CHAPTER-III

METHODOLOGY

This chapter discusses the methodology used in the selection of subjects, classification of group, experimental treatment, selection of variables, selection of tests, reliability of instruments, pilot study, competency of the tester, subjects reliability, orientation to the subjects, reliability of the data, collection of data, administration of tests and experimental design and statistical technique were presented.

3.1 Selection of Subjects

The purpose of this study was to find out the impact of varied gym exercises on selected cardiopulmonary fitness and biochemical variables among middle aged men. To achieve the purpose of the study, eighty (n=80) middle age men were selected from various parts of Tamil Nadu state, India. The age of subjects ranged from 30 to 45 years. All the subjects were informed about the nature of the study and their consent was obtained to co-operate till the end of the experiment and testing period.

3.2 Classification of group

The subjects were divided into four equal groups of twenty subjects each, the groups were designed as follows:

Group-I	Endurance training (Experimental group 'A')
Group-II	Resistance training (Experimental group 'B')
Group-III	Combined training (Experimental group 'C')
Group -IV	Control group

For the convenience in illustration the investigator takes the liberty to express experimental group 'A', experimental group 'B' and experimental group 'C' as endurance training, resistance training and combined training groups respectively.

3.3 Experimental treatment

Group-I underwent gym based endurance training and Group-II underwent gym based resistance training, Group –III underwent gym based endurance and resistance training respectively. The control group was not exposed to any specific training /conditioning programme. The experimental treatment namely endurance training, resistance training and combined training was administrated for a duration of 12 weeks and the number of session per week was confined to three alternative days and each session lasted 70 minutes, in addition to the regular schedule.

The subjects were free to with draw their consent in case they felt any discomfort during the period of training but there were no dropout in the study. A qualified physician examined the subjects medically and declared that they were fit for the study.

The subjects underwent their respective programme under the strict supervision of the investigator, prior to every training session, the experimental groups had a ten minutes warm-up exercise, which included jogging and stretching. All the subjects involved in the training programmes were questioned about their state throughout the training provide none of the new reported any injury, however muscle soreness

was reported in the early weeks, but it subsided later. Attendance was calculated for the experimental groups by dividing the total number of training sessions by number of sessions present. It was 97.2% for the experimental group 'A', 96.3% for experimental group 'B' and 95.1% for experimental group 'C' respectively.

3.4 Selection of Variables

The research scholar reviewed the available scientific literature pertaining to the problem from books, journals, periodicals, e-resources, unpublished thesis and dissertation. Keeping in mind the opinion of the experts, availability of equipments, acceptability of the subjects and the time to be derived, the following variables were selected namely

Dependent variables

Cardiopulmonary fitness variables

1. Cardiorespiratory Endurance
2. Resting Pulse Rate
3. Vital Capacity
4. Breath Holding Time

Biochemical Variables

1. Total cholesterol (TC)
2. Triglycerides (TG)
3. High Density Lipoprotein (HDL)
4. Low Density Lipoprotein (LDL)

Independent variables

1. Gym based endurance training

  2. Gym based resistance training

  3. Combined endurance and resistance training

3.5 Selection of tests

   The present study was undertaken primarily to assess the impact of varied gym exercises on selected cardiopulmonary fitness and biochemical variables among middle aged men. The selected variables were tested by using the following standardized tests and they were presented in Table 3.1.

Table 3.1
SELECTION OF TEST

S.No	Variables	Test/Equipment used	Measuring unit
cardiopulmonary fitness components			
1	Cardiorespiratory Endurance	Harvard step test	In Numbers
2	Resting Pulse Rate	Digital heart rate monitor	In Numbers
3	Vital Capacity	Spirometer	In liters
4	Breath Holding Time	Manual method	In Seconds
Biochemical variables			
5	Triglycerides	Blood Sample and using Friedewald formula	Mg/dl
6	Total Cholesterol		
7	High Density Lipoprotein		
8	Low Density Lipoprotein		

3.6 Reliability of instruments

   The instruments which were required to test the selected criterion variables such as stop watches, spirometers, barbells, free weights, collor and measuring tape were borrowed from the YMCA College of Physical Education, Nandanam, Chennai, Tamil Nadu, India. All the instruments

used in this study were in good condition and workable, purchased in a reputed and reliable companies. Their calibration were tested and found to be accurate enough to serve the purpose of the study.

3.7 Pilot study

Prior to the formal study sessions, a pilot study was conducted to validate research procedure and the initial capacity of the participants to design the training programme. For the purpose, twelve participants were selected at random, group-A (n=4) underwent endurance training, group-B (n=4) underwent resistance training and group – C(n=4)underwent combined endurance and resistance training under the watchful eyes of the investigator. The initial loads of the participants were fixed and the training programme for group-I, group-II and group-III were designed separately based on the performance in the pilot study. While constructing the training programmes the basic principles of sports training were followed during construction of training programme, the individual differences were also considered. The investigator in consultation with the experts constructed the both training schedules.

3.8 Competency of the tester

All the measurement in this study was taken by the investigator with assistance of research scholars from the YMCA College of Physical Education, Chennai, Tamil Nadu state, India. To ensure that the investigator and his assistants were well versed with the techniques of conducting tests. They had a number of practice sessions in the correct
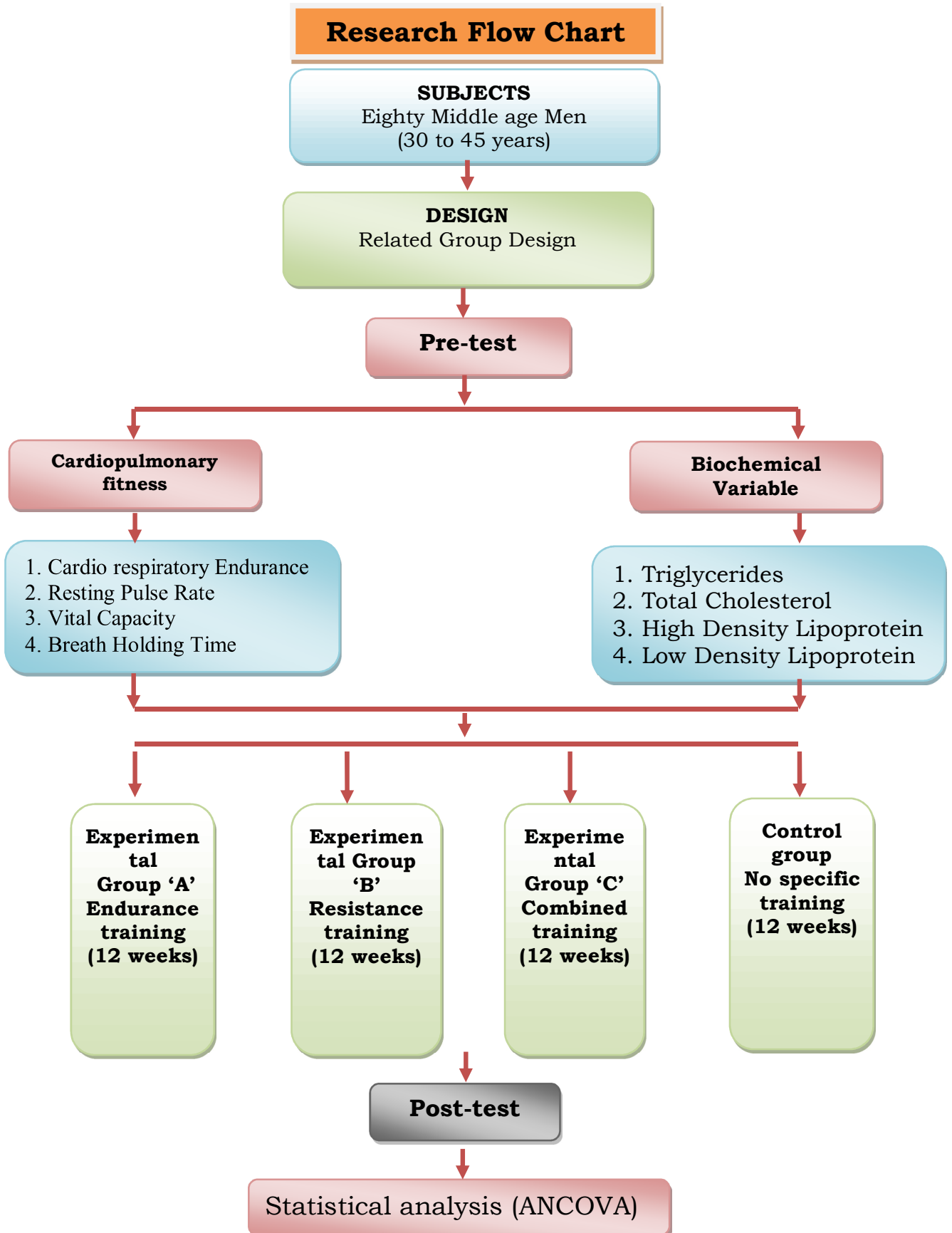
testing procedure. The tester's reliability was established by test and re-test method.

3.9 Subjects reliability

In order to get uniform results from the same subjects, they were used under similar conditions for the same test by the same tester. The test – retest method was used to find out the subject's reliability.

3.10 Orientation to the subjects

The investigator explained the purpose of the study to the subjects and their part in the study. For the collection of the data, the investigator explained the procedure of testing on selected dependent variables and gave instructions about the procedure to be adopted by them. Four sessions were spent to familiarize the subjects with the technique involved to execute both the training. It helped them to perform both training perfectly and avoids injuries, further; the control group was specially oriented, advised and controlled to avoid the special practice of any of the specific training programme till the end of the experimental period. The participants of all the groups were sufficiently motivated to perform their maximal level during training and testing periods.

Research Flow Chart

SUBJECTS
Eighty Middle age Men
(30 to 45 years)

DESIGN
Related Group Design

Pre-test

Cardiopulmonary fitness

1. Cardio respiratory Endurance
2. Resting Pulse Rate
3. Vital Capacity
4. Breath Holding Time

Biochemical Variable

1. Triglycerides
2. Total Cholesterol
3. High Density Lipoprotein
4. Low Density Lipoprotein

Experimental Group 'A' Endurance training (12 weeks)

Experimental Group 'B' Resistance training (12 weeks)

Experimental Group 'C' Combined training (12 weeks)

Control group No specific training (12 weeks)

Post-test

Statistical analysis (ANCOVA)

3.11 Reliability of the data

Test and retest method was followed in order to establish the reliability of the data by using twelve subjects at random. All the dependent variables selected in the present study were tested twice by the same personnel under similar conditions. The intra class co-efficient of correlation was used to find out the reliability of the data and the results are presented in Table 3.2.

Table 3.2
INTRA CLASS CO-EFFICIENT OF CORRELATION
ON SELECTED VARIABLES

Sl. No	Variables	r -Value
1	Cardiorespiratory Endurance	0.89*
2	Resting Pulse Rate	0.95*
3	Vital Capacity	0.86*
4	Breath Holding Time	0.87*
5	Triglycerides	0.89*
6	Total Cholesterol	0.92*
7	High Density Lipoprotein	0.90*
8	Low Density Lipoprotein	0.92*

Significant at 0.05 level of confidence.
 (Table value required for significance at 0.05 level of confidence df 11 was 0.60)

Since the obtained 'r' values were much higher than the required value, the data were accepted as reliable in terms of instrument, tester and the subjects.

Table 3.3
Training Schedule

Week	Resistance Training	Exercises	Intensity	Repetition	Set	Frequency per week
1 -3 weeks	Morning	1.Wall push ups 2.Resistance Tube bicep curl 3.Swiss ball squats 4.Abe crunch 5.Single leg reveres curl 6.Pelvic bridge	60	12	2	3 days
	Evening	1. Resistance Tube late row 2.Dumbell one arm tri extension 3.Resistance tube front raise 4.Stick side bend 5.Stick side bend 6..Stick oblique twist	60	12	2	3 days
3-6 weeks	Morning	1.Dumbell chest press 2.Dumbell hammer curl 3.Hamstring curl 4.Abe crunch & Hold 5.Both the	60-65	15	2	3 days

		leg reveres curl 6.Pelvic bridge				
	Evening	1.Lat pull down 2.Dumbell tri kick back 3.Resistance tube lateral rise 4.Leg side raise with Ankle weight 5.Medicin ball partner oblique twist 6.prone on mat Single leg lift	60-65	15	2	3 days
6-9 weeks	Morning	1.modified Push Ups 2.Dumbell Biceps Curl 3.Leg Extension 4.Abe Crunch and Hold 5.Alternate Reverse Curl 6.Prone on mat Same arm and same leg lift	65-70	12	2	3 days
	Evening	1.cable lat row 2.Cable tri push down 3.Dumbel combo raise 4.Medicine ball side bend 5.Side laying	65-70	12	2	3 days

		on mat legs side raise with crunch 6.prone on mat Hyper extension				
9-12 weeks	Morning	1. Dumbbell fly 2. Z-bar biceps curl 3. Barbell stiff leg dead lift 4.Air bicycle 5. Sit ups 6.Alternate reverse curl	65-70	12	2	3 days
	Evening	1. Dum bell one arm lat row 2. Tri dips 3. Barbell shoulder press 4. side plank 5. Diagonal reverse curl 6. Superman hyperextensi on	65-70	12	2	3 days

Week	Endurance Training	Exercises	Intensity	Duration	Frequency per week
1 -3 weeks	Morning	1.Requmalan Cycle 2. Cross training (EFX)	60	45	3 days
	Evening	1. Treadmill - walking 2. Floor Aerobics(basics)	60	45	3 days
3-6 weeks	Morning	1. Rowing 2. Hill climbing	60-65	45	3 days
	Evening	1. Zumba dance 2. Step aerobics	60-65	45	3 days
6-9 weeks	Morning	1.Requmalan Cycle 2. Cross training (EFX)	65-70	45	3 days
	Evening	1. 1. Treadmill - Jogging 2. Floor Aerobics(intermediate)	65-70	45	3 days
9-12 weeks	Morning	1.Requmalan Cycle 2. Cross training (EFX)	65-70	45	3 days
	Evening	1. 1. Treadmill - running 2. Step aerobics (intermediate)	65-70	45	3 days

Week	Combined Training	Exercises	Intensity	Duration/ Repetition	Set	Frequency per week
1 -3 weeks	Morning	1. Treadmill - walking 2. Floor Aerobics(basics)	60	45	-	3 days
	Evening	1.Wall push ups 2.Resistance Tube bicep curl 3.Swiss ball squats 4.Abe crunch 5.Single leg reveres curl 6.Pelvic bridge	60	12	2	3 days
3-6 weeks	Morning	1. Zumba dance 2. Step aerobics	60-65	45	-	3 days
	Evening	1.Lat pull down 2.Dumbell tri kick back 3.Resistance tube lateral rise 4.Leg side raise with Ankle weight 5.Medicin ball partner oblique twist 6.prone on mat Single leg lift	60-65	12	2	3 days

6-9 weeks	Morning	1.Requmalan Cycle 2. Cross training (EFX)	65-70	45	-	3 days
	Evening	1. Dumbbell fly 2. Z-bar biceps curl 3. Barbell stiff leg dead lift 4.Air bicycle 5. Sit ups 6.Alternate reverse curl	65-70	15	2	3 days
9-12 weeks	Morning	1. Rowing 2. Hill climbing	65-70	45	-	3 days
	Evening	1. Dum bell one arm lat row 2. Tri dips 3. Barbell shoulder press 4. side plank 5. Diagonal reverse curl 6. Superman hyperextension	65-70	15	2	3 days

3.12 Collection of Data

Pre-test data were collected two days before the commencement of treatment period and post-test data were collected immediately after completion of experimental treatment period for all the groups namely endurance training, resistance training, combined training and control group. Data were collected for two days in the forenoon and afternoon sessions. The collected data were processed with appropriate statistical tool and the detailed procedure of the same is given below.

3.13 Administration of Tests

3.13.1 Cardiopulmonary Fitness Components

1. CARDIORESPIRATORY ENDURANCE (HARVARD STEP TEST)

Purpose

To measure the cardio respiratory endurance through Physical Efficiency Index.

Equipments

A stable bench 20 inches high and a stop watch.

Procedure

The subjects stepped up and down 30 times a minute on a bench 20 inches high. Each time the subject should step all the way up on the bench with the body erect. The stepping process was performed in four

counts, as follows: 1. one foot placed on bench, 2. other foot placed on the bench; 3. one foot placed on the floor; 4. the other foot is placed on floor. The tester may lead off with the same foot each time or any change feet as he desires, so long as the four count step was maintained. The steps were counted the cadence as 'up, up, down, down'.

The stepping exercise continued for exactly five minutes, unless the subject was forced to stop sooner due to exhaustion. In either case the duration of the exercise in seconds was recorded; the maximum number of seconds was 300 for the full five minute period.

Immediately after completing the exercise, the subject sat on a chair. The pulse was counted $1 - 1\frac{1}{2}$, $2 - 2\frac{1}{2}$ and $3 - 3\frac{1}{2}$ minutes after the stepping ceases.

Scoring

Physical efficiency index (PEI) was computed utilizing the following formula:

$$\text{PEI} = \frac{\text{Duration of Exercise in Seconds x 100`}}{\text{2 x Sum of pulse counts in recovery}}$$

2 VITAL CAPACITY

Purpose

To measure the forced vital capacity (FVC) of the subject.

Equipments

Micro Plus Spirometer (MS03) with mouthpiece, nose clip, pieces of gauze were used to measure the vital capacity of the subject.

Procedure

Subjects were oriented about using the Spirometer by fully inhaling and exhaling through the mouth piece. Two trials were permitted before the measurement so that the subjects would be well versed with the use of Spirometer to ensure that proper measurements could be made.

The vital capacity of the subject was assessed during an expiratory maneuver, starting from end-tidal volume the subjects made a full inspiration and subsequently exhaled maximally. The maneuver was performed with maximal force. The subject first filled the lung with air to the fullest (that is to total lung capacity), and then, exhaled forcefully and completely to residual volume, the volume change of the lung was the forced vital capacity (FVC), which was displayed in the Spirometer.

Scoring

The score of the subject's vital capacity was displayed in the Spirometer, which was recorded in liters.

3.RESTING HEART RATE

Objective

To measure the resting heart rate of each subject per minute

Equipments

Digital Heart Rate Measuring Machine, Model No. EW 243, manufactured by National Company, Japan.

Administration

The pulse rate of all the subjects were recorded in a sitting position, in the morning between 6 and 6.30 a.m. Before taking heart rate the subjects were asked to relax for about 30 minutes.

Then the subjects were instructed to sit in a back supported chair and maintain in a slight incline position and placed his left hand on the table. Next the researcher was collected Heart Rate by using Digital Heart Rate measuring machine which was placed in the chest level on a table. In this way the researcher was measured the heart rate of the subject.

Scoring

The number of pulse beats per minute were recorded as the scores.

(Fox and Mathews, 1985)

4. BREATH HOLDING TIME

Objective

The purpose of this test was to measure the breath holding time.

Equipments

For recording the breath holding time, a stop watch ($1/10^{th}$ of second) and nose clip were used.

Administration

The subject was instructed to stand at ease and to inhale deeply after which he holds his breath for a length of time possible by him. A nose clip was placed on nose to avoid letting the air through nostrils. The duration from the time of holding his breath until the movement he let air out was clocked by using the stop watch to the nearest one tenth of a second as breath holding time. The co-operation of the subject to let out the air by opening the mouth was sought to clock the exact breath holding time.

Scoring

The time was recorded in seconds and the beset of two trials were recorded (Mathew, 1988).

3.13.2 BIOCHEMICAL VARIABLES

1. Estimation of Lipid Profile

Lipid profile were measured using blood samples. The blood sample was collected before training and immediately after the 12 weeks training for all the three groups.

Blood Collection

The subject was asked to sit on an arm chair comfortably. An examination of the superficial vein of the left fore arm was made to select the site for venous puncture. The skin was cleared with spirit and allowed to dry. A tourniquet was tied around the upper arm. The subject was asked to flex and extend the wrist joint to make the veins more prominent. Thumb of the left hand was placed on the lower part of the cleared area and gentle traction was given to fix the vein. A 3 ml sterilized syringe with needle was used to puncture the vein and blood flowed in the syringe. Five millimeter of blood was collected from each subject and stored in a stoppered container with antioogulant. The collected blood samples were subjected to the following estimations using Friedewald formula (Rifai, et.al. 1992)

2. High Density Lipoprotein

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.

<u>Principle</u>

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

<u>Precipitating Reagent</u>

Phosphotungstic acide - 2.4 mmol/1

Magnesium chloride   - 39 mmol/1

<u>Procedure</u>

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. (Rifai, et.al. 1992) Serum HDL cholesterol was expressed as mg/dl.

Low Density Lipoprotein Cholesterol

LDL –C was calculated from TC, TG and HDL-C levels using the following Friedewald's equation. (Rifai, et.al. 1992)
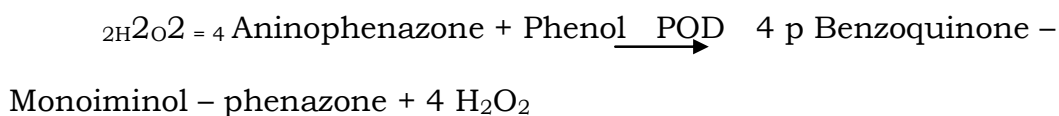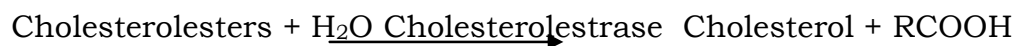
LDL-C = TC – TG/5 - HDL – C

LDL-C was expressed as mg/dl.

3. Total Cholesterol

Enzymatic calorimetric method recommended by Siedal et al., and Kuattermann et al., was applied for estimation of cholesterol. Bio-chemistry analyser (Model RA-50) was used for this purpose.

<u>Principle</u>

Cholesterolesters + H_2O Cholesterolestrase $\longrightarrow$ Cholesterol + RCOOH

Cholesterold + O_2 Cholesterol Oxidase $\longrightarrow$ Δ^4 – cholesterone + H_2O_2

$2H_2O2 = 4$ Aninophenazone + Phenol POD $\longrightarrow$ 4 p Benzoquinone – Monoiminol – phenazone + 4 H_2O_2

<u>Procedure</u>

Ten µl of serum, standard and distilled water was incubated with 1000 µl of reagent at 37º C for 5 minutes and the absorbance of the
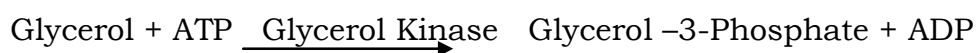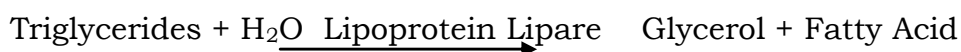
sample and standard were read at 546 nm within one hour against reagent blank. **(**Rifai, et.al. 1992)

Serum cholesterol was expressed as mg/dl.

4. Triglycerides

Triglycerides were estimated by enzymatic calorimetric method. Bio-chemistry analyses (Model RA –50) was used for this purpose

Principle

Triglycerides + H_2O Lipoprotein Lipare → Glycerol + Fatty Acid

Glycerol + ATP Glycerol Kinase → Glycerol –3-Phosphate + ADP

$2H_2O_2$ + 4 Aninoantipyrine + ADPS 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 is directly proportional to the triglyceride concentration in the sample and is 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°C.

The readings were taken and the final colour is stable for atleast 30 minutes. **(**Rifai, et.al. 1992). Triglycerides was expressed as mg/dl.

3.14 Experimental design and statistical technique

This study was conducted to determine the possibility cause and effect relationship of varied gym exercises on selected cardiopulmonary fitness and biochemical variables among middle aged men. The related group design was employed for this investigation. This study consisted of four equal groups of twenty subjects each. Group-I (n=20) underwent endurance training, Group-II (n=20) underwent resistance training, Group-III (n=20) underwent combined endurance and resistance training and Group IV acted as control group. The related group research design was used in this study. The collected data from the three groups prior to and after the experimental treatments on selected cardiopulmonary fitness and biochemical variables were statistically analyzed by using the statistical technique of analysis of covariance (ANCOVA). Whenever the 'F' ratio for adjusted post-test means was found to be significant, Scheffe's test was followed as a post hoc test to determine which of the paired mean difference was significant. In all the cases 0.05 level of confidence was fixed as a level of confidence to test the hypotheses.