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# Effects of strength training and plyometric training on selected physical fitness variables among inter-collegiate volleyball players

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**Abstract**
Strength training is important for athletes across all sports but for football players, it's a prerequisite for safe competition. The physicality of football means that athletes, especially young athletes, must be structurally strong and conditioned to compete safely. If one of your players shows up under-prepared, his safety and your team's chance of success is at risk. The good news is that most football programs have adopted some system of strength and conditioning to prepare their players. But if you're not currently training your players on a periodized strength training program, designed by a certified strength coach for the specific demands of football, you might not be doing enough to reduce your athletes' risk of injury.

The purpose of the present study, 90 players were selected as samples from Bharathiar University affiliated colleges, Coimbatore District in the year of 2019 - 2020. Finally sixty men volleyball players were randomly selected as subjects for the present study. They were divided into three groups. Each group consists of 20 subjects. Group -I Strength Training Group (STG), Group - II Plyometric Training Group (PTG) and Group - III control group (CG). The ages of subjects were ranged from 18-25. In the present study are significant source to maintain the skill performance and with its related physical fitness variables is leg explosive power and shoulder muscular strength. The present study pays attention mainly on testing the means of three groups (two experimental and one control) and secondarily deals with the increase of means in each group from baseline to post treatment for various measures. The statistical tools used are the analysis of co-variance was applied. To determine whether the training programmes produced significantly different improvements in selected variables after 12 weeks of training the analysis of co-variance was used. The result of this study indicates that there is insignificant difference in leg explosive power and shoulder muscular strength among players of volleyball game. The hypothesis of this study stated that there would be significant difference in leg explosive power and shoulder muscular strength among players of volleyball game.

**Keywords:** Leg explosive power and shoulder muscular strength

## Introduction
In the present world, Sports have become extremely competitive. It is not mere participation or practice that makes an individual victorious. Sports life is affected by various factors like physiology, biomechanics, sports training, sports medicine, sociology and coaching, computer application and psychology and so on). The physical activity involves the movement of people, animals and/or a variety of objects such as balls and machines. In contrast, games such as card games and board games, though these could be called mind sports, require only mental skills. Non-competitive activities such as jogging and rock-climbing are usually classified as recreations.

## Methodology
The purpose of the present study, 90 players were selected as samples from Bharathiar University affiliated colleges, Coimbatore District in the year of 2019 - 2020. Finally sixty men volleyball players were randomly selected as subjects for the present study. They were divided into three groups. Each group consists of 20 subjects. Group -I Strength Training Group (STG), Group - II Plyometric Training Group (PTG) and Group - III control group (CG). The ages of subjects were ranged from 18-25. In the present study are significant source

to maintain the skill performance and with its related physical fitness variables is leg explosive power and shoulder muscular strength. The present study pays attention mainly on testing the means of three groups (two experimental and one control) and secondarily deals with the increase of means in each group from baseline to post treatment for various measures. The statistical tools used are the analysis of co-variance was applied. To determine whether the training programmes produced significantly different improvements in selected variables after 12 weeks of training the analysis of co-variance was used. Since the initial means were not matched, comparisons between actual could not be made, all means were adjusted by regression to a common mean. The significance on difference of pairs of adjusted final group means were tested for significance by applying Schefe post hoc test. Further, the group means gains recorded by the various groups in the pre-test and post-test was tested for significance by applying paired 't' test.

**Training procedure**

In the present study as invention strategies strength training and plyometric training were used. These invention strategies are differed from one another in nature and the degree of influence on changes of physical fitness variables. In the effect of strength training and plyometric training would be higher rather than the individualized effect on physical fitness variables.

**Table 1:** F-Ratio for pre-test and post-test among strength training plyometric training and control groups on leg explosive power

| | Group | Mean | Source | Sum of Square | DF | Mean Square | F-ratio |
|---|---|---|---|---|---|---|---|
| Pre-test | STG | 42.55 | Between set | 22.80 | 2 | 11.42 | 2.09 |
| | PTG | 41.96 | Within Set | 318.10 | 57 | 5.61 | |
| | CG | 41.07 | | | | | |
| Post test | STG | 46.20 | Between set | 318.85 | 2 | 278.87 | 34.44 |
| | PTG | 47.10 | Within Set | 557.19 | 57 | 8.95 | |
| | CG | 41.20 | | | | | |
| Adjusted Mean | STG | 6.45 | Between set | 461.70 | 2 | 215.19 | 34.25 |
| | PTG | 6.39 | Within Set | 352.12 | 56 | 6.35 | |
| | CG | 6.83 | | | | | |

Table 1 reveals that the F-value for pre-test 2.09and post-test 34.44 among the experimental groups (strength training group and plyometric training group) and control group on leg explosive power. The obtained F-ratio for pre-test and post-test to be significant at 0.05 level for degree of freedom 2, 57 the required critical value was 3.16.Hence the F-ratio (2.05) obtained for pre-test was found to be not significant since it do not reach the required critical value 3.16.regarding this F-ratio for post-test mean 4.11 was found to statistically significant since it was higher than their required critical value 3.16. Based on F-ratio it was informed that experimental group and control group are equal in this performance of leg explosive power before they included into their respective treatment whereas, after completion of 12 week treatment period, experimental group as control group were significantly different from one another in the performance of leg explosive power. The F-ratio for leg explosive power 5.39 obtained for adjusted post test was found to be significant at 0.05 level for degree of freedom 2, 56 the required critical value was 3.16. Based on the results, in testing the hypothesis No.2 that there may be significant difference among the effects of training namely strength training group, plyometric training group and control group on physical fitness variables volleyball players is accepted. The mean value of leg explosive power among strength training group plyometric training group and control group are graphically represented in figure 1.

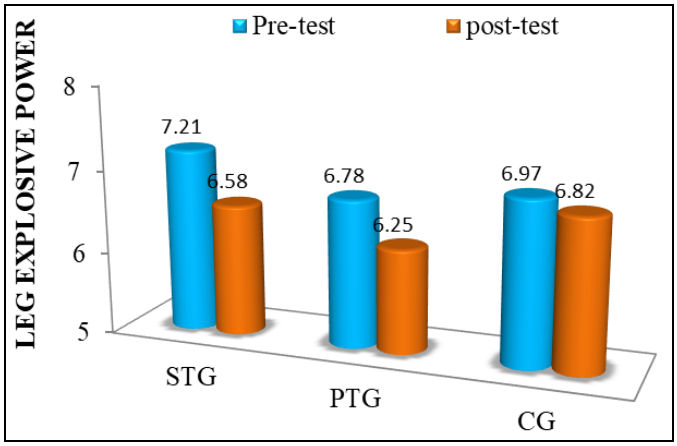


**Fig 1:** Bar diagram showing the mean values of pre test and post test on leg explosive power of STG, PTG and CG

To identify the specific differences among the three groups as post hoc test was used. The results of post hoc testes are presented in table 2

**Table 2:** Table showing the scheffes post hoc test on leg explosive power

| Variables | ST | PT | CG | MD | F |
|---|---|---|---|---|---|
| Leg Explosive Power | 6.45 | 6.39 | ------ | 0.06 | 0.16 |
| | 6.45 | ------- | 6.83 | -0.38 | 6.88 |
| | ------ | 6.39 | 6.83 | -0.44 | 9.13 |

Table 2 shows that the mean differences of Leg Explosive Power among strength training group, plyometric training group and control group were 0.06, 0.38and 0.44 respectively. The required confidence interval value is 3.16. Since the mean difference between Leg Explosive Power among strength training group, plyometric training group and control group were lesser than the confidence interval value 3.16, it was observed that there was insignificant difference on Leg Explosive Power between these groups. The mean value of Leg Explosive Power among strength training group, plyometric training group and control group are graphically represented in figure 2

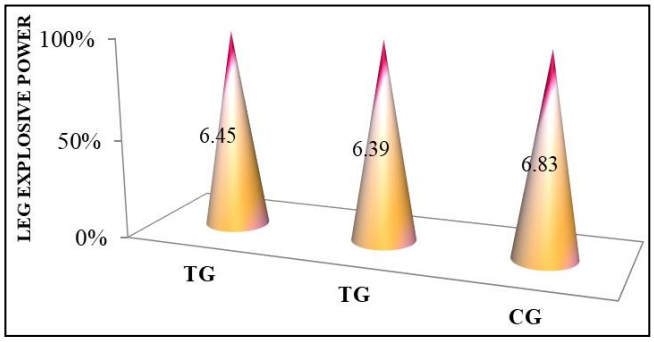


**Fig 2:** Adjusted mean value on leg explosive power of STG, PTG and CG

**Table 3:** F-Ratio for pre-test and post-test among the strength training plyometric training and control group on shoulder muscular strength

| | Group | Mean | Source | Sum of Square | DF | Mean Square | F-ratio |
|---|---|---|---|---|---|---|---|
| Pre-test | STG | 72.95 | Between set | 7.60 | 2.00 | 3.80 | 3.11 |
| | PTG | 72.85 | Within Set | 68.05 | 57.00 | 1.19 | |
| | CG | 72.15 | | | | | |
| Post test | STG | 70.85 | Between set | 26.43 | 2.00 | 13.22 | 13.33* |
| | PTG | 70.50 | Within Set | 56.50 | 57.00 | 0.99 | |
| | CG | 72.05 | | | | | |
| Adjusted Mean | STG | 70.68 | Between set | 39.75 | 2.00 | 19.87 | 31.75* |
| | PTG | 70.39 | Within Set | 35.06 | 56.00 | 0.63 | |
| | CG | 72.33 | | | | | |

Table 3 reveals that the F-value for pre-test mean 3.11 and post-test mean13.33 among the experimental groups strength training group, plyometric training group and control group on shoulder muscular strength. The obtained F-ratio for pre-test mean 3.18 and post-test mean 13.33 to be significant at 0.05 level for degree of freedom 2, 57 the required critical value was 3.16.Hence, the F-ratio3.18 obtained for pre-test mean was found to be significant since it do not reach the required critical value 3.16.Regarding this F-ratio for post-test mean 13.33was found to statistically significant since it was higher than their required critical value 3.16 based on F-ratio it was informed that experimental group and control group are equal in this performance of resting heart rate before they included into their respective treatment whereas, after completion of 12-week treatment period, experimental group as control group were significantly different from one another in the performance of shoulder muscular strength.

The F-ratio for resting shoulder muscular strength 10.67 obtained for adjusted post test was found to be significant. To be significant at 0.05 level for degree of freedom 2, 56 the required critical value was 3.16. Based on the results, in testing the hypothesis No.2 that there may be significant difference among the effects of training namely strength training group, plyometric training group and control group on physical fitness variables shoulder muscular strength of volleyball players is accepted. The mean value of shoulder muscular strength among strength training group, plyometric training group and control group are graphically represented in figure 3.

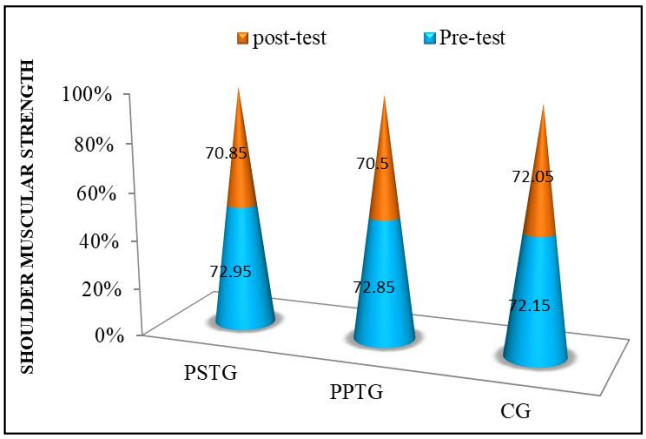


**Fig 3:** Bar diagram showing the mean values of pre-test and post-test on shoulder muscular strength of STG, PTG and CG

To identify the specific differences among the three groups as post hoc test was used. The results of post hoc testes are presented in table 4

**Table 4:** Table showing the scheffes post hoc test on shoulder muscular strength

| Variables | ST | PT | CG | MD | F |
|---|---|---|---|---|---|
| Resting Heart rate | 70.68 | 70.39 | ------ | 0.29 | 1.38 |
| | 70.68 | ------- | 72.33 | -1.65 | 43.44 |
| | ------ | 70.39 | 72.33 | -1.94 | 60.30 |

Table 4 shows that the mean differences of shoulder muscular strength among strength training group, plyometric training group and control group were 0.29, 1.65 and 1.94 respectively. The required confidence interval value was 3.16. Since the mean difference between shoulder muscular strength among strength training group, plyometric training group and control group were lesser than the confidence interval value 3.16, it was observed that there was insignificant difference on shoulder muscular strength between these groups. The mean value of shoulder muscular strength among strength training group, plyometric training group and control group were graphically represented in figure 4

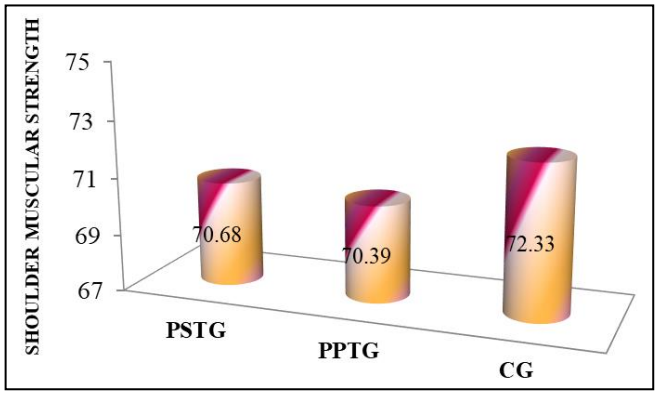


**Fig 4:** Adjusted mean value on shoulder muscular strength of STG, PTG and CG

**Discussion of Findings**

The pre-test before the related training showed that there was an insignificant and variation on leg explosive power and shoulder muscular strength among the three groups. The post-test after the related training showed significant improvement on explosive power and shoulder muscular strength. In the strength training group and in the plyometric training group than the control group. Comparision among these three groups resulted that the strength training group shows better improvement in all the selected variables than the plyometric training group and control group. The result also revealed that the explosive power and shoulder muscular strength were comparative better in the plyometric group than the strength training group after the related training.

## Conclusion and Recommendations

Based on the results of the study, the following recommendations have been made.

In the physical exercise, while designing t training programme the effect of varied training modalities is explained positively on muscle fitness parameters and skill performance variables of volleyball players. This is due to integrating the plyometrics with resistance training which requires the players to perform the plyometrics exercises in a fatigue stage, resulting in potentially increasing explosive power production. Hence the volleyball players can use this type of training as a module in order to achieve high level skill performance in the game of volleyball. In a combined training routine, a player performs a heavy set of traditional resistance training exercise, which is followed almost immediately by a plyometric exercise. Another training strategy is known as complex training in which a player alternates biomechanically similar high load resistance training exercises with plyometric exercises, set forest, in the same workout. Since this type of training also proves to be effective in developing the fitness parameters and skill performance of the volley ball players the coaches can utilize this technique in their conditioning programme to develop the fitness and skill performance.

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