Eurasian Journal of Analytical Chemistry
ISSN: 1306-3057 OPEN ACCESS 2025 20 (1): 96-101

"Comparison Between The Effects Of Box Jump Training And Squat Jump Training On Lowerbody Power Generation, Speed And Vo2max In Healthy Collegiate Athletes"

Arvind[1*], Dr. Monika Sharma[2]

[1*]Researcher), Institute of Applied Medicines and Research, Ghaziabad, ak729622@gmail.com
[2]Associate Professor, Institute of Applied Medicines and Research, Ghaziabad, drmonikasharma05@gmail.com

Abstract

Background: The explosive leg power of the athlete is crucial to their success in many sports. The ability to swiftly and aggressively use one's strength within a specified time frame is an essential skill for many athletic disciplines, including leaping, throwing, track and field, and others. Power, speed, and strength are the outward manifestations of this. Additionally, the two most important physiological performance metrics in team sports are maximal oxygen uptake velocity and running economy. [1,2] Squats, lunges, and other explosive movements are what plyometric training is all about One of the most important ways to improve neuromuscular function is via plyometric training. [3,4]

Objective: The objective of this study was to compare the effect of box jump training and Squat jump training on lower body power generation , speed and Vo athletes.

Methodology: 2max In healthy collegiate 54 healthy collegiate male athletes aged 18 to 25 years were selected. As per inclusion criteria the selected subjects were randomly assigned into three groups. Group- A (n=18) and Group-B (n=18) and Group-C (Control) (n=18). Group A received box jump training ,Group B receivedsquatjumptrainingandGroupCwastakenascontrolgroup.3sets x 10 repetitions were performed three times in a week, every alternate day with 90 sec rest between each set.

Result: The results show there was an improvement in power and VO_{2max}in both box jump training and squat jump training groups. However, VO_{2max} decreased in the control group. Speed in Box jump training group and in Squat jump training group was significantly lower than of control group.

Conclusion: This study concluded that both box jump training and squat jump training have shown significant improvement in speed, power and VO_{2max}. However, there is no significant change seen in control group.

Keywords: box jump training, squat jump training, speed, power, VO $_{2max}$, control group

Introduction:

The explosive leg power of the athlete is crucial to their success in many sports .The ability to swiftly and aggressively use one's strength within a specified time frame is an essential skill for many athletic disciplines, including leaping, throwing, track and field, and others. Power, speed, and strength are the outward manifestations of this . Additionally , the two most important physiological performance metrics in team sports are maximal oxygen uptake velocity and running economy. [1,2] Squats, lunges, and other explosive movements are what plyometric training is all about .One of the most important ways to improve neuromuscular function is via plyometric training. [3,4]As part of plyometric training, you'll do a series of fast, explosive motions called "concentric" and "concentric" muscle contractions .Jumps, which comprise sets of jumps like squat and box, are done with maximum effort and fast speed and are the most popular kind of plyometrics. [5] During eccentric contraction, a lot of things happen in the connective tissues and tendons that make it possible to build up potential elastic energy; during concentric contraction, gravity exerts a lot of force .You may engage post activation potential and boost your performance with both the box jump and the squat jump. Both the mechanical and neuro physical theories may be used to explain how plyometric training works . As a consequence of quick stretching, the mechanical model's elastic energy is created in muscles, tendons, and ligaments .When you stretch your muscles and then instantly contract them in a concentric pattern, you release this stored energy. [6,7,8]In the neuro -physical paradigm, a protective, instinctive reaction is triggered whenever the muscles sense a rapid stretch, in order to avoid overstretching. We call this reaction the stretch reflex. [9]Even for a short duration (less than 10 weeks), plyometric training is an excellent method to enhance strength and power .The countermovement jump, box jump, and squat jump are all exercises that may be used alone or in conjunction with training. [10,11] One of the most important plyometric exercises for building leg strength is the squat jump. To help with stability and balance, it targets the abdominal muscles and their stabilization. [12] Quickly and forcefully stretching and shortening muscles is what the box jump is all about. [13] To enhance lower body power production, many forms of strength training have been used. There are three distinct kind of strength training: general, specialty, and targeted. If you want to make your leaping muscles stronger, you should do general strength training activities. Power training makes use

of specialized strength training routines. Many different kinds of plyometric activities are specific strength exercises . like box jumps and squat jumps. [14-17] When you exercise the three components of muscle—general strength, special strength, and specialized strength—you will see the influence of plyometrics on boosting lower body power. [18]Training in plyometrics, which includes activities like the box jump and the squat jump, is a great way to increase your cardio respiratory fitness and endurance Improving one's speed is mostly concerned with enhancing one's agility, leaping, sprinting, acceleration, and dynamic stopping. [19,20]
Training in plyometrics, which includes activities like the box jump and the squat jump, is a great way to increase your cardio respiratory fitness and endurance .Improving one's speed is mostly concerned with enhancing one's agility, leaping, sprinting, acceleration, and dynamic stopping. [21-22]The purpose of this study is to evaluate the effects of box jump training v/s squat jump training on lower body power production, speed, and Vo2max in active college athletes.

OBJECTIVES

1.The primary objective is to determine how training for box jumps affects the power output, speed, an volume of healthy collegiate athletes measured by their by their maximal heart rate (VO2MAX).
2. Our second goal is to find out how healthy collegiate athletes' lower body power generation, speed, and Vo 2 max are affected by squat jump training.
3. To determine the healthy collegiate athletes' lower body power output, speed, and Vo2max change when they train using box jumps instead of squat jumps.

Inclusion criteria:
1. Collegiate athletes aged between18–25years[16]
2. Male athletes with a training experience of 1or more year[17]
3. Apparently healthy athletes not suffering from any systemic disease.
4. BMI between 18and 25 kg/m^2

Exclusion criteria:
1. Athletes suffering from any musculoskeletal /neurological or cardiopulmonary conditions[18]
2. Any recent injury of muscle or tendon that may violate the plyometric protocol[19]
3. Lower limb fracture with in one year[20]
4. Chronic ankle instability[21]
5. Any subjects with known respiratory disease.

Methodology

Subjects in group A(n=18) performed Box Jump training. Jumping as high as one can after "dropping off" a box is a great way to evaluate one's leg power and strength in the box jump, which is also known as the depth leap. The participant was required to stand for the whole exam. To execute the jump, the subject sprang onto the box from the ground, landing on top of it while maintaining their knees bent After that, they resorted to stepping back and forth to recreate the motion.[58] Every other day, for three weeks, we did three sets of ten repetitions, with a 90-second break in between. [59]Subjects in group B (n=18) performed Squat Jump training .The method is used for measuring leg power using the Squat Jump. The subject stood on the mat with weight evenly distributed over both feet. Hands were placed on the hip. The subject squat down until the knees were bent at90 degrees, preserving the trunk Straight. His next move was a very high vertical leap, after which he landed back on the mat simultaneously on both feet.[60]The exercise was done three times a week, on alternate days, with a 90-second break in between each set of ten repetitions..[61] 18 subjects from group C control group. They didn't stop doing what they normally did because they weren't trained. At baseline and six weeks into the training program, all three groups had their speed, power, and Vo_{2max} evaluated. Dependent variables Power , Speed and VO_{2max}

Pre and post training comparison of speed ,power and vo $_{2max}$ in three groups

	Box jump training (n=18)		**Squat jump training (n=18)**		**Control group (n=18)**	
Variables	**Pre training mean ±SD**	**Post training mean ±SD**	**Pre training mean ±SD**	**Post training mean ±SD**	**Pre training mean ±SD**	**Post training mean ±SD**
Power	39.50±8.63	41.44±7.26	36.06±12.65	40.89±12.55	39.39±8.77	39.50±8.10
Speed	5.76±1.11	6.01±1.21	5.46±0.84	5.13±0.59	7.38±1.30	7.16±1.10
O2max	46.26±2.95	49.58±3.77	45.177±3.69	49.38±4.20	49.24±4.30	48.74±4.15

Comparasion between the groups comparing t-values and p- values

Group		Mean	Std. Deviation	Std. Error Mean	t	df	P value
Box jump training	**Power Baseline-Power after 6weeks**	-1.944	2.817	.664	-2.928	17	.009*
	Speed Baseline-Speed after6weeks	-.2489	.5837	.1376	-1.809	17	.088^{NS}
	VO2Max Baseline - VO2Maxafter6weeks	-3.32167	1.55807	.36724	-9.045	17	.000**
Squat jump training	**Power Baseline-Power after 6weeks**	-4.833	1.543	.364	-13.286	17	.000**
	Speed Baseline-Speed after6weeks	.3278	.4308	.1015	3.228	17	.005*
	VO2Max Baseline - VO2Maxafter6weeks	-4.20278	.92939	.21906	-19.186	17	.000**
Control	**Power Baseline-Power after 6weeks**	-.111	2.272	.536	-.207	17	.838^{NS}
	Speed Baseline-Speed after6weeks	.2222	.6709	.1581	1.405	17	.178^{NS}
	VO2 Max Baseline - VO2Maxafter6weeks	.50778	.88084	.20762	2.446	17	.066

Pre and post training inter group comparison of Power ,speed and VO_{2max} among three groups by one way ANOVA

ANOVA						
		Sum of Squares	**Df**	**Mean Square**	**F**	**P value**
Power Baseline	**Between Groups**	137.926	2	68.963	.664	.519^{NS}
	With inGroups	5297.722	51	103.877		
	Total	5435.648	53			
Power after 6weeks	**Between Groups**	36.111	2	18.056	.196	.822^{NS}
	Within Groups	4690.722	51	91.975		
	Total	4726.833	53			
Speed Baseline	**Between groups**	38.638	2	19.319	15.850	.000**
	With in groups	62.161	51	1.219		
	Total	100.799	53			
Speed after 6weeks	**Between groups**	37.376	2	18.688	18.552	.000**
	With in groups	51.373	51	1.007		
	Total	88.749	53			
VO2maxbaseline	**Between groups**	160.034	2	80.017	5.870	.005*
	Within groups	695.205	51	13.631		
	Total	855.238	53			
VO2max after 6 weeks	**Between groups**	6.956	2	3.478	.212	.810^{NS}
	With in groups	836.932	51	16.410		
	Total	843.888	53			

DISCUSSION

This study was designed for comparison between the Box jump training and Squat jump training on lower body power generation, speed and VO_{2max} in healthy collegiate athletes.A total no of 54 subjects were included according to inclusion and exclusion criteria and randomly assigned into three groups, for the duration of 6 weeks (3 days/week).

The results depicted that both box jump training and squat jump training resulted in a significant increase in power, speed and VO_{2max}($p<0.05$) in the training groups.

Al-Ahmad et al also observed the same and found 6 weeks plyometric training significantly increased the vertical jump values.[34] There are a number of recent studies that showed improvements in running economy after6 weeks of plyometric training in moderately trained players. Ramadan et al, 2017 reported that there are significant differences in $VO_{2max}$and running economy after training and they found that plyometric and explosive speed training for 12 weeks can enhance running economy and vo2max.The efficacy of squat jumps and plyometric exercises was compared in a research with 40 participants by Kentetal., 1992,[75]. According to the results, squat plyometric exercise yielded better results for increasing vertical jump height. Plyometric training may improve strength, anaerobic power, and vertical leap capacity, according to Rahimi et al.,[76] Blattneretal. ,[77] also reported that plyometrics have a significant effect in increasing hip

Thigh power specific to vertical jumping. This is the end outcome of working on motor unit recruitment and increasing kinetic energy storage in muscles.The results of our investigation corroborate the idea that squat jumping helps build explosive power. Plyometric exercises help the neuromuscular system contract more rapidly and efficiently.[78]

CONCLUSION

Training for box jumps and squat jumps, according to this research, significantly increases speed, power and VO_{2max}. The control group, however, did not show any statistically significant changes.

As a result, the working hypothesis is accepted and the null hypothesis is rejected in this research

LIMITATIONS

No females were included in the study.

Researcher was not able to observe activities of the subjects other than specified training of box and squat jump during the study period.

REFERENCES

1. YessisM., Hatfield F. Plyometric training, Achieving Explosive Powerin Sports Canoga Park CA: Fitness systems 1986.
2. Ramadan WA, Elsayed AA. The combined influence of plyometric and explosive speed training on vo2 max and running economy. International journal of sport science and arts. 2017.
3. Ramadan WA, Elsayed AA. The combined influence of plyometric and explosive speed training on vo2max and running economy. International journal of sport science and arts. 2017.
4. Ramadan WA, Elsayed AA. The combined influence of plyometric and explosive speed training on vo2max and running economy. International journal of sport science and arts. 2017.
5. Villarreal ES, Requena B, Cronin JB. The effects of plyometric training on sprint performance : ameta- analysis. The Journal of Strength & Conditioning Research.2012Feb1;26(2):575-84.
6. Tahsin İN,DaglioglüÖ.The effect of the plyometric training program on sportive performance parameters in young soccer players. Turkish Journal of Sport andExercise.2018;20(3):184-90. AF KJ, Stieg JL, Tran TT, AF LE, AF JW, AF DA. Effects of depth jump vs. box jump warm-ups on vertical jump in collegiate vs .club female volley ball players.Med Sport. 2011;15(3):103-6.
7. BalBS,SinghS,DhesiSS.Effectsof6-weekplyometrictrainingonbiochemicaland physical fitness parameters of Indian jumpers. Journal of Physical Education andSport Management. 2012 May 31;3(2):35-40.
8. BalBS,SinghS,DhesiSS.Effectsof6-weekplyometrictrainingonbiochemicaland physical fitness parameters of Indian jumpers. Journal of Physical Education andSport Management. 2012 May 31;3(2):35-40.
9. Saez DV, Newton RU. Does plyometric training improve strength performance?Journalof science medicine sport 2010;13(5):513-22
10. Bobbert MF. Drop jumping as a training method for jumping ability. Sports medicine 1990;9:7-22
11. Mulcary RL,Crowther RG. The effect of an 8 week supplemented plyometric exercise training program on leg power, agility and speed in adolescentnetball players. Journals of Australian strength and conditioning. 2013; 21(3): 31-6
12. AlamS, Pahlavani HA, Mehdipou A. The effect of plyometric circuit exercises on the physical preparation in dicesofeliteh and ballplayer. Physical education and sport. 2012; 10(2): 89-98

13. Carlson K, Magnusen M, Walters P. Effect of various training modalities on vertical jump. Research in Sports Medicine. 2009 Jun 2;17(2):84-94.
14. Baker D. Improving vertical jump performance through general, special and specific strength training. Journal of strength and conditioning research. 1996; 10: 131-136
15. Harman EA, Rosenstein MA. The effect of arms and countermovement on vertical jumping. Journal of medicine and science in sport and exercise.1990;22:825-833.
16. Adams K, Climstein M. The effect of six weeks of squat, plyometric and squat plyometrictrainingonpowerproduction.Journalofappliedsportscienceresearch. 1992; 6: 36-41
17. Fatourous IG, Buckenmeyer P. Evalauation of plyometric training , weight training and their combination on vertical jumping performance and leg strength. Journal of strength and conditioning research. 2000; 14: 470-476
18. Saez DV, Badillo JJ. Enhancing sprint and strength performance after combined vs maximal power, heavy resistance and plyometric training alone. Journal of science medicine sport. 2013; 16: 146-150.
19. Andrzejewski M, Chmura J, Pluta B. A analysis of sprinting activities of professional soccerplayers.Journalofstrengthandconditioningresearch.2013;27(8):2134-2140.
20. Djaoui L, Chamari K, Dellal A. Maximal sprinting speed of elite soccer players duringtrainingandmatches.Journalofstrengthandconditioningresearch.2017; 31(6): 1509-1517.
21. Sharma HB, Gandhi S, Meitei KK, Dvivedi J, Dvivedi S. Anthropometric basis of vertical jump performance: A study in young Indian national players. Journal of clinical and diagnostic research: JCDR. 2017 Feb;11(2):CC01.
22. Reeves RA, Hicks OD, Navalta JW. The relationship between upper arm anthropometricalmeasuresandverticaljumpdisplacement.International journal of exercisescience.2008;1(1):22-29.
23. Vadivelan K, Sudhakar S. To compare the effects of sprint and polymetric training program on anaerobic power and agility in collegiate male football players. InternationalJournalofPhysiotherapy.2015Jun 1;2(3):535-43.
24. Baechle T, Earle RW. Essentials of strength training and conditioning. National strength and conditioning association. 2008.
25. Whitehead MT, Scheett TP, McGuigan MR, Martin AV. A comparison of the effects of short-term plyometric and resistance training on lower-body muscular performance.TheJournalofStrength&ConditioningResearch.2018Oct 1;32(10):2743-9.
26. Faigenbaum AD, Keiper FB, Tevlin W. Effect of short term plyometric and resistancetrainingprogramonfitnessperformanceinboysage18to25years. Journal of sport science and medicine. 2007;6, 519-525.
27. Shete AN, Bute SS, Deshmukh PR. A study of VO2 max and body fat percentage in female athletes. Journal of clinical and diagnostic research: JCDR. 2014 Dec;8(12):BC01.
28. BrownJD.Stayingfitandstayingwell;physicalfitnessasmoderatoroflifestress. Journalofpeassocialpsychological. 1991;60:555-561.
29. TahsinİN,DagliogluÖ.Theeffectoftheplyometrictrainingprogramonsportive performance parameters in young soccer players. Turkish Journal of Sport andExercise.2018;20(3):184-90.
30. Ramadan WA, Elsayed AA. The combined influence of plyometric and explosive speed training on vo2max and running economy.
31. AF KJ, Stieg JL, Tran TT, AF LE, AF JW, AF DA. Effects of depth jump vs. box jumpwarm-upsonverticaljumpincollegiatevs.clubfemalevolleyballplayers.Med
Sport.2011;15(3):103-6.
32. Paul J, Kumar S. Comparative effect of squat jump and split jump exercise on dynamic balance among female netball players. International journal of physiotherapy. 2018 Apr 1;5(2):57-62.
33. Adams K, O'Shea JP, O'Shea KL, Climstein M. The effect of six weeks of squat, plyometricandsquat-plyometrictrainingonpowerproduction.Journalsofapplied sport science research. 1992 Feb 1;6(1):36-41.
34. Kamble KG, Kazi AH. Effect of squat jump training on performance of high jumping in young female students. International Journal of Multidisciplinary Research and Development. 2017;4(2):162-4.
35. StamfordB.Theresultofaerobicexercise.Thephysicianandsportmedicine.2001. 1(9):145
36. Burkett LN, Philips WT, Ziuraritis J. The best warm up for the vertical jump in collegiateathletes.Journalofstrengthandconditioningresearch.2005:19:673-676
37. GourgolisV,AggleoussisN,Kasimatisp.Effectofsubmaximalhalfsquatswrmup program on vertical jumping ability. Journal of strength and conditioning research. 2003; 17: 342-344
38. KentT.Theeffectofsixweekofsquat,plyometricandsquatplyometrictrainingon power production. Journal of strength and conditioning research. 1992; 6(1): 36-41
39. Rehman R. The effects of plyometric, weight and plyometric weight training on Anaerobicpowerandmuscularstrengthphysicaleducationandsport.2005:3(1):81- 89
40. BlattnerSE,NobleL.Relativeeffectsofisokineticsandplyometrictrainingon vertical jumping performance. Research quartz. 1979:50(4) :583-588
41. YessieM,HatfieldF.Plyometrictraininginachievingexplosivepowerinsports. Journal of fitness systems. 1986:

221-228
42. SaundersP,TelfordRD,HawleyJA.Reliabilityandvariabilityofrunningeconomy in elite distance runners. Journal of medicine andscience in sport and exercise. 1976:36 (11); 11-22
43. Holm I, Fosdahl MA. Effect of neuromuscular training on proprioception, balance, musclestrengthandlowerlimbfunctioninfemaleathlete.Clinicaljournalofsports medicine. 2004; 14(2) 88-94
44. FredW,MarquesMC.Relationshipbetweenstrengthparametersandsquatjump performance in trained athletes. Journals of motricidade. 2011.7:43-48
45. HerreroJA,MaffiulettiN.Electrromyostimulationandplyometrictrainingeffects on jumping and sprint time. International journal of sports medicine. 2006. 27(07) 533-539
46. MarkovicG,MetikosD.Effectofsprintandplyometrictrainingonmusclefunction and athletic performance. The journal of strength and conditioning research. 2007; 21.543-549