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Effect of varied intensity of plyometric training on speed and cardio respiratory endurance among college women volleyball players

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Abstract

The purpose of the study was to find out the effects of varied intensity of Plyometric training on selected motor fitness and physiological variables among college women volleyball players. To achieve the purpose of this study, sixty (N=60) women volleyball players were selected from different colleges of Andhra Pradesh who represented their colleges in intercollegiate level volleyball tournaments. The selected subjects were of age group ranging from 19 to 24 years with standard deviation of ± 2.1 . The subjects were randomly divided into four groups and each group contained fifteen subjects. Group I acted as experimental group I and Group II acted as experimental group II group III acted as experimental group III and the fourth group was considered as control group. Pre test scores were obtained using standard tests on selected motor fitness and physiological variables, such as speed and cardio-respiratory endurance before the experimental period and the post test scores were obtained immediately after the twelve weeks experimental period. The difference between the pre test and post test means were subjected to statistical treatment using ANCOVA, which was the effect of varied intensities of plyometric training. In all cases 0.05 level was fixed to test of the study.

Keywords: Physiological, motor fitness abilities

Introduction

The physical education programme provides each student with an opportunity to assess his fitness and to develop skill and understanding that will enable him to enjoy a productive stay in school, college and a more meaningful existence after school and college.

Right from the origin of physical education the major objectives of physical education was physical fitness. The aim of physical education in the early years attained physical fitness, which was a main requisite of the then citizens. As days changed, the need, importance, scope and objectives have also changed because the demand of environment to preserve to withstand stress, to resist fatigue and to possess the energy for vigorous and well-rounded life has increased.

Objectives of the study

The main objective of this study was to frame different intensities of Plyometric training, after classification of intensities, such as, low, medium and high, the investigator would administer the Plyometric training with varied intensities on the subjects for a period of twelve weeks.

- To formulate different intensities of plyometric training for the benefit of college level volleyball players.
- To measure selected motor fitness and physiological variables of college level volleyball players.
- To experiment with different intensities of plyometric training for 12 weeks and compare the effect with control group.
- To determine which of the intensity of plyometric training, whether low or medium or high beneficially alter selected motor fitness and physiological variables of college level volleyball players.

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Statement of the problem

The purpose of this study was to find out the Effect of Varied Intensity of Plyometric Training on Speed and Cardio Respiratory Endurance among College Women Volleyball Players

Hypothesis

- It was hypothesized that there would be significant improved due to varied intensities of plyometric training, namely, low, medium and high intensity plyometric training on selected motor fitness variables, speed compared to control group.
- It was hypothesized that there would be significant improvement due to varied intensities of Plyometric training, namely, low, medium and high intensity plyometric exercises, on selected physiological variables, cardio- respiratory endurance among volleyball players compared to control group.
- It was hypothesized that there would not be any significant differences among different intensities of plyometric training on selected motor fitness variables of college women volleyball players.
- It was hypothesized that there would not be any significant differences among different intensities of plyometric training on selected physiological variables of college women volleyball players.

Limitations

The research study was limited to the following factors, and these limitations would be taken in to consideration while analyzing the data and interpreting the results.

- While conducting the study the external factors like atmosphere conditions, cultural influence, and socio-economic condition and also the body structure of the subjects were not taken in to consideration.
- No attempt was made to control the subjects participating in other extracurricular activities.
- Though the subjects were motivated verbally, no attempt was made to differentiate their motivation level during testing and training.
- The investigator did not consider the geographical location at the time of conducting the experiment.
- The exercises were classified in to low, medium and high intensity based the classification of experts.

Delimitations

The study delimited to the following aspect

- Only sixty women volleyball players from different colleges in Andhra Pradesh, who represented their college at intercollegiate level tournaments, were randomly selected as subjects for the study.
- This experimental study was administered to only four groups of fifteen (15) women volleyball players each.
- The age of the subjects ranged from 19-24 years only
- In the study, only low, medium and high intensities of plyometric training where considered as varied intensities of plyometric training.

Methodology

Selection of subjects

The purpose of the study was to find out the effects of varied intensity of Plyometric training on selected motor fitness and physiological variables among college women volleyball players.

To achieve the purpose of this study, sixty women volleyball players were selected from different colleges of Andhra Pradesh who represented their colleges in intercollegiate level volleyball tournaments. The selected subjects were of age group ranging from 19 to 24 years with standard deviation of ± 2.1 . The subjects were randomly divided into four groups and each group contained fifteen subjects. Group I acted as experimental group I and Group II acted as experimental group II group III acted as experimental group III and the fourth group was considered as control group.

Selection of variables

The investigator reviewed scientific journals, books and periodicals on different training methods especially plyometric exercises. Based on the experience gained and in consultation with the Guide the following dependent and independent variables were selected for this study.

Dependent variables

1. Motor fitness variables

Speed

2. Physiological variables

Cardio- respiratory endurance

3. Independent variables

- 12 Weeks Low Intensity Plyometric Exercises
- 12 Weeks Medium Intensity Plyometric Exercises
- 12 Weeks High Intensity Plyometric Exercises

Experimental design

For the purpose of the study, random group design was employed. Randomly selected college women volleyball players, who represented their college (N=60) were divided into four groups consisting of 15 in each group. Experimental Group I underwent low intensity plyometric training, experimental group II underwent medium intensity plyometric training and experimental group III underwent high intensity plyometric training group four was control group which did not participated in any special training. The control group did not participate in any special exercises except of their routine. Pre test scores were obtained using standard tests on selected motor fitness and physiological variables, such as, speed and cardio-respiratory endurance before the experimental period and the post test scores were obtained immediately after the twelve weeks experimental period. The difference between the pre test and post test means were subjected to statistical treatment using ANCOVA, which was the effect of varied intensities of plyometric training. In all cases 0.05 level was fixed to test the hypothesis of the study.

Statistical technique

To find out the effects of varied intensity plyometric training (low, medium and high intensities) on selected motor fitness and physiological variables of the subjects, the pre test and post test scores were analysed by suing ANCOVA technique. When the F ratio was found to be significant, Scheffe's post hoc test was applied to test which of the possible comparison among the means was significant differences among three groups, namely, experimental group I, experimental group II, experimental group III and control group in the development of twelve weeks of training.

The test and retest correlation coefficient values on selected variables, tests conducted and the obtained 'r' are detailed in

Table 1: Intra class correlation coefficient of test – retest scores

| S. No. | Variables | Tests | Obtained 'r' |
|--------|------------------------------|----------------------|--------------|
| 1 | Speed | 50 M sprint test | 0.89* |
| 2 | Cardio respiratory Endurance | Harvard Step up test | 0.82* |

*Significant at 0.01 level *Required table value (2,8) = 0.765

Computation of analysis of covariance and post-hoc test results on speed

The descriptive statistics comparing the initial and final means of Speed due to varied intensities (low, medium and high intensity) of plyometric training, and control groups of college men volleyball players is presented in

Table 2: Descriptive statistics on low, medium and high intensity plyometric training and control groups on speed

| Groups | Test | Mean | Standard deviation | Range | |
|--------------------------------------|---------------|------|--------------------|-------|------|
| | | | | Min | Max |
| Low Intensity Plyometric training | Initial | 8.01 | 0.18 | 7.80 | 8.30 |
| | Final | 7.81 | 0.18 | 7.60 | 8.10 |
| | Adjusted Mean | 7.81 | | | |
| Medium Intensity Plyometric training | Initial | 7.99 | 0.16 | 7.80 | 8.30 |
| | Final | 7.80 | 0.16 | 7.50 | 8.00 |
| | Adjusted Mean | 7.82 | | | |
| High Intensity Plyometric training | Initial | 8.01 | 0.19 | 7.70 | 8.30 |
| | Final | 7.79 | 0.16 | 7.50 | 8.00 |
| | Adjusted Mean | 7.79 | | | |
| Control Group | Initial | 8.03 | 0.18 | 7.80 | 8.30 |
| | Final | 8.01 | 0.21 | 7.80 | 8.40 |
| | Adjusted Mean | 7.99 | | | |

Table 2 shows that the pre test mean on Speed of low intensity plyometric training group was 8.01 with standard deviation ± 0.18 pre test mean of medium intensity plyometric training group was 7.99 with standard deviation ± 0.16 , the pre test mean of high intensity plyometric training group was 8.01 with standard deviation ± 0.19 , the pre test mean of control group was 8.03 with standard deviation ± 0.18 . The descriptive statistics on post test mean on Speed of low intensity plyometric training group was 7.81 with standard deviation ± 0.18 post test mean of medium intensity

plyometric training group was 7.80 with standard deviation ± 0.16 , the post test mean of high intensity plyometric training group was 7.79 with standard deviation ± 0.16 , the post test mean of control group was 8.01 with standard deviation ± 0.21 .

The adjusted mean on Speed on low intensity plyometric training group was 7.81, medium intensity plyometric training group was 7.82, high intensity plyometric training group was 7.79 and control group was 7.99, as shown in Table 2.

The obtained mean values on the experimental and control groups were presented in

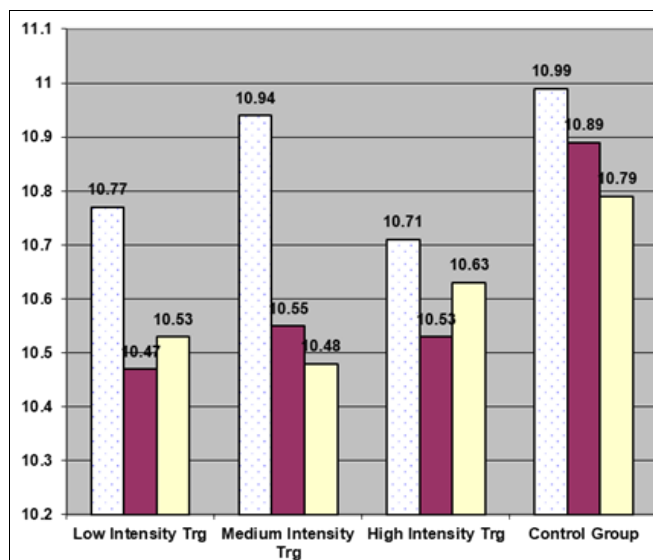


Fig 1: Bar diagram showing pre, post and adjusted means on speed due to low, medium and high intensity plyometric training and control groups

The results on descriptive statistics proved that there exist differences in different intensities of plyometric training compared to control group of variable Speed. And to test statistical significance of the differences, the obtained data on Speed using ANCOVA was presented in

Table 3: Computation of analysis of covariance due to low, medium and high intensity plyometric training and control group on speed

| | Source of variance | Sum of squares | df | Mean squares | Obtained F |
|-------------------------|--------------------|----------------|----|--------------|------------|
| Pre test mean | Between | 0.01 | 3 | 0.00 | 0.10 |
| | Within | 1.79 | 56 | 0.03 | |
| Post test mean | Between | 0.49 | 3 | 0.16 | 5.27* |
| | Within | 1.74 | 56 | 0.03 | |
| Adjusted post test mean | Between | 0.40 | 3 | 0.13 | 29.82* |
| | Within | 0.25 | 55 | 0.00 | |

Required $F_{(0.05), (df 3,56)} = 2.77$ * Significant at 0.05 level of confidence

As shown in Table 3, the obtained F ratio of 0.10 on pre test means of the groups was not significant at 0.05 level as the obtained F value was less than the required table F value of 2.77 to be significant at 0.05 level. This shows that there was no significant difference in means of the groups at initial stage.

The results presented in Table 3, the obtained F ratio of 5.27 on post test means of the groups was significant at 0.05 level as the obtained F value was greater than the required table F value of 2.77 to be significant at 0.05 level. This shows that there was significant difference in means of the groups at post test stage.

Taking into consideration of the pre test means and post test means, adjusted post test means were determined and analysis of covariance was done. The obtained F value on adjusted means was 29.82. The obtained F value was greater than the required value of 2.77 and hence it was accepted that there was significant differences among the adjusted means on the Speed of the subjects.

Since significant improvements were recorded, the results were subjected to post hoc analysis using Scheffe's Confidence Plyometric test. The results were presented in

Table 4: Multiple comparisons between low, medium, and high intensity plyometric training and control groups and Scheffe's post hoc analysis on speed

| Low intensity plyometric training group | Medium intensity plyometric training group | High intensity plyometric training group | Control group | Mean Diff | C.I |
|---|--|--|---------------|-----------|------|
| 7.81 | 7.82 | | | 0.00 | 0.07 |
| 7.81 | | 7.79 | | 0.03 | 0.07 |
| 7.81 | | | 7.99 | -0.18* | 0.07 |
| | 7.82 | 7.79 | | 0.03 | 0.07 |
| | 7.82 | | 7.99 | -0.18* | 0.07 |
| | | 7.79 | 7.99 | -0.21* | 0.07 |

*Significant at 0.05 level

The post hoc analysis of obtained ordered adjusted means proved that to be significant at 0.05 level confidence the required confidence plyometric was 0.07. The following paired mean comparisons were greater than the required confidence plyometric and were significant at 0.05 level.

- Low intensity plyometric training Vs Control Groups (MD: -0.18)
- Medium intensity plyometric training Vs Control Groups (MD: -0.18)
- High intensity plyometric training Vs Control Groups (MD: -0.21)
- The following paired mean comparisons were less than the required confidence plyometric and were not significant at 0.05 level.
- Low intensity plyometric training Vs Medium intensity plyometric training Groups (MD: 0.00)
- Low intensity plyometric training Vs High intensity plyometric training Groups (MD: 0.03)
- Medium intensity plyometric training Vs High intensity plyometric training Group (MD: 0.03)

Results on cardiovascular endurance

The descriptive statistics comparing the initial and final means of cardiovascular endurance due to varied intensities (low, medium and high intensity) of plyometric training, and control groups of college men volleyball players is presented in

Table 5: Descriptive statistics on low, medium and high intensity plyometric training and control groups on cardiovascular endurance

| Groups | Test | Mean | Standard deviation | Range | |
|--------------------------------------|---------------|-------|--------------------|-------|-------|
| | | | | Min | Max |
| Low Intensity Plyometric training | Initial | 76.86 | 6.26 | 67.11 | 90.11 |
| | Final | 82.08 | 7.78 | 66.56 | 96.11 |
| | Adjusted Mean | 81.53 | | | |
| Medium Intensity Plyometric training | Initial | 75.49 | 8.50 | 63.33 | 95.78 |
| | Final | 83.87 | 7.53 | 73.11 | 98.44 |
| | Adjusted Mean | 84.06 | | | |
| High Intensity Plyometric training | Initial | 76.01 | 7.55 | 62.44 | 89.56 |
| | Final | 84.25 | 5.88 | 76.44 | 94.67 |
| | Adjusted Mean | 84.15 | | | |
| Control Group | Initial | 74.99 | 9.04 | 64.44 | 99.11 |
| | Final | 76.44 | 7.63 | 65.00 | 96.11 |
| | Adjusted Mean | 76.89 | | | |

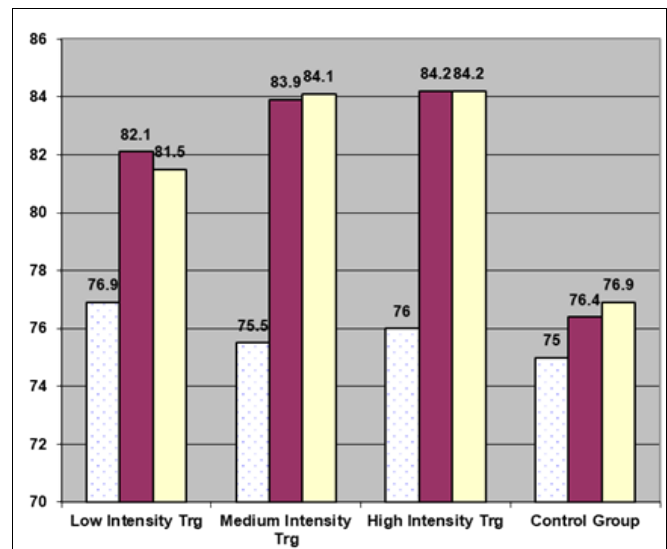
Table V shows that the pretest mean on Cardiovascular Endurance of low intensity plyometric training group was 76.86 with standard deviation ± 6.26 pre test mean of medium intensity plyometric training group was 75.49 with standard

deviation ± 8.50 , the pre test mean of high intensity plyometric training group was 76.01 with standard deviation ± 7.55 , the pre test mean of control group was 74.99 with standard deviation ± 9.04 .

The descriptive statistics on post test mean on Cardiovascular Endurance of low intensity plyometric training group was 82.08 with standard deviation ± 7.78 post test mean of medium intensity plyometric training group was 83.87 with standard deviation ± 7.53 , the post test mean of high intensity plyometric training group was 84.25 with standard deviation ± 5.88 , the post test mean of control group was 76.44 with standard deviation ± 7.63 .

The adjusted mean on Cardiovascular Endurance on low intensity plyometric training group was 81.53, medium intensity plyometric training group was 84.06, high intensity plyometric training group was 84.15 and control group was 76.89, as shown in Table 5.

The obtained mean values on the experimental and control groups were presented in

**Fig 2:** Bar diagram showing pre, post and adjusted means on cardiovascular endurance due to low, medium and high intensity plyometric training and control groups

The results on descriptive statistics proved that there exists differences in different intensities of plyometric training compared to control group of variable Cardiovascular Endurance. And to test statistical significance of the differences, the obtained data on Cardiovascular Endurance using ANCOVA was presented in

Table VI: Computation of analysis of covariance due to low, medium and high intensity plyometric training and control group on cardiovascular endurance

| | Source of Variance | Sum of Squares | Df | Mean Squares | Obtained F |
|-------------------------|--------------------|----------------|----|--------------|------------|
| Pre Test Mean | Between | 28.66 | 3 | 9.55 | 0.15 |
| | Within | 3500.58 | 56 | 62.51 | |
| Post Test Mean | Between | 585.77 | 3 | 195.26 | 3.72* |
| | Within | 2941.09 | 56 | 52.52 | |
| Adjusted Post Test Mean | Between | 519.81 | 3 | 173.27 | 4.97* |
| | Within | 1918.40 | 55 | 34.88 | |

Required $F_{(0.05), (df 3,56)} = 2.77$

*Significant at 0.05 level of confidence

As shown in Table 6, the obtained F ratio of 0.15 on pre test means of the groups was not significant at 0.05 levels as the obtained F value was less than the required table F value of 2.77 to be significant at 0.05 level. This shows that there was no significant difference in means of the groups at initial stage. The results presented in Table 6, the obtained F ratio of 3.72 on post test means of the groups was significant at 0.05 level as the obtained F value was greater than the required table F value of 2.77 to be significant at 0.05 level. This shows that there was significant difference in means of the groups at post test stage.

Taking into consideration of the pre test means and post test means, adjusted post test means were determined and analysis of covariance was done. The obtained F value on adjusted means was 4.97. The obtained F value was greater than the required value of 2.77 and hence it was accepted that there was significant differences among the adjusted means on the Cardiovascular Endurance of the subjects.

Since significant improvements were recorded, the results were subjected to post hoc analysis using Scheffe's Confidence Plyometric test. The results were presented in

Table VII: Multiple comparisons between low, medium, and high intensity plyometric training and control groups and Scheffe's post hoc analysis on cardiovascular endurance

| Low intensity plyometric training group | Medium intensity plyometric training group | High intensity plyometric training group | Control group | Mean Diff | C.I |
|---|--|--|---------------|-----------|------|
| 81.53 | 84.06 | | | -2.53 | 5.28 |
| 81.53 | | 84.15 | | -2.62 | 5.28 |
| 81.53 | | | 76.89 | 4.64 | 5.28 |
| | 84.06 | 84.15 | | -0.10 | 5.28 |
| | 84.06 | | 76.89 | 7.16* | 5.28 |
| | | 84.15 | 76.89 | 7.26* | 5.28 |

*Significant at 0.05 level

The post hoc analysis of obtained ordered adjusted means proved that to be significant at 0.05 level confidence the required confidence plyometric was 5.28. The following paired mean comparisons were greater than the required confidence plyometric and were significant at 0.05 level.

- Medium intensity plyometric training Vs Control Groups (MD: 7.16)
- High intensity plyometric training Vs Control Groups (MD: 7.26)
- The following paired mean comparisons were less than the required confidence plyometric and were not significant at 0.05 level.
- Low intensity plyometric training Vs Medium intensity plyometric training Groups (MD: -2.53)
- Low intensity plyometric training Vs High intensity plyometric training Groups (MD: -2.62)
- Low intensity plyometric training Vs Control Groups (MD: 4.64)
- Medium intensity plyometric training Vs High intensity plyometric training Group (MD: -0.10)

Findings

Based on the results it was found that varied intensities of plyometric training, namely, low, medium and high intensity plyometric training can significantly alter selected motor fitness variables, speed, and physiological variables, cardiovascular endurance compared to control group.

Conclusions

Within the limitations and delimitations of the study, the following conclusions were drawn.

1. It was concluded that twelve weeks varied intensities of plyometric training significantly improved motor fitness variable, speed among college women volleyball players compared to control group. Comparison among the experimental groups proved that there were no significant differences on speed among college women volleyball players.
2. It was concluded that twelve weeks varied intensities of plyometric training significantly altered physiological variable, cardiovascular endurance among college women volleyball players compared to control group. Comparison among the experimental groups proved that there were no significant differences among experimental groups on cardiovascular endurance of college women volleyball players.
3. It was concluded that twelve weeks varied intensities of plyometric training significantly altered physiological variable, cardiovascular endurance among college women volleyball players compared to control group. Comparison among the experimental groups proved that there were no significant differences among experimental groups on cardiovascular endurance of college women volleyball players.

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