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Research Article

The Effect of Plyometric Training and Strength Training among Male College Volleyball Players - A Comparative Study

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A B S T R A C T

Introduction: The performance of sports persons can be enhanced through scientific inputs from physiotherapists, as demonstrated in this study.

Purpose: The aim of this study was to compare the efficacy of plyometric training versus strength training in improving the power, standing broad jump, and vertical jump performance of college-level volleyball players.

Methodology: Fifty subjects were randomly assigned to either of one group equally after assessment. Subjects in Group 1 were trained with plyometric training while subjects in Group 2 (n = 25) were trained with strength training. The pre-test and post-test data of standing broad jump, power, vertical jump performance were taken before and after the intervention respectively using standing long jump test, power by Sayer's formula, and vertical jump test.

Results: In Group 1, average power before the intervention was 3409.39 ± 290.19 watts and after the intervention, it was 3912.30 ± 100.00 watts. In Group 2, average power before the intervention was 3318.30 ± 236.17 watts, and after the intervention, it was 3709.2 ± 298.86 watts. Thus, in both the groups, intervention led to a significant improvement in power. In Group 1, average vertical jump height before the intervention was 42.16 ± 4.52 cm and after the intervention, it was 49.68 ± 4.95 cm. In Group 2, average vertical jump height before the intervention was 40.96 ± 3.93 cm and after intervention, it was 47.08 ± 4.76 cm.

Conclusion: Both the groups showed improvement after the training, but the group trained with plyometric training showed better results than the strength training group.

Keywords: Sports medicine, Fitness training, Physiotherapy, Plyometric training

Introduction

Volleyball is a limited-contact sport that is played at all levels of skill and on multiple surfaces. The volleyball training programme requires a combination of aerobic fitness, flexibility, strength and power for enhanced sport-specific skills.[1-5]

Power is essential for playing most sports. Plyometrics is a technique used to enhance explosive power, as a significant part of most athletic performances. It has been fused into the overall training programme in several sports.

Volleyball involves many movements, like diving, short sprinting, lateral change of direction, and most importantly, vertical jumping. Therefore, increasing vertical jump height is a critical factor for improving performance.[6] Volleyball players use large muscle groups with agonist and antagonist muscle contractions simultaneously. Strengthening individual muscle groups is time-consuming and also boring for players. Plyometrics training is less time consuming and is also liked by players.

Objective

To compare the effect of plyometrics and strength training in improving the vertical jump, standing broad jump, and peak power in male college volleyball players.

Null Hypothesis: There will be no significant difference in pre-training and post-training value of the vertical jump test, standard broad jump test, and peak power between the groups after giving plyometric training and strength training.

Alternative Hypothesis: There will be a significant difference in the pre-training and post-training value of the vertical jump test, standard broad jump test, and peak power between the two groups after plyometric training and strength training.

Material & Method

Fifty volleyball male players were chosen from different colleges of Chandigarh based on the below-mentioned inclusion and exclusion criteria. Informed consent was obtained from all the participants. Clearance was obtained from the thesis committee and ethics committee of the parent institution. Experimental Method (two group pre/post-test design; 25 in each group) was used.

Inclusion Criteria

Participants aged 18-28 years who had done neither plyometric nor weight training of their lower extremity for a minimum of 6 months before the study.

Exclusion Criteria

Any history of cardio respiratory disorders, orthopaedic and neurological impairments, previous injury.

The collected data were analysed by mean standard deviation, paired and unpaired t-tests.

Procedure

For all participants, vertical jump height efficiency, standing broad base and peak power was measured. After randomising the subjects into two groups (n = 25), warm-up exercises were given for both the groups in the form of jogging and callisthenics for 10 minutes. After training, cooldown exercises were given for both the groups in the form of stretching for 5 minutes. The study duration was from February to April 2021.

The subjects of one group (n = 25) were given plyometric training for 8 weeks with 3 sessions per week. The protocol for plyometric training has been shown in Table 1.

The subjects of other groups (n=25) were given strength training with 3 sessions per week, over a period of 8 weeks. The protocol of strength training was as shown in Table 2.

After plyometric training and strength training of 8 weeks, vertical jump height efficiency, standing broad base and peak power was measured again.

The data thus collected were compared using paired/unpaired t-test, using SPSS (SPSS 15.0, Chicago, USA), Microsoft Word, and Excel. All variables were tested for normal distribution of data. Data have been shown as mean ± SD.

Table 1.Plyometric Training for Group I

Plyometric Exercises	1st Phase (2 Weeks) [Sets*Repetition (Box Height) Rest Period]	2nd Phase (2 Weeks) [Sets*Repetition (Box Height) Rest Period]	3rd Phase (2 Weeks) [Sets*Repetition (Box Height) Rest Period]	4th Phase (2 Weeks) [Sets*Repetition (Box Height) Rest Period]
Depth jump	3*10 (20) 30	3*12 (30) 30	3*11 (40) 30	3*12 (50) 30
Counter movement Jump (CMJ)	3*10 (-) 30	3*12 (-) 30	3*11 (-) 30	3*12 (-) 30
Lateral jump	3*10 (-) 30	3*12 (-) 30	3*11 (-) 30	3*12 (-) 30
Squat jump	3*10(-)30	3*12 (-) 30	3*11 (-) 30	3*12 (-) 30

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Table 2.Strength Training for Group 2

Exercises	1st Phase (2 Weeks) [Sets*Repetition (% of 1 RM) Rest Period]	2nd Phase (2 Weeks) [Sets*Repetition (% of 1 RM) Rest Period]	3rd Phase (2 Weeks) [Sets*Repetition (% of 1 RM) Rest Period]	4th Phase (2 Weeks) [Sets*Repetition (% of 1 RM) Rest Period]
Leg press	4*10 (40%) 30	4*10 (60%) 30	4*8 (80%) 30	4*6 (100%) 30
Knee Extension	4*10 (40%) 30	4*10 (60%) 30	4*8 (80%) 30	4*6 (100%) 30
Knee Flexion	4*10 (40%) 30	4*10 (60%) 30	4*8 (80%) 30	4*6 (100%) 30
Calf raise	4*10 (40%) 30	4*10 (60%) 30	4*8 (80%) 30	4*6 (100%) 30

Table 3.Age (Years)of Participants in Both Groups

Group	N	Minimum Age	Maximum Age	Mean	Standard Deviation	Median	t value	p value
Group 1	25	18	28	21.84	2.641	21.00	0.160	0.873 NS
Group 2	25	18	28	21.72	2.654	21.00		
Total	50	18	28	21.78	2.621	21.00		

NS: Not significant

Results

As shown in Table 3, the average age in Group 1 was 21.84 ± 2.6 years, and that in Group 2 was 21.72 ± 2.65 years. No significant difference was found between Groups 1 and 2 asp = 0.873 (>0.05).

Table 4 shows that the average height in Group 1 was 164.36 ± 3.4 cm and the average height in Group 2 was 165.32 ± 2.1 cm. The average weight in Group 1 was 64.08 ± 2.61 kg and that in Group 2 was 64.16 ± 2.42 kg.

Table 5 shows that in Group 1, average power before the intervention was 3409.39 ± 290.19 watts and that after the intervention was 3912.30 ± 100.06 watts indicating an improvement of 14.75%. In Group 2, average power before the intervention was 3318.30 ± 236.17 watts and that after the intervention was 3709.2 ± 298.86 watts indicating 11.56% improvement. In both the groups, thus, the intervention was effective ($p < 0.01$).

Table 4.Height and Weight of Both Groups

Group Height/ Weight		N	Minimum	Maximum	Mean	Standard Deviation	Median	t value	P value
Height (cm)	Group 1	25	155	170	164.36	3.439	165.0	1.177	0.245
	Group 2	25	161	169	165.32	2.193	165.0		NS
Total		50	155	170	164.84	2.895	165.0		
Weight (kg)	Group 1	25	60	68	64.08	2.613	64.00	0.112	0.911
	Group 2	25	60	68	64.16	2.427	64.00		NS
Total		50	60	68	64.12	2.496	64.00		

Table 5.Comparison within the Group (Pre-post Comparison) for Power Parameter (Watts)

Group	N	Min.	Max.	Mean	Standard Deviation	Median	Mean Difference	SD of Difference	Change (%)	t value	p value
Group 1 Pre	25	2788	4061	3409.3	290.19	3424.4	02.9	259.01	14.75	9.71	0.000 HS
Post	25	3872	4172	3912.3	100.06	3872.3					
Group 2 Pre	25	2954	3728	3318.3	236.17	3332.0	390.9	169.05	11.78	11.56	0.000 HS
Post	25	3136	4137	3709.2	298.86	3756.9					

HS: Highly significant

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Table 6.Comparison within the Group (Pre-post Comparison) for Standing Broad Jump Height Parameter (cm)

Group	N	Min.	Max.	Mean	Standard Deviation	Median	Mean Difference	SD of Difference	Change (%)	t value	p value
Group 1 Pre	25	200	230	214.6	8.46	215.0	15.28	2.909	7.12	26.27	0.000 HS
Post	25	215	246	229.8	9.01	229.0					
Group 2 Pre	25	200	229	215.2	8.16	215.0	10.44	4.574	4.85	11.41	0.000 HS
Post	25	206	245	225.6	11.47	225.0					

HS: Highly significant

Table 7.Comparison within the Group (Pre-post Comparison) for Vertical Jump Height Parameter (cm)

Groups	Pre and Post Test	N	Min.	Max.	Mean	Standard Deviation	Median	Mean Difference	SD of Difference	Change (%)	t value	p value
1	Pre Post	25 25	35 40	51 58	42.16 49.68	4.52 4.95	42.00 51.00	7.52	2.551	17.84	14.74	0.000 HS
2	Pre Post	25 25	35 38	49 55	40.96 47.08	3.93 4.76	40.00 48.00	6.12	2.147	14.94	14.25	0.000 HS

HS: Highly significant

Table 6 shows that after the intervention, there was 14.75% improvement in Group 1, and 11.78% improvement in Group 2 ($p = 0.009$; $p < 0.01$).

Table 7 shows that in Group 1, average vertical jump height before the intervention was 42.16 ± 4.52 cm and after intervention, it was 49.68 ± 4.95 cm resulting in 17.84% improvement. In Group 2, average vertical jump height before the intervention was 40.96 ± 3.93 cm and after intervention, it was 47.08 ± 4.76 cm resulting in 14.94% improvement. In both groups, intervention was effective ($p < 0.01$).

Discussion

The key result in this study is that 8 weeks of plyometric training and strength training can remarkably improve a volleyball player's vertical jump and power output. This finding is beneficial for coaches who get only a short period of time to train their athletes before contests, for example, in high school sports. They can select the most suitable approach as per their schedule and available resources. Athletes should possess a moderate-to-high level of skill when considering the intensity, volume, and progression of a plyometric programme. This programme is designed for collegiate athletes who should possess this skill level in order to be successful at the college level. Data analysis showed that both plyometric training and strength training are beneficial in improving the vertical jump performance, but when compared between the two procedures for effectiveness, the results were significant for plyometric training. Thus, this study accepts the experimental hypothesis. Plyometric training is more effective in improving the vertical jump performance as compared to strength entraining.

Power measures found for this study are directly proportional to vertical jump measures. Power is equated using vertical jump height and mass. Hence, an alteration in jump height will show a comparative change in power.

These results support the earlier findings of Vassil & Bazanov who proposed that the efficiency of the composed plyometric training programme on youth volleyball players improves the force capabilities in their usual training period.[7] Hosseini concluded that PT is regarded as the best mentor of coaches and trainers for enhancing the intensity of performance of volleyball players.[8]Abaas studied the association among strength, endurance and power performance features of untrained university undergraduates using three distinct methods of plyometric training. The study proved that plyometric training can make the leg muscle stronger and increase the power significantly.[9]

This study tried to explain how to tackle the difficulties arising in sports by practising specific training regimens. Both groups had a better outcome because of the training, but the group trained with plyometric training had superiority over the other for vertical jump performance.

Limitations

The scope of the study was limited due to short duration of training period.

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This study included only male college level subjects with in a small range of body mass index.

Conclusion

This study shows that plyometric training can be used effectively in the field of physiotherapy and sports medicine to obtain better results for the fitness of volleyball players.

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Conflict of Interest: None

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