CHAPTER – III

METHODOLOGY

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3.1. INTRODUCTION

In this Chapter, the selection of subjects, selection of variables, selection of the tests, reliability of the instruments, reliability of the data, testers competency, orientation of the subjects, test administration, training programme, experimental design, collection of data and statistical procedures have been explained.

3.2. SELECTION OF SUBJECTS

To achieve the purpose of the study, ninety six players were selected as samples from the qualified teams of the quarter finals in the Acharya Nagarjuna University Inter-Collegiate Tournaments. To ensure the quality in selection of samples, as a criterion overall playing ability was considered. The overall playing ability of selected samples was assessed by a team of three experts including the investigator, using ten point rating scale of the ninety six volleyball players, eighty players were selected excluding the players who scored lower and upper quarter. Finally 80 male volleyball players were selected as subjects for the present study.

3.3. EXPERIMENTAL DESIGN

The selected subjects (N=80) were divided into four groups equally of which experimental Group I underwent Combination of Resistance Training followed by Plyometric Training in the Same Session (CRTPT), Group II underwent Complex Training of Resistance Training followed by Matched Plyometric Training in the same session (CTRTMPT), Group III underwent Resistance Training for six weeks followed by Complex Training of Resistance Training with Matched Plyometric Training for another six weeks (RTCTRTMPT) and Group IV Control Group (CG) underwent traditional training. All the four groups were treated with their respective training for one and half hours per day for three days a week for a period of twelve weeks.

3.4. SELECTION OF VARIABLES

The performance of volleyball players is mainly concerned with the muscle fitness, aerobic and anaerobic capacity and skill performance. The overall playing ability aspects have to be considered as the major factor since these aspects have functional association with one another. The earlier studies on volleyball substantiated clearly its nature and importance. Based on the earlier studies and the opinion of the experts, the variables of muscle fitness parameters, aerobic capacity, anaerobic capacity, skill performance variables and overall playing ability have been chosen as the variables for the present study.

Muscle Fitness Parameters

1. Muscle Strength
    a. Upper body muscular strength
    b. Lower body muscular strength
2. Abdominal Muscular Strength and Endurance
3. Muscle Power
    a. Upper body muscular power
    b. Lower body muscular power

Physiological Parameters

4. Aerobic Capacity
5. Anaerobic Capacity

Skill Performance Variables

6. Passing Ability
7. Service Ability and
8. Overall Playing Ability

3.5. CRITERION MEASURES

Based on the literature survey related to test, measurement and evaluation, the following test items have been chosen as criterion measures. The chosen test items were highly standardized, appropriate and ideal to assess the selected variables.

3.5.1 Selection of Tests

1. Upper body and lower body strength was measured by using 1 RM (one repetition maximum) technique and recorded to the nearest 0.5 kilograms.

2. Abdominal muscular strength and endurance was measured by modified sit-ups for 1minute and recorded in numbers.

3. Upper body muscular power was measured by using seated medicine ball throw and recorded to the nearest meters.

4. Lower body muscular power was measured by using vertical jump and recorded to the nearest centimeters.

5. Aerobic capacity was measured by using Queens College 3 minute step test and the estimation of VO_2max was done by using the following regression equation: VO_2max (ml/kg/min) = 111.33 - 0.42 x heart rate (bpm).

6. Anaerobic capacity was measured by using Margaria Kalamen power test. Anaerobic capacity was estimated by using the following formula: Power = (M x D) x 9.8/t.

7. Serving ability was measured by using Russell –Launge volleyball test and recorded their performance in points.

8. Passing ability was measured by using Russell–Launge repeated volleyball test and recorded their performance in points.

9. Overall playing ability was measured by ten point judges rating.

3.6. RELIABILITY OF DATA

The reliability of data was ensured by establishment of instrument reliability, testers' competency and subject reliability.

3.6.1 Instrument Reliability

With respect to the instruments used for measuring the variables, certificate of accuracy was obtained from appropriate instrument testing agencies. In addition, reliability was established by recalibrating the scale by using known amounts of variables wherever required.

3.6.2 Testers' Competency

The assistance of four specially trained physical education research scholars were sought for administration of various test items. They were oriented about the procedures of measuring and recording the scores in each variable. The assistants were asked to measure few subjects on variables used in the study and the coefficient of correlation was calculated from the recorded scores.

3.6.3 Subjects Reliability

The subjects reliability was established by test and re-test coefficient of correlation for the scores in each of the criterion measures. Re-testing was done within a period of a week of initial testing in each of the criterion measures. And the coefficient of correlation is presented in the table 3.1.

Table 3.1

Reliability of co-efficient of muscle fitness parameters, physiological and skill performance variables of male volleyball players

S.NO	VARIABLES	'r' – Value
1	Muscle Strength a. Upper body muscular strength b. Lower body muscular strength	 0.89 0.90
2	Abdominal Muscular Strength and Endurance	0.87
3	Muscle power a. Upper body muscular power b. Lower body muscular power	 0.89 0.87
4	Aerobic Capacity	0.90
5	Anaerobic Capacity	0.93
6	Passing Ability	0.88
7	Serving Ability	0.88
8	Overall Playing Ability	0.84

3.7. ORIENTATION OF THE SUBJECT

The purpose of the study and the testing procedure while measuring the selected variables were explained to the subjects. Three sessions were spent to familiarize the subjects with the technique involved in various tests used to collect the data.

3.8. PILOT STUDY

The pilot study was aimed to determine the initial training capacity of the subjects in the training programme. In order to fix the training load in each resistance exercise for all the subjects in all three experimental groups 1 RM (one Repetition Maximum) technique was used. Based on the subject's initial training ability and difficulty faced by the subjects appropriate modifications were made to ensure the suitability, frequencies, and duration of different training programmes.

3.9. ADMINISTRATION OF TESTS

3.9.1. Bench Press

The strength of the upper body was measured by bench press test (Jackson and Smith, 1974). The equipment needed for this test is a bench that is approximately 10 to 14 inches wide and weight bar (5 or 6 feet in length) and enough weight plates to be more than sufficient for the strongest subject. The subject was assumed on the floor, with the back straight. The partners helped the subject to lower the weight slowly to subject's chest and then he attempted to raise the weight until his arms were straight. Scoring is the maximum weight lifted by the subject and it was recorded in kilograms.

3.9.2. Half Squat

The strength of the lower body was measured by half squat. It requires adjustable bench, a weight bar (5 to 6 feet in length) with enough weight plates, knee cap and a thick towel to pad bar. After adjusting the desired amount of weight on the bar, two assistants placed the bar upon the shoulders (and behind the neck) of the subjects as he stood near the edge of the bench with the feet a comfortable distance apart and a firm grasp of the hands on the bar. The subject lowered to an erect sitting position on the bench. Then, with out rocking back and forth, the subject returned to the standing position. After the two assistants removed the weight, the performer might readjust the weights if a second trial was to be taken. The total weight of the barbell (including the collars) satisfactorily lifted was recorded. Only the best lift of two trials was recorded.

3.9.3. Modified Sit-ups

The test is to measure the abdominal strength and endurance. The subjects were asked to lie flat on the back with knees bent and feet on the floor with the heals not more than one foot from the buttocks. The knee angle was kept at 90 degrees. The fingers were held at the back of the head. The feet were held securely by a partner the student then curled up to a sitting position and the fore head touched the knees. This exercise was repeated as many times as possible in one minute. One point was scored

for each correct sit- up. The score was the maximum number of sit-ups completed in one minute.

3.9.4. Seated Medicine ball Throw

The test is to measure the arm strength and explosive power. The subjects were asked to sit with their back to a wall on a mat facing the area to which the ball was to be thrown, and with the feet extended and slightly apart. The ball was held with the hands on the side and slightly behind the center. The ball was brought to the chest, then thrown vigorously out as far as possible. The back remained in contact with the wall at all times. The distance from the wall to the place where the ball landed was recorded. The measurement was recorded to the nearest 10 cm. The best result of the three throws was used.

3.9.5. Vertical Jump

The explosive power was measured by the vertical jump with the help of the stand and reach test (Chu, 1996). The vertical jump test was completed from a 2-foot standing position without a step into the jump. The subject was asked to stand with side to the wall keeping both feet flat on the floor. He reached as high as possible with his middle finger touching the wall. This was his standing reach. Keeping color chalk powder on his middle finger he stood comfortable at a distance from the wall. On signal the subject swung both arms upward and jumped vertically extending his hand and touching the wall with the chalked finger. This jump must be taken without any preliminary feet movement such as hopping or stepping. The difference between standing hand reach and the jump reach were recorded. Out of three attempts the best reach was taken and recorded.

3.9.6. Queens College 3 Minute Step Test

This step test provides a measure of aerobic capacity. The equipment required for this test was 41.3 cm step, stopwatch, metronome or cadence tape. The subjects stepped up and down on the platform at a rate of 24 steps per minute, for a total of 3 minutes. Afterwards the subject sat immediately on completion of the test, and the

heart beats were counted for 15 seconds from 5-20 seconds of recovery. The estimation of VO_2max was calculated from the test results, using the formula below:

VO_2max (ml/kg/min) = 111.33 - 0.42 x heart rate (beat per minute).

3.9.7. Margaria – Kalamen Test

Margaria - Kalamen anaerobic power test was administered to assess anaerobic power. It measures the time lapse between the third and the ninth step, a digital timer was used. A concrete staircase with 12 steps was constructed for administering Margaria-Kalaman anaerobic power test**.** Meardle (1986), the width and perpendicular height of the staircase was 125 cms and 210 cms respectively. The angle of the staircase with respect to the ground was approximately 45 degrees. The average perpendicular distance of consecutive steps was 17.4 centimeters. The perpendicular height between third and ninth step was 105 centimeters. The subjects stood 6 meters in front of the staircase. At their pleasure they ran upon the stairs as rapidly as possible taking three at a time. The clock started as the person stepped on the first switch mat (on the third step) and stopped as he stepped on the second (on the ninth step). The time it took to travel the distance between stair 3 and 9 was recorded in seconds. The power generated is a product of the subjects' weight and the vertical distance (D) divided by the time. The test was repeated for three times for each subject to record the best score. The following formula was used.

$$P = \frac{W \times 9.8 \times D}{T}$$

P = lactic acid Power (Watt)

9.8 = Normal acceleration of gravity in M.Sec

W = Weight of the Subject (Kg)

D = Vertical height between first and second switch mat (M)

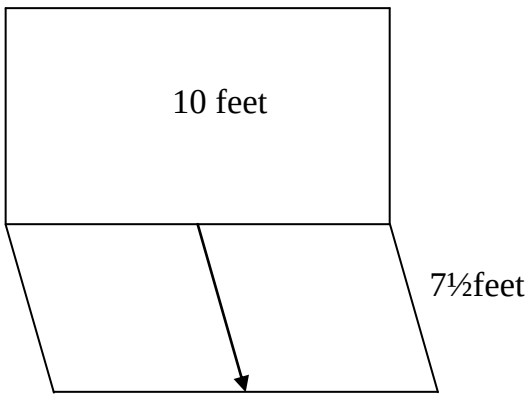
T = Time from first to second switch mat (S)

Scoring

The performance was recorded in Kilogram / Meter / Seconds.

3.9.8. Russell – Lange Volleyball Test (Repeated Volley Test)

The Russell-Lange volleyball test (Repeated volley test) is used to masure the volley accuracy. The equipment required for this test was volleyball, flat vertical wall, stop watch, score sheet. The subject volleyed as rapidly as possible against a wall. The subject started volleying from behind 3 foot line, with any under hand movement pass, tosses the ball to the wall, and then volleyed the ball repeatedly against the wall above the net line for 30 seconds. The test was started and restarted with a toss. If the ball got out of control, it was retrieved by the subject and put into play at the 3-foot line as at the beginning. In this test a simple target was marked on a smooth side wall, consisting of a horizontal chalk line 5' long and 7½' from the floor, a vertical line was drawn extended upward towards the ceiling at the end of the horizontal line. The score consisted of the number of times the ball was clearly batted (not tossed) from behind the 3 feet line to the wall above on the net line. The best score of the trails was recorded. Rest periods of one minutes between trails was allowed.

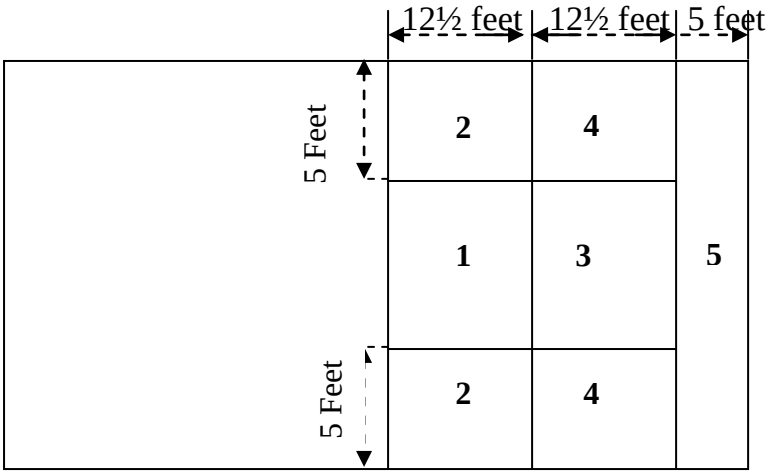


3 feet

3.9.9. Russell – Lange Volleyball Test

The test is used to measure the serving ability. The equipment required for this test was volleyball court, measuring tape, volleyball and score card. The subject served ten times in a legal into a target on the court across the net. Net serves were repeated. Each service was scored according to the value of the target area in which the ball lands.

A ball landing on a line separating two areas was given the higher value. A ball landing on a side or the end line scored the value of the area adjacent. Trails in which foot faults occurred scored zero. A line was drawn 5 feet inside and parallel to the end line and another line was drawn across the court 12½ feet parallel from the net line under the net. Another line was drawn with 5 feet inside and parallel to each side line extending from line under the net to the line. The score was awarded for each trail separately as indicated in the figure. The total score for all the 10 trails was the final score.



3.9.10. Overall Playing Ability

An expert team consisting of three experts, including the investigator using ten-point rating scale assessed the overall playing ability.

3.10. TRAINING PROGRAMME

Training schedule for the three treatment groups were given in the Table 3.2. The total training duration for each day was one and half hours (90 mints). It included 15 minutes for stretching and warming up, 15 minutes for instruction and cool down and 60 minutes for exclusive complex training. Group I was treated with combination of resistance training followed by plyometric training in the same session for a duration of sixty minutes. First 30 minutes was allotted for resistance training and next 30 minutes for plyometric Training. Four minutes rest was given between resistance training and plyometric training programme in all the three treatments. Group II was

treated with complex training of resistance training followed by matched plyometric training in the same session. Group III was treated with resistance training for first six weeks followed by complex training of resistance training with matched plyometric training for another six weeks. Load progression was adapted for every four weeks. The detailed training scheduled for each group was given in the form of tables by indicating the intensity, repetitions, set, rest and duration. All the three treatment groups were treated with their respective treatment for weekly three days with a duration of 90 minutes for a period of 12 weeks.

Table 3.2

Group	Treatment
Group-I	Combination of Resistance Training followed by Plyometric Training in the same session (CRTPT).
Group – II	Complex Training of Resistance Training followed by Matched Plyometric Training in the same session (CTRTMPT).
Group – III	Resistance Training for first six weeks followed by Complex Training of Resistance Training with Matched Plyometric Training for another six weeks (RTCTRTMPT).
Group – IV	Control Group (CG)
Training Duration	Ninety Minutes
Training session Per week	Three
Total Length of Training	Twelve weeks
Training Load Progression	Every Four weeks

3.10.1.TRAINING PROGRAMME FOR GROUP - I

The subjects of Group-I were treated with resistance training for the first 30 minutes, after completion of resistance training for another 30 minutes of Plyometric training in the same session (CRTPT). The intensity for the resistance training for first four weeks was 70% (1RM) with 4-6 repetitions of 3 sets. The rest in between the

exercise was 60 seconds and rest in between sets was 2 to 3 minutes. In the plyometric session the subjects were actively involved in plyometric training. Each exercise was 4-6 repetitions for 3 sets. The intensity for plyometric training for the first four weeks were 3 kg Medicine ball, 1 feet plyometric Box and body weight as intensity for all jumping exercises. The load progression technique was adapted in the training to maintain the training load and training principles. Resistance training intensity was raised by 5% for every four weeks (70%, 75%, and 80% respectively).

Table 3.3 GROUP – I COMBINATION OF RESISTANCE TRAINING FOLLOWED BY PLYOMETRIC TRAINING IN THE SAME SESSION

Training Schedule for 1 to 12 weeks

S. No	Resistance Training	Intensity			Repetitions	Sets	Plyometric Training
		1st to 4th week	5th to 8th week	9th to 12th week			
1.	Arm curl	70%	75%	80%	4-6	3	Vertical Jump
2.	Triceps extension	70%	75%	80%	4-6	3	Medicine ball chest pass
3.	Bench press	70%	75%	80%	4-6	3	Box Jump
4.	Lat pull down	70%	75%	80%	4-6	3	Medicine ball over head pass
5.	Military press	70%	75%	80%	4-6	3	Medicine ball set up
6.	Leg press	70%	75%	80%	4-6	3	Hop (single leg)
7.	Half squat	70%	75%	80%	4-6	3	Shot put throw
8.	Leg Curl	70%	75%	80%	4-6	3	Front obstacle jump
9.	Heel raise	70%	75%	80%	4-6	3	Over head throw
10.	Abdominal crunches				15-20	3	Burfee

3.10.2.TRAINING PROGRAMME FOR GROUP - II

The subjects of Group - II underwent complex training of resistance training followed by matched plyometric training in the same session (CTRTMPT). The subjects underwent resistance training with the intensity of 70% (1RM) 4-6 repetitions of 3 sets and then the subjects performed matched plyometric training with 8–10 repetitions of 3 sets. Like wise one resistance training and one plyometric training was designed for a period of one-hour. The rest in between the exercises was 60 seconds and the rest in between the sets was 3-4 minutes. The subjects were motivated to continue the exercise programme for 3 days a week for the period of 12 weeks.

The load progression technique was adapted in the training to maintain the training load and training principles. Resistance training intensity was raised by 5% for every four weeks (70%, 75%, and 80% respectively), and 4-6 repetitions were maintained throughout the training periods.

Table 3.4. GROUP – II COMPLEX TRAINING OF RESISTANCE TRAINING FOLLOWED BY A MATCHED PLYOMETRIC TRAINING IN THE SAME SESSION

Training schedule 1 to 12 weeks

S. No		Complex Training	Resistance 1 RM			Repetitions	Sets	Rest in between exercise	Rest in between sets
			1st to 4th week	5th to 8th week	9th to 12th week				
1	R	Squat	70%	75%	80%	4-6	3	60 seconds	3-4 minutes
	P	Vertical Jump	--	--	--	8-10	3		3-4 minutes
2	R	Bench Press	70%	75%	80%	4-6	3	60 seconds	3-4 minutes
	P	Medicine ball Chest pass	--	--	--	8-10	3		3-4 minutes
3	R	Barbell lunge	70%	75%	80%	4-6	3	60 seconds	3-4 minutes
	P	Box Jump	--	--	--	8-10	3		3-4 minutes
4	R	Lat Pull Down	70%	75%	80%	4-6	3	60 seconds	3-4 minutes
	P	Medicine ball overhead pass	--	--	--	8-10	3		3-4 minutes
5	R	Roman Bench				15-20	3	60 seconds	3-4 minutes
	P	Medicine ball sit up	--	--	--	8-10	3		3-4 minutes
6	R	Leg Press	70%	75%	80%	4-6	3	60 seconds	3-4 minutes
	P	Burfee	--	--	--	8-10	3		3-4 minutes
7	R	Barbell step up	70%	75%	80%	4-6	3	60 seconds	3-4 minutes
	P	Hop (single leg)	--	--	--	8-10	3		3-4 minutes
8	R	Triceps Extension	70%	75%	80%	4-6	3	60 seconds	3-4 minutes
	P	Shot Put Throw	--	--	--	8-10	3		3-4 minutes
9	R	Straight legged dead lift	70%	75%	80%	4-6	3	60 seconds	3-4 minutes
	P	Front Obstacle jump	--	--	--	8-10	3		3-4 minutes
10	R	Straight arm pull over	70%	75%	80%	4-6	3	60 seconds	3-4 minutes
	P	Over head throw	--	--	--	8-10	3		3-4 minutes

R – Resistance Exercise, P – Plyometric exercise.

3.10.3.TRAINING PROGRAMME FOR GROUP – III

The subjects in the group - III were treated with resistance training for six weeks followed by Complex Training of Resistance training with Matched Plyometric training for another six weeks (RTCTRTMPT). The idea of giving six weeks resistance training before the complex training is to develop the prerequisite strength for complex training to be most effective and that this type of training may be best suited for those who are involved in motor performance activities (Ebben and Watts, 1998). In the first 6 weeks the subjects were treated with resistance training with the intensity of 55% (1RM) with 10-12 repetitions of 3 sets for one-hour. After completion of 6 weeks of resistance training the subjects of group-III were treated with complex training of resistance training with matched plyometric training from 7 to 12 weeks. The training pattern was similar to that of the Group-II. The load progression technique was adapted in the training to maintain the training load and training principles. Resistance training intensity was raised by 5% for every two weeks (55%, 60%, and 65% respectively).

Table 3.5. GROUP – 3 RESISTANCES TRAINING FOR FIRST SIX WEEKS FOLLOWED BY COMPLEX TRAINING OF RESISTANCE TRAINING WITH MATCHED PLYOMETRIC TRAINING FOR ANOTHER SIX WEEKS IN THE SAME SESSION

Resistance Training Schedule for 1 to 6 weeks

S. No	Resistance Training	Intensity			Repetitions	Sets
		1st and 2nd week	3rd and 4th week	5th and 6th week		
1.	Arm curl	55%	60%	65%	10-12	3
2.	Triceps extension	55%	60%	65%	10-12	3
3.	Bench press	55%	60%	65%	10-12	3
4.	Lat pull down	55%	60%	65%	10-12	3
5.	Military press	55%	60%	65%	10-12	3
6.	Leg press	55%	60%	65%	10-12	3
7.	Half squat	55%	60%	65%	10-12	3
8.	Leg Curl	55%	60%	65%	10-12	3
9.	Heel raise	55%	60%	65%	10-12	3
10.	Abdominal crunches	55%	60%	65%	15-20	3

Table 3.6. GROUP – 3 (METHOD - III) RESISTANCE TRAINING FOR FIRST SIX WEEKS FOLLOWED BY COMPLEX TRAINING OF RESISTANCE TRAINING WITH MATCHED PLYOMETRIC TRAINING FOR ANOTHER SIX WEEKS IN THE SAME SESSION

Training Schedule 7 to12 weeks

S. No		Complex Training	Resistance 1 RM			Repetitions	Sets	Rest in between exercise	Rest in between sets
			7^{th} and 8^{th} week	9^{th} and 10^{th} week	11^{th} and 12^{th} week				
1	R	Squat	70%	75%	80%	4-6	3	60 seconds	3-4 minutes
	P	Vertical Jump	--	--	--	8	3	60 seconds	3-4 minutes
2	R	Bench Press	70%	75%	80%	4-6	3	60 seconds	3-4 minutes
	P	Medicine ball Chest pass	--	--	--	8	3	60 seconds	3-4 minutes
3	R	Barbell lunge	70%	75%	80%	4-6	3	60 seconds	3-4 minutes
	P	Box Jump	--	--	--	8	3	60 seconds	3-4 minutes
4	R	Lat Pull Down	70%	75%	80%	4-6	3	60 seconds	3-4 minutes
	P	Medicine ball overhead pass	--	--	--	8	3	60 seconds	3-4 minutes
5	R	Abdominal crouches				15-20	3	60 seconds	3-4 minutes
	P	Medicine ball sit up	--	--	--	8	3	60 seconds	3-4 minutes
6	R	Leg Press	70%	75%	80%	4-6	3	60 seconds	3-4 minutes
	P	Burfee	--	--	--	8	3	60 seconds	3-4 minutes
7	R	Barbell step up	70%	75%	80%	4-6	3	60 seconds	3-4 minutes
	P	Hop (single leg)	--	--	--	8	3	60 seconds	3-4 minutes
8	R	Triceps Extension	70%	75%	80%	4-6	3	60 seconds	3-4 minutes
	P	Shot Put Throw	--	--	--	8	3	60 seconds	3-4 minutes
9	R	Stiff legged dead lift	70%	75%	80%	4-6	3	60 seconds	3-4 minutes
	P	Front Obstacle jump	--	--	--	8	3	60 seconds	3-4 minutes
10	R	Strict arm pull over	70%	75%	80%	4-6	3	60 seconds	3-4 minutes
	P	Over head throw	--	--	--	8	3	60 seconds	3-4 minutes
R- Resistance Exercises, P-Plyometric Exercises									

3.10.4. CONTROL GROUP

The control group was engaged in practicing the volleyball skills on weekly three days in the evening. They practiced the volleyball skills in a traditional way without and special coaching or training by any instructor. They were allowed to play whenever they liked.

3.11. COLLECTION OF DATA

Subjects of the four groups namely Group I: Combination of Resistance Training followed by a Plyometric Training in the Same Session (CRTPT), Group II: Complex Training of Resistance Training followed by Matched Plyometric Training in the same session (CTRTMPT), Group III: Resistance Training for first six weeks followed by Complex Training of Resistance Training with Matched Plyometric Training for another six weeks (RTCTRTMPT) and Group IV: Control Group (CG) were tested on selected criterion variables muscle fitness parameters (upper body muscular strength, lower body muscular strength, abdominal muscular strength and endurance, upper body muscular power and lower body muscular power), physiological parameters (aerobic capacity and anaerobic capacity) and skill performance variables **(**passing ability, service ability and overall playing ability). The initial test was performed and considered as pre-test score on the selected criterion variables. On completion of pre-test, they were treated with their respective treatments: weekly three days in the morning session for a training duration of one and half hours for a period of twelve weeks. At the end of twelve weeks, all the four groups were tested again on all selected variables and it was kept as post–test score. The collected data were analyzed with appropriate statistical techniques.

3.12. STATISTICAL TECHNIQUES

The present study focuses mainly on testing the significance of mean differences of four groups (three 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 described here. Analysis of co-variance was applied to determine whether the training programmes produced significantly different improvements in selected variables after 12 weeks of training. Since the initial means were not matched, comparisons between actual means 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 Scheffe's post hoc test. Further, the group mean gains recorded by the various groups in the pre-test and post-test were tested for significance by applying paired 't' test.