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Effect Of Plyometric Training With Dynamic Stretching Programme On Upper Body Strength And Lower Body Strength Of Female Volleyball Players

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Abstract:

The purpose of the study was to investigate the effect of plyometric training with dynamic stretching programme on Upper body strength and lower body strength of female volleyball players. Sample chosen about 60 volleyball players and they were divided in to plyometric training group (n = 15),dynamic stretching group (n= 15), plyometric with dynamic stretching group (n=15)and control group (n = 15). The plyometric training programme and dynamic stretching programme comprises of plyometric exercises and dynamic stretching exercises. Result showed that 4 weeks of training programme significantly improved the Upper body strength and lower body strength between the pre and post test scores. It indicated a significant improvement between pre – post test mean difference (t = 4.41, P< 0.05) in plyometric training group, (t = 3.64, P< 0.05) in dynamic stretching group , (t = 7.86, P< 0.05) in plyometric with dynamic stretching group and (t = 0.42, P< 0.05) in control group and (t = 2.28, P< 0.05) in plyometric training group (t = 2.99, P< 0.05) in dynamic stretching group , (t = 5.72, P< 0.05) in plyometric with dynamic stretching group and (t = 1.87, P< 0.05) in control group for Upper body strength and lower body strength respectively. The findings suggested that three days of plyometric training with dynamic stretching programme a week for 4 weeks is sufficient enough to show improvements in Upper body strength and lower body strength.

Introduction:

Physical fitness is important to improve health, a more attractive appearance, and increased physical performance. More recently, physical fitness has been conceptualized as a manifested continuum extending from birth and death and has been operationally defined by the tests and to measure it. (AAPHERD, 1980). Physical fitness comprises of several components are muscular strength and endurance, cardio vascular and respiratory endurance, muscular power, flexibility, speed, agility ,co ordination, balance and accuracy. Those components acted for the efficient functioning of the day to day performance of the players.

Volleyball is one of the most popular team sport extensively played and viewed all over the world. By that time, volleyball has developed to involve common techniques of defensive and offensive structures. When competitive volleyball is carefully regulated; numerous variations of volleyball have developed for casual play. Volleyball game is play is played as a outdoor and indoor courts competitively at national and international basis (JOHN SHAJI, 2009).

A good volleyball player needs the ability to rapidly switch between forward, backward, lateral and vertical movement. It can be enhanced through the basic training or some advanced training program. It is understood that the key to success for volleyball game is to become proficient with The more basic training versions and then advance to more difficult one (SALUJA ISHA, 2009). Volleyball players must generate power and torque in the shoulders and focus on developing strength in both areas through compound movements. Explosive power in the lower-body muscles -- the hamstrings, quadriceps and calves -- allows a player to play above the net, dominating opposing defenses with hitting, smother opposing offenses with blocking or assisting teammates by receiving even the toughest passes high in the air. (Bauer, et.al.,)

Plyometric type of exercises have been used successfully by all the players of different games as a method of training to enhance power. In order to realize the benefits of plyometric training the stretch-shortening cycle must be invoked. It requires careful attention to the technique used in the drill or exercise during the training period. The primary importance in plyometric training is the rate of stretch rather than the magnitude of stretch.

Plyometrics can be described as a "explosive-reactive" power training. This type of training involves powerful muscular contractions in response to a rapid stretching of the involved musculature. These powerful contractions are not a pure muscular event; because they have an extremely high degree of central nervous system involvement. So this event is called neuromuscular event (Van Praagh E, 2001)

Dynamic stretching is the use of movement to stretch the muscles before a workout or competition. The dynamic exercises should incorporate into warm up program should be appropriate to the movements that would experience in the particular sport/event. This type of stretching prepares the body for physical exertion and sports performance. Dynamic stretching used to increases range of movement, blood and oxygen flow to soft tissues prior to exertion. (Brent L, etal., 2006)

Methods:

Selection of subjects

The researcher used experimental design approach with two groups (Pre / Post test) 15 volleyball players in each group, aged between 18 – 25 years in SNS group of institutions were selected by using purposeful sampling.

Training Program

Training program consisted of (a) 10 min of warm up exercises (b) 35 min of plyometric exercises involving upper body and lower body muscle group at an intensity of low to moderate level with 2 sets in 6-10 repetitions (c) 20 min of dynamic stretching exercises were performed for muscle groups of upper limb and lower limb. Each stretch was trained with 1 to 5 repetitions for each muscle (d) at the end of the session 10 min if cool down exercise. The subjects were trained 3 days in a week in the morning session between the total times of 75 min per session.

Testing Procedures

The variable measured in this study was Upper body strength and lower body strength. The tests and measurements to measure the outcome of intervention had been described as practical, valid and reliable.

Upper body strength was measured by using Bench press test (1 RM technique) and the score was recorded in kilograms.

Lower body strength was measured by using Horizontal Leg press test and the

score was recorded in kilograms.

The above test was measured before and after 4 weeks training period.

Statistical Analysis:

Statistical analysis followed the most important descriptive statistics, such as 't' test was used to determine the significance of differences in the measured variable between pre test and post test. The result was presented as means (SD) $P < 0.05$ was accepted as significant.

Variables	Group	Mean \pm SD	Mean Differences	SEM	't' ratio	%
Upper body strength	Pre test	30.46 \pm 3.31	5.53	1.32	4.41	18.15
	Post test	36.0 \pm 3.44				
Lower body strength	Pre test	45.33 \pm 8.73	1.32	3.50	2.28	17.64
	Post test	53.33 \pm 11.75				

*Significant at 0.05 level

Table:.1

Results of the Pre test and Post test of Upper body strength and Lower body strength for plyometric training group

Table 1 indicates the obtained 't' values of the plyometric training group on variables of: 4.41 (Upper body strength) and 2.28 (Lower body strength). Hence the obtained t-values on the selected criterion variables higher than the required critical values, it was concluded that the plyometric training programme produced significant improvement in Upper body strength (18.15%) and Lower body strength (17.64%).

Variables	Group	Mean± SD	Mean Differences	SE M	't' ratio	%
Upper body strength	Pre test	30.26 ± 1.53	3.73	1.02	3.64	12.32
	Post test	34.0 ± 2.95				
Lower body strength	Pre test	43.8 ± 8.02	4.8	1.60	2.99	10.95
	Post test	48.6 ± 8.68				

*Significant at 0.05 level

Table: 2

Results of the Pre test and Post test of Upper body strength and Lower body strength for dynamic stretching group

Table 2 indicates the obtained 't' values of the dynamic stretching group on variables of: 3.64 (Upper body strength) and 2.99 (Lower body strength). Hence the obtained t-values on the selected criterion variables higher than the required critical values, it was concluded that the plyometric training programme produced significant improvement in Upper body strength (12.23%) and Lower body strength (10.95%).

Variables	Group	Mean± SD	Mean Differences	SE M	't' ratio	%
Upper body strength	Pre test	31.26 ± 4.36	8.73	1.11	7.86	27.92
	Post test	40.0 ± 1.41				
Lower body strength	Pre test	45.20 ± 9.21	15.0	15.0	5.72	33.18
	Post test	60.20 ± 3.82				

*Significant at 0.05 level

Table:3

Results of the Pre test and Post test of Upper body strength and Lower body strength for plyometric training with dynamic stretching group

Table 3 indicates the obtained 't' values of the plyometric training with dynamic stretching group on variables of: 7.86 (Upper body strength) and 5.72 (Lower body strength). Hence the obtained t-values on the selected criterion variables higher than the required critical values, it was concluded that the plyometric training programme produced significant improvement in Upper body strength (27.92%) and Lower body strength (33.18%).

Variables	Group	Mean \pm SD	Mean Differences	SE M	't' ratio	%
Upper body strength	Pre test	31.06 \pm 3.82	.133	0.09	1.46	0.42
	Post test	31.20 \pm 3.74				
Lower body strength	Pre test	44.13 \pm 8.73	.400	.213	1.87	0.90
	Post test	44.53 \pm 8.56				

Table: 4

Results of the Pre test and Post test of the Upper body strength and Lower body strength for control group

Table 4 indicates the obtained 't' values of the control group on variables of: 1.46 (Upper body strength) and 1.87 (Lower body strength). Hence the obtained t-values on the selected criterion variables lesser than the required critical values, it was concluded that it produced insignificant improvement in Upper body strength (0.42%) and Lower body strength (0.90%).

Variables	Source of variation	Sum of squares	Degrees of freedom	Mean square	F
Upper body strength	Between Groups	10.20	3	3.40	.289
	Within Groups	658.53	56	11.76	
Lower body strength	Between Groups	26.31	3	8.77	.116
	Within Groups	4225.86	56	75.46	

Table:5

ANALYSIS OF VARIANCE ON PRE-TEST

Variables	Source of variation	Sum of squares	Degrees of freedom	Mean square	F
Upper body strength	Between Groups	616.20	3	205.40	22.44
	Within Groups	512.40	56	9.15	
Lower body strength	Between Groups	2038.26	3	679.42	9.014
	Within Groups	4221.06	56	75.37	

*Significant at 0.05 level

Table:6

ANALYSIS OF VARIANCE ON POST-TEST

Results :

Analysing the Significance of Mean Difference on Criterion Variables

In analysis of covariance, analyzing the data on pre test means and post test means among the Plyometric training group, Dynamic stretching group and Plyometric training with Dynamic stretching group is the preliminary process. As the final step of analysis of covariance, the post test means are adjusted for differences in the pre test means, and the adjusted means are tested for significance. Thus the data were analyzed and the results on pre test, post test and adjusted test are as follows.

Results on Pre test means

In testing the pre test means among Plyometric training group and Dynamic stretching group and control group on criterion variables, the obtained f-ratios are: .289 (Upper body strength) and .116 (Lower body strength). The obtained F- ratios were statistically not significant since they failed to reach the critical value at 0.05 level. Thus the obtained results on pre test mean confirm the random assignment of subjects in to different groups was successful.

Results on Post test means

In testing the post test means among Plyometric training group and Dynamic stretching group and control group on criterion variables, the obtained f-ratios are: 22.44

(Upper body strength) and 9.014 (Lower body strength). The obtained F- ratios were found as statistically significant on Upper body strength and Lower body strength.

Variables	Source of variation	Sum of squares	Degrees of freedom	Mean squares	F
Upper body strength	Between Groups	604.727	3	201.576	23.432
	Within Groups	473.136	55	8.602	
Lower body strength	Between Groups	1870.015	3	623.338	10.295
	Within Groups	3330.028	55	60.546	

Table:7

ANOVA FOR ADJUSTED POST TEST MEAN

Results on Adjusted means

In testing the adjusted means among the Plyometric training group and Dynamic stretching group and control group on criterion variables, the obtained f-ratios are: 23.43 (Upper body strength) and 10.29 (Lower body strength). The obtained F- ratios on the above said criterion variables among the four groups were significant at 0.05 level. Thus the obtained results on adjusted means statistically confirm the differences exist after completion of treatment period on criterion variables among the four different groups such as Plyometric training group, Dynamic stretching group, Plyometric training with Dynamic stretching group and control group.

Discussion and Conclusion:

This study is an attempt to investigate that combined effect of dynamic stretching and plyometrics for the athletes who require repetitive jumping activity and agility. However there has been limited research examining the influence of plyometric training with dynamic stretching exercises. The focus of plyometrics is on power, not muscle growth. Exercise such as rebound jumps (jump from a box or bench to the floor and then immediately jump up) can increase strength in the bench press and squat, respectively.

When a concentric contraction occurs immediately following an eccentric contraction, then the force generated can be dramatically increased, such as when the player immediately switch from lowering the bar in a bench press to pushing it up. Because stretched muscles cannot store the eccentric energy, the switch from eccentric (lengthening the muscle) to concentric (shortening the muscle) must be instantaneous to get the maximum plyometric effect. This process is called the stretch-shortening cycle, and it is the underlying mechanism of plyometric training. Therefore, a dynamic stretching that stresses the dynamic receptor is more beneficial when preparing for a warm-up when it was performing a dynamic activity. This study demonstrated that dynamic stretching and plyometrics when used in conjunction with one another provides both statistically significant and practically relevant improvement in Upper body strength and lower body strength over a period of 4 weeks in female volleyball players.

Discussion on Upper body strength

The 1RM bench press test was used to measure Upper body strength. The pre test Upper body strength scores were as follows: Plyometric training group = 30.46 ; Dynamic stretching group = 30.26; Plyometric training with Dynamic stretching group = 31.26 and Control group = 31.06. The post test score was discernibly larger than the pre test ($t= 4.41, p < 0.05$) in the Plyometric training group. The post test score was discernibly larger than pre test ($t= 3.64, p < 0.05$) in the Dynamic stretching group. The post test score was discernibly larger than pre test ($t= 7.86, p < 0.05$) in the Plyometric training with Dynamic stretching group. The Upper body strength had improved significantly after 4 weeks of training .The improvements were as follows: Plyometric training group = 18.15%; Dynamic stretching group = 12.32%; Plyometric training with Dynamic stretching group = 27.92% and Control group = 0.42%. The plyometric training with Dynamic stretching group therefore yielded a 27.92% greater mean gain in Upper body strength than Plyometric training group and dynamic stretching group. We conclude that plyometric with Dynamic stretching training produced greater development of Upper body strength . The results of the present study are in line with previous study (Torres EM,et.al., 2008) who reported the influence of upper-body static stretching and dynamic stretching on upper-body muscular performance significantly larger ($p \leq 0.05$) for the static and dynamic condition compared to the static-only condition.

Discussion on Lower body strength

The leg press test was used to measure Lower body strength. The pre test Lower body strength scores were as follows: Plyometric training group = 45.33 ; Dynamic stretching group = 43.8; Plyometric training with Dynamic stretching group = 45.20 and Control group = 44.13. The post test score was discernibly larger than the pre test ($t=2.28$, $p<0.05$) in the Plyometric training group. The post test score was discernibly larger than pre test ($t=2.99$, $p<0.05$) in the Dynamic stretching group. The post test score was discernibly larger than pre test ($t=5.72$, $p<0.05$) in the Plyometric training with Dynamic stretching group. The Lower body strength had improved significantly after 4 weeks of training .The improvements were as follows: Plyometric training group = 17.64%; Dynamic stretching group = 10.95%; Plyometric training with Dynamic stretching group = 33.18% and Control group = 0.90%. The plyometric training with Dynamic stretching group therefore yielded a 33.18% greater mean gain in Lower body strength than Plyometric training group and dynamic stretching group. We conclude that plyometric with Dynamic stretching training produced greater development of Lower body strength. The results of the present study are in line with previous study (Damon P.S et al., (1999))who reported that statistically significant improvements were observed among the plyometric groups for functional tests of muscle strength and speed.

Conclusion

The experimental group produced a greater improvement in Upper body strength and Lower body strength about 18.15% and 17.64% in Plyometric training, 12.32% and 10.95% in Dynamic stretching, 27.92% and 33.18% in Plyometric training with Dynamic stretching group and 0.42% and 0.09% in control group respectively. Therefore, plyometrics is recommended to be incorporated prior to dynamic stretching when the vision is to enhance the Upper body strength and Lower body strength. Plyometric training and volleyball go together if the player want to reach their full potential. Not only with volleyball, but with any sport, the correct training will help to achieve your goals. Plyometric exercises are designed to do is improve the functions of the nervous system. Performing dynamic stretches increases the core and muscle temperature, stimulates the nervous system, and improves elasticity. It helps to produce fast and powerful movements. So that this study is naturally related to the variables which was focussed. It is greatly helps in the improvement of Upper body strength and Lower body strength. The results of the present study are in line with previous study (Ronnestad BR.,

et al, 2008). compared the effects of combined strength and plyometric training with strength training alone on power-related measurements in professional soccer players. There was a significant difference in relative improvement between the intervention group and control group in 1RM half squat, 4BT, and SJ. Likewise the findings suggested that 3 days of plyometric training with dynamic stretching a week for 4 week is sufficient enough to show improvement in Upper body strength and Lower body strength.

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