	1.12		
Post test	Group A	19.76	1.35	2.7738	0.0069
	Group B	19.03	1.00		
Difference	Group A	0.48	1.37	-1.4434	0.1529
	Group B	0.81	0.54		

Table 5: Comparison of pretest and posttest vertical jump height (cm) scores in twogroups (Plyometrics and Plyometrics with WT) by paired t test

Groups	Time	Mean	Std. Dv	Mean Diff	SD Diff	% of change	Paired t	p-value
GroupA	Pretest	36.88	2.93	-2.16	1.30	-5.85	-10,5161	0.00001*
	Posttest	39.03	2.78					
GroupB	Pretest	37.75	3.04	-4.48	1.30	-12.83	-23.5114	0.00001*
	Posttest	42.59	3.12					

Table 6: Comparison of Plyometrics group and Plyometrics with WT group withrespect to Vertical jump height (cm) scores at pretest and posttest by applying t test.

Variable	Groups	Mean	SD	t-value	p-value
Pretest	GroupA	36.88	2.93	-1.3115	0.1935
	GroupB	37.75	3.04		
Posttest	GroupA	39.03	2.78	-5.3925	0.00001*
	GroupB	42.59	3.12		
Difference	GroupA	2.16	1.30	-9.2461	0.00001*
	GroupB	4.84	1.30		

DISCUSSION AND CONCLUSION

After sample size calculation, eighty participants, divided into two groups, Group Aand Group B (n=40), were recruited for our study. Table 1 depicted the comparison of two groups that is Group A (plyometrics) andGroup B (plyometrics with weight training) with mean age of the subjects. The meanage of Group A was 20.30±1.60 and that of group B was20.10±1.41.The total meanage of the subjects involved in this study was 20.20±1.50. The p value was 0.5555,which were considered non-significant.

Table 2 showed the comparison of two groups (Group A and Group B) with BMIscores. In this, the mean BMI of the subjects of group A was 21.86±2.34 andof group B were 1.47±1.85.The total mean BMI of the participants were21.66±2.10.The p value was 0.4194 which were termed to be non-significant.

The table no.3 depicted within group comparison of Group A (plyometrics) and GroupB (plyometrics with weight training) with respect to mean of Illinois Test scores atpre-test and post-test. The mean Illinois Test scores of Group A were 20.24±1.15before intervention and 19.76±1.35 on the last day of intervention. Similarly, the meanscore of Group B were19.84±1.12 before intervention and 19.03±1.00 on the last dayof intervention.

A study was done to investigate, the effect of short-term high intensity plyometrictraining program on strength, power and agility in male soccer players. Two types oftests were applied to evaluate changes in agility. Minor but significant improvementswere seen both in the T agility (2.5%) and in the Illinois agility (1.7%) tests.

In another study done in 2009 found that despite that sprint time was unchanged, sixweeks of PT significantly improved agility (9%) in semi-professional adolescentsoccer players. The greatest improvement in agility (10%) was found in childrensoccer players after 8 weeks of PT. In a study conducted in 2006 found 5 to 3%improvements in the T agility and Illinois agility tests, correspondingly, after 6 weeks ofPT. These improvements are greater than those obtained in the study. Overall,improvements in agility following plyometric working out can becredited to neuraladjustment, mainly to increased inter-muscular coordination.[7]

In our study the p value of Group A was 0.0336 and the p value of Group B was0.00001, hence the results suggested that Group A was significant and Group B washighly significant.

On the contrary, according to a study that aimed to observe the acute effects ofcomplex training program of 6 weeks on agility with the ball, sprinting and theefficiency of crossing and shooting in youth soccer players. Sixteen youth male soccerplayers participated and were randomly divided into three groups: a group thatperformed one weekly complex training session (GCT1, n = 5, age: 13.80 ± 0.45years); or a group that performed two weekly complex training sessions (GCT2, n = 5,age: 14.20 ± 0.45 years); or a control group that have not perform the CTX (n = 6, age:14.20 ± 0.84 years). This study suggested that no significant results in agility werenoticed. Agility movements are additionally dependent on factors of motor control,rather than maximal strength or muscle power and this may be the factor that maypartially explain a lack of significant results at the agility level.[8]

Table 4 indicated the comparison of pre-test and post-test values between the twogroups (Group A and Group B) with Illinois test (sec) scores.The mean scores of Illinois test of Group A and Group B before intervention were20.24±1.15 and 19.84±1.12 and on the last day were 19.76±1.35 and 19.03±1.00respectively.

In a similar study done in 2007, in which the effects of combined plyometric trainingand resistance training was compared to resistance training alone on fitnessperformance in boys between the age group of 12 to 15 years , the training wascarried out for six weeks. The resistance training group performed stretching exercisesfollowed by resistance training and whereas the PRT group carried out plyometricexercises followed by the same resistance training program. The results of this studyrevealed significant improvements in thecombined training group in the pro agilityshuttle performance rather than resistance training group alone (3.8% vs. 0.3%,respectively). Therefore the findings of this study demonstrate the necessity of a multicomponent conditioning program to enhance performance in activities that includeacceleration, deceleration and change of direction.[9]

In a particular study that aimed to examine the short-term performance effects of threein-season low-volume strength-training programmes in college male soccer players.Fifty-seven male college soccer players (age: 20.3±1.6 years) participated and wererandomly assigned to a resistance-training group (n=12), plyometric training group(n=12), complex training group (n=12), or a control group (n=21). In the mid-season,players undergo a 9-week strength-exercise programme, with two 20 min trainingsessions per week. Short-term effects on strength, sprint, agility, and vertical jumpabilities were measured before and after the training sessions. All training groups increased 1-RM squat (range, 17.2-24.2%), plantar flexion (29.1-39.6%), and kneeextension (0.5- 22.2%) strength compared with the control group ($p<0.05$). Theresistance-training group improved concentric peak torque of the knee extensormuscles by 9.9-13.7%, and changes were greater compared with the control group($p<0.05$). The compound training group showed major increments (11.7%) ineccentric peak torque of the knee flexor muscles on the non-dominant limb comparedwith the control group and plyometric training group ($p<0.05$). All training groupsenhanced 20-m sprintperformance by 4.6-6.2% ($p<0.001$) compared with the controlgroup. No differences were observed in 5-m sprint and agility performances($p>0.05$).[10]

According to a study conducted where in the purpose of this study was to find out theeffects of plyometrics training and weight training among university male students.This study consisted of 60 male students from the various colleges of the BurdwanUniversity. The subjects were randomly (19-25 years) allotted in the followingtraining groups that are Weight training Group (WTG), Plyometric Training Group(PTG) and the Control Group (CT).Weight training was done for 8 weeks andplyometric training was given for 6 weeks given consequently. Routine training wasgiven to the subjects in the control group. Thecomponents of motor ability, speed,endurance, explosive power and agility of the participants were measured. The findingof this study indicated Plyometric training and weight training groups significantlyincreased speed, endurance, explosive power and agility. The plyometric traininggroup had significantly improved speed, explosive power, muscular endurance andagility. The weight training group had significantly improved agility, muscular endurance, and explosive power. The plyometric training was proved to be superior toweight training in improving explosive power, agility and muscular endurance.In our study the p value for Group A and Group B was 0.0069. The result of this table4 suggests a highlysignificant ($p<0.05$) increase in Illinois post test scores oncomparing both groups.

The table no.5 indicated the comparison of pre-test and post-test vertical jumpheight(cm) scores within Group A (plyometrics) and Group B (plyometrics withweight training).The mean scoresvertical jump height of Group A was 36.88±2.93before intervention and 39.03±2.78 on the last day of intervention. Likewise, the meanscore of Group B were 37.75±3.04 beforeintervention and 42.59±3.12 on the last dayof intervention. In a study conducted in 2010, aimed to analyze the short-term effects of complex andcontrast training (CCT) on vertical jump (squat and countermovement jump),sprint (5and 15 m), and agility (505 Agility Test) abilities in soccer players. The complextraining alternates biomechanical similar high-load weight training with plyometricexercises, Twenty-three young elite Portuguese soccerplayers (age 17.4 6 0.6 years)were divided into 2 experimental groups (G1, n = 9, and G2, n = 8) and 1 controlgroup (G3, n = 6). Groups G1 and G2 have done their regular soccertraining alongwith a 6-week strength training program of complex and contrast training, with 1 and2 training sessions, respectively. G3 has been kept to their regular soccer trainingprogram. Each training session from the complex and contrast training program wasorganized in 3 stations in which a general exercise, a multiform exercise, and aspecific exercise were performed. The load was increased by 5% from 1repetitionmaximum each 2 weeks. The result of this study did not find any significant change incounter-movement jump performance in any subject group after training. According tothe authors, improving jump performances would demand a minimum of 2 weeklytraining sessions. However, in this study, the use of 2 training sessions had notproduced significant increases in counter-movement jump height. Contrarily to the oneobserved in this study, another study found a significant increase (2.8 cm) in CMJ, in agroup of athletes who used a strength training program that included exercises ofOlympic weight combined with squat exercise. Another group of subjects wassubmitted to a strength training program combining jumps with squat exercises.Thisgroup showed a significant increase in the counter-movement jump height (2.5 cm).This strength-training program involved 8 weeks with 3 training sessions per week.This fact can lead to speculate that an insufficient weekly training frequency canjustify theinefficiency of complex and contrast training to promote changes incounter-movement jump performances.[11]

A study identified a significant increase in soccer players'counter-movement jumpperformances. The authors used a strength-training program with intensity loadsbetween 3RM and 8RM, combined with 4–6 sets of 30-m sprints. This programincluded only 2training sessions; however, when compared with the program with thestudy mentioned above, the total duration was superior in 3 weeks. These datasuggested that besides the weekly frequency, the total training program duration canalso influence the effectiveness of strength training programs.[12]

In our present study, the p values of Group A were 0.00001 and the p values of Group B were 0.00001, hence the results in table no.5 showed that Group A and Group B werehighly significant.

Table 6 indicated the comparison of (Group A and Group B) with respect to verticaljump height scores (cm)at pre-test and post-test values.The mean scores of vertical jump height of Group A and Group B before interventionwere 36.88±2.93 and 37.75±3.04 and on the last day were 39.03±2.78 and 42.59±3.12respectively. In a similar study, different training protocols—plyometric training, weight training,and including both—on particular parameters of vertical jump performance and legstrength. Forty-one men were randomly assigned to 1 of 4 groups: plyometric training,weight training, plyometric plus weight training , and control. Vertical jump,mechanical power, flight time, and maximal leg strength were measured before andafter 12 weeks of training. Subjects in every training group trained 3 days per week,while control subjects did not contribute in any training activity. Results showedthat all training treatments elicited significant (p, 0.05) improvement in all testedvariables. However, the combination-training group produced improvements invertical jump performance and leg strength that were significantly greater thanimprovements in the previous 2 training groups (plyometric training and weight training).This study gives support for the use of a combination of traditional and Olympic styleWeightlifting exercises and plyometric drills to improve vertical jumping abilityand explosive performance in general.[13]The effectiveness of plyometric training in improving explosive performance has beensupported by most training studies in the field during the last 2 decades. Severalprevious investigations have failed to find that plyometric training is significantlymore effective than other training methods in improving vertical jumping ability.Furthermore, previous research that used a combination of plyometric and weighttraining found increased [14,15,16] or unaffected vertical jumping performance.[17]Other investigators [5,17] found that the combination of plyometric and weight training is equally effective to plyometric or weight training. Results of the presentstudy indicate otherwise. This combination training provided the most powerfulstimulus in improving various parameters of vertical jumping ability. However, thecombination training treatment evoked the most significant changes in the verticaljump ability.[18,19,20]In the findings of table 6 the p value for Group A and Group B was 0.00001. Theresult of this table suggests a highly significant ($p<0.05$) increase in vertical jumpheight scores on comparing both groups.

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