CHAPTER III

METHODOLOGY

This chapter the methodology and procedure adopted which precisely include selection of the subjects, selection of variables, experimental design, pilot study, criterion measures, reliability of data, reliability of instruments, tester's reliability, subject reliability, plyometric training, Swiss ball exercises, training schedule, test administration, collection of data and the statistical techniques used are described.

ETHICAL COMMITTEE APPROVEL

The ethical committee of Christian Medical College has approved to conduct this study vide its letter IRB no 7476 dated 20.4.2011.

3.1 SELECTION OF SUBJECTS

For the purpose of this study, sixty university level men basketball players were randomly selected from Thiruvalluvar and VIT University Vellore in Tamil Nadu state, who participated in university level tournaments. The subjects were randomly selected and their age group was between 19 to 25 years with mean age of 22 with standard deviation $\pm$ 2.5 years. The subjects expressed their willingness to participate in the study.

3.2 SELECTION OF VARIABLES

Variables are the conditions or characteristics that the experimenter manipulates controls or observes. The investigator selected the following dependent variables for the purpose of this study.

DEPENDENT VARIABLE

Fitness Components

1. Explosive power
2. Speed
3. Agility
4. Flexibility

Biochemical Variables

1. Triglycerides
2. Total cholesterol
3. High density lipoprotein
4. Low density lipoprotein

For interventional programme, the investigator selected two training programmes. They are:

1. Plyometric training
2. Swiss ball training

3.3 CRITERION MEASURES

1. Explosive power was measured by vertical jump height with the help of the stand and reach (Chu 1996).This test was selected because it has high validity (0.80) and reliability (0.93) coefficients (Safrit1990)
2. Flexibility was measured by sit and reach test and has high correlation coefficient (0.91) - Johnson and Nelson 1982.
3. Speed was measured by the 50 yard dash which is one of the short-term test of muscular power that directly reflects the measure of the subject's

ability to regenerate ATP during that interval. It has high correlation coefficient (0.974) with Margaria kalamen power test (Fox &Mathews, 1971)

4. Agility was measured through shuttle run test and has high correlation coefficient (0.901) Johnson and Nelson (1992).
5. The biochemical variables (Total cholesterol (TC) and triglyceride (TG), LDL and HDL) were determined by enzymatic method using Boehringer Mannhein kit. (Mukharjee, 1997).

3.4 RESEARCH DESIGN

A research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure.

The purpose of this study was to find out the effect of plyometric training and Swiss ball training on selected physical fitness and biochemical variables of university level men basketball players. Sixty (N=60) subjects were selected at random who participated at level university basketball tournaments, representing Thiruvalluar and VIT university Vellore in Tamil Nadu. The selected subjects were divided into three equal groups, namely experimental group I Plyometric training group, experimental group II Swiss ball training group and a Control group. Experimental group I underwent 12 weeks of plyomeric training, group II underwent Swiss ball training for 12 weeks designed by the researcher. Group III was considered as control group which was not involved in any special treatment. Prior to the experimental treatment

all the subjects were measured of their physical fitness levels, explosive power, speed, agility and flexibility using the standardized tests. To measure the biochemical parameters of the university level basketball players,' 05 ml of venous blood was drawn from an antecubital vein after a 12 h fast and 24 h after the last session of exercise. Total cholesterol (TC) and triglyceride (TG), LDL and HDL were determined by enzymatic method using Boehringer Mannhein kit (Mukharjee, 1997). After the completion of 12 weeks experiment, the subjects were measured of the selected physical and biochemical variable, as it was done during the pre test, which was considered as post test scores. The difference between the initial and final scores was considered as the effect of the respective training. The significance of the differences was subjected to statistical treatment using ANCOVA. In all cases 0.05 level was fixed to test the significance

3.5 PILOT STUDY

A pilot study was conducted to assess the initial capacity of the subjects in order to fix the load of exercise. For this, ten basketball players other than the subjects were selected and divided into two groups and administered the two different training, namely, plyometric training and Swiss ball training to be undertaken. The intensity of the plyometric training, and Swiss ball exercises were given to determine the maximum heart rate reserved method. The method consisted of calculating the working heart rate and target heart rate. The working heart rate (WHR) was the difference between the maximal heart rate (MHR) and resting heart rate (RHR). The target heart rate (THR) was

determined as the percentage of working heart rate (WHR) resting heart rate (RHR). Training packages were administered with utmost care of the researcher.

Based on the response of the subjects in the pilot study and during the training, the training schedules for group I, and II were constructed. The number of repetitions assigned to each subject was tested and it was found that they were within the reach of the individual's capacity.

3.6 RELIABILITY OF DATA

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

3.6.1 INSTRUMENT RELIABILITY

The instruments used for this study to measure selected fitness components, stop watches and measuring tapes. Total cholesterol (TC), triglyceride (TG), High Density Lipoprotein (HDL) and Low Density Lipoprotein LDL were determined by enzymatic method using Boehringer Mannhein kit. The services of expert lab technicians were drawn to collect samples and the blood samples were tested in prominent laboratory which has adequate experience in testing the blood samples for more than 10 years. The instruments used were tested for its reliability by comparing the other instruments and found reliable. Moreover, the measuring tape was manufactured by a standard company and its calibration was checked with other measuring tape and found to be reliable.

3.6.2 TESTER'S COMPETENCY

Reliability was established by the test re-test process. Subjects were tested of their fitness and biochemical variables on the first day and the second day. The obtained scores were correlated to find out the correlation between the two scores. The obtained correlation coefficient value was highly significant and it was found that the tester was competent to test the criterion measure. Table 3.I shows the intra class correlation co-efficient obtained for different variables tested.

Table – 3.1

Intra Class Correlation Coefficient of Test – Retest Scores

	Variables	**Coefficient of Correlation**
1	Explosive power	0.87*
2	Speed	0.86*
3	Agility	0.72*
4	Flexibility	0.83*
5	Triglycerides	0.82*
6	Total Cholesterol	0.79*
7	High density lipoprotein	0.84*
8	Low density lipoprotein	0.81*

***** Significant at 0.01 level

3.6.3 SUBJECTS RELIABILITY

The correlation value of the above test and retest also indicated subject reliability as the same subjects were used under similar conditions by the same tester. The co-efficient of reliability were significant at 0.01 level, for the above test under investigation.

3.7 TRAINING PROGRAMME

The methods of doing plyometric training and swiss ball exercise were explained to the experimental groups before starting the training. The **researcher** himself demonstrated the plyometric and swiss ball exercises to the subjects. The training was given for a period of twelve weeks, three days per week on alternate days, except Sundays. Each training session was for two hours including warming up and cooling down exercise. The control group did not undergo any treatment.

The training programme was conducted systematically to improve the selected variables. The weekly training schedules are presented in annexure-I.

3.8 ADMINISTRATION OF TESTS

3.8.1 EXPLOSIVE POWER (VERTICAL JUMP TEST)

Purpose

To measure the leg power of the subject.

Equipments

A measuring tape and a smooth wall surface at least 12 feet from the floor.

Description

The subject stood with one side towards a wall heels together kept on the floor, he reached upward as high as possible and made a mark on the wall. Then the subject jumped as high as possible and made another mark at the peak height of their jumped and arched.

Score

The score was the vertical distance between the reach and jump and reached marks recorded in centimeters.

3.8.2 SPEED (50 METERS RUN)

Objective

To measure the maximum speed of the subjects.

Facilities and Equipments

An area on a track, with a starting line, a 50 meters course and a finish line, stop watches and whistle were used to collect the data.

Administration

The subjects were asked to take a position behind the starting line. The subject was asked to start on hearing 'clapper sound' and so cover the fifty meters with maximum effort.

Scoring

The score was the elapsed time to the nearest tenth of a second between the starting and the instant the subject crosses the finish line.

3.8.3 AGILITY

Objective

The purpose of this test was to measure agility.

Facilities and Equipments

Floor, stop watch, whistle, score sheet, measuring tape, chunnam powder, two wooden blocks (2”x2”x4”), score card and pencil.

Administration

Two parallel lines were drawn on the floor 10 meters apart. The blocks were placed behind one of the lines. The subjects were instructed to start from behind the other line. To start the shuttle run a whistle was blown and the subject ran to the blocks up one block, run back to the starting lines and placed the block on the ground beyond the line. Then the subject ran back picked up the other block and run across the starting line as fast as possible. The stop watch was started as the whistle blew and stopped when the subject crossed the starting line.

Scoring

The trials were administered with a rest period of five minutes in between the best of the two times were recorded as the scores in seconds.

3.8.4 FLEXIBILITY (SIT AND REACH)

Purpose

To estimate the trunk flexibility

Equipments

Yardstick and measuring steel tape

Procedure

Place the yardstick on the floor and put an 18 inch piece of tape across the 15 inch mark on the yard stick. The tape should secure the yardstick to the floor. The subject sits with the O end of the yardstick between the legs. The subject heel should almost touch the tape at the 15 inch mark and be about 12 inch apart with the legs held straight. The subject bends forward slowly and reaches with parallel hand as far as possible and touches the yardstick. The subject should hold this reach long enough for the distance to be recorded.

Scoring

The best score recorded out of the three trials was the score in flexibility.

3.9 MEASUREMENT OF BIOCHEMICAL VARIABLES

Biochemical variables were measured using blood samples. The subject was asked to sit on an arm chair comfortably. To measure the biochemical variables, 05 ml of venous blood was drawn from an antecubital vein after a 12 h fast and 24 h after the last session of exercise. HDL and LDL were estimated by applying phosphtungstate method, as recommended by Castelli, et al., Bio-chemistry analyzer (Model RA-50) Bayer Diagnostics was used for this purpose. Total cholesterol (TC) and triglyceride (TG) were determined by enzymatic method using Boehringer Mannhein kit. The services of expert lab technicians were drawn to collect samples and the blood samples were tested in prominent laboratory which has adequate experience in testing the blood samples for more than 10 years. The collected blood samples were subjected to the following estimations.

3.9.1 HIGH DENSITY LIPOPROTEIN (HDL)

HDL was estimated by applying phosphtungstate method, as recommended by Castelli, et al., Bio-chemistry analyzer (Model RA-50) Bayer Diagnostics was used for this purpose.

PRINCIPLE

Chylomicrons, VLDL and LDL fractions in serum were separated from HDL by precipitating with phosphtumgstic acid and magnesium chloride. After centrifugation, the cholesterol in the HDL fraction, which remained in the supernatant was arrayed with enzymatic cholesterol method, using cholesterol esterase, cholesterol oxidase, peroxidase and the chromogen Aninoantspyrine.

Precipitating Reagent

Phosphotungstic acide - 2.4 mmol/l

Magnesium chloride - 39 mmol/l

PROCEDURE

To 0.02 ml of sample, 0.20 ml of precipitating reagent was added and mixed well. The tubels were centrifuged at 4000 rpm for 10 minutes, 100 mg/dl clear supernatant was separated immediately to determine HDL cholesterol content by enzymatic cholesterol method and the readings were taken.

Serum HDL cholesterol was expressed as mg/dl.

3.9.2 LOW DENSITY LIPOPROTEIN CHOLESTEROL (LDL)

LDL –C was calculated from TC, TG and HDL-C levels using the following Friedewald's equation.

LDL-C = TC – TG/5 - HDL – C

LDL-C was expressed as mg/dl.

3.9.3 TOTAL CHOLESTEROL

Enzymatic method using Boehringer Mannhein kit was used to estimate the cholesterol.

PRINCIPLE

Cholesterolesters + H_2O $\xrightarrow{\text{Cholesterolestrase}}$ Cholesterol + RCOOH

Cholesterold + O_2 $\xrightarrow{\text{Cholesterol Oxidase}}$ Δ^4 – cholesterone + H_2O_2

$2H_2O_2$ $\xrightarrow{=4}$ Aninophenazone + Phenol $\xrightarrow{\text{POD}}$ 4 p Benzoquinone – Monoiminol – phenazone + 4 H_2O_2

PROCEDURE

Ten µl of serum, standard and distilled water was incubated with 1000 µl of reagent at 37^o C for 5 minutes and the absorbance of the sample and standard were read at 546 nm within one hour against reagent blank.

Serum cholesterol was expressed a mg/dl.

3.9.4 TRIGLYCERIDES

Triglycerides were estimated by enzymatic calorimetric method using Boehringer Mannhein kit.

PRINCIPLE

Triglycerides + H_2O $\xrightarrow{\text{Lipoprotein Lipare}}$ Glycerol + Fatty Acid

Glycerol + ATP $\xrightarrow{\text{Glycerol Kinase}}$ Glycerol –3-Phosphate + ADP

$2H_2O_2$ + 4 Aninoantipyrine + ADPS $\xrightarrow{\text{Peroxidase}}$ Red quinone +4 H_2O

GPO - Glycerol – 3 – Phosphate Oxidine

ADPS –N-Ethyl – N- Self propyl-n-onisidine

The intensity of purple coloured complex formed during the reaction was directly proportional to the triglyceride concentration in the sample and was measured at 546 nm.

PROCEDURE

To ten µl of the sample, one ml of the reagent was added and mixed and incubated for 5 minutes at 37^{o}C. The readings were taken and the final colour is stable for atleast 30 minutes.

Triglyceride is expressed as mg/dl.

3.10 STATISTICAL TECHNIQUE

The pre test and post test scores on selected physical and biochemical variables of university men basketball players, due to the effect of plyometric training and swiss ball training were subjected to statistical analysis using ANCOVA. ANCOVA technique was used to test the adjusted post test mean differences among the experimental groups. If the adjusted post–test result was significant, the Scheffe's post hoc test was used to determine the significance of the paired mean differences (Thirumalaisamy, 1997).

Flow Chart Showing the Methodology Adapted in the Study