CHAPTER III

METHODOLOGY

This chapter describes in detail about the selection of subjects, selection of variables, experimental design, pilot study, selection of tests, criterion measures, reliability of data, training programme, test administration, collection of data and statistical techniques involved in this study.

3.1 SELECTION OF SUBJECTS

The purpose of the study was to find out the effects of varied capsules of fitness training such as circuit training, interval training and stair case training on selected physical, physiological, psychological and skill variables among college level men handball players. To achieve the purpose of this study, 80 college men handball players from various colleges of the University of Madras were selected as subjects and they were in 18 to 24 years of age.

3.2 SELECTION OF VARIABLES

The research scholar reviewed the various scientific literature pertaining to the circuit training, interval training and stair case training on selected physical, physiological and psychological variables from books, journals, periodicals, magazines and research papers. Taking into consideration of feasibility criteria, availability of instruments and the relevance of the variables of the present study, the following variables were selected.

3.2.1 Dependent Variables

a. Physical Variables

1. Speed
2. Abdominal Strength
3. Flexibility
4. Cardiovascular Endurance

b. Physiological Variables

1. Vital Capacity
2. Breath Holding time

c. Psychological Variables

1. Achievement Motivation
2. Self-Confidence
3. Anxiety

d. Skill Variables

1. Dribbling
2. Shooting
3. Wing Shot Shooting

3.2.2 Independent Variables

1. Experimental Group I: Twelve weeks of Circuit Training

2. Experimental Group II: Twelve weeks of Interval Training

3. Experimental Group III: Twelve weeks of Stair Case Training

4. Group IV: Control Group

3.3 EXPERIMENTAL DESIGN

The study was formulated as a true random group design, consisting of a pre test and post test. The subjects (n = 80) were randomly assigned into four equal groups of 20 handball players in each group. The groups were assigned as Experimental Groups I, II, III and control group respectively. Experimental group I was assigned as Circuit Training Group (CTG), experimental group II was assigned as Interval Training Group (ITG), experimental group III was assigned as Stair Case Training Group (SCTG) and the Control Group (CG) was strictly under control not involving any special training. Pre tests were conducted for all the subjects on selected physical, physiological and psychological variables. The experimental groups participated in their respective circuit training, interval training and stair case training for a period of twelve weeks. After the experimental period, the post tests were conducted on the above said dependent variables for all the four groups. The difference between the initial and final scores on each variable was considered the effect of respective treatments. The effects of varied package of training on selected variables were tested through ANCOVA. In all cases 0.05 level was fixed to test the hypothesis.

3.4 PILOT STUDY

A pilot study was performed to fix the intensity and duration of training programme in relation with the initial capacity of the subjects. The study was

executed with 15 subjects to identify the suitability, short comings and limitations of the training. Further, this study has helped the scholar to mastery over the procedure of the tests and capable to take accurate measurement of selected variables among college level men handball players.

3.5 CRITERION MEASURES

The following criterion measures were adopted to measure the test.

1. To measure the speed, 50 meters run test was administered by using stop watch and the scores were recorded in seconds.

2. To measure the abdominal strength, sit-up test was administered and the scores were recorded in number.

3. To measure the on flexibility, sit and reach test was administered and the scores were recorded in centimeters.

4. To measure the cardiovascular endurance, Cooper's 12 Minutes run / walk test was conducted and the scores were recorded in meters.

5. To measure the vital capacity, wet spiro meter was used and scores were recorded in milliliters.

6. To measure the breath holding time was measured using nose clip method was administered with stop watch and the scores were recorded in centimeters.

7. Achievement motivation was measured by questionnaire was and the scores were recorded in points.

8. Self-confidence was measured by Basavanna's questionnaire (1971) and the scores were recorded in points.

9. Anxiety was measured through Sinha's Comprehensive Anxiety Test (SCAT) and the scores were recorded in points.

10. Skill variables, dribbling, shooting and wing shot shooting were determined as per standard tests in handball.

3.6 RELIABILITY OF DATA

Before the commencement of experiment, the reliability of the data was established through reliability of instruments, reliability of tester, reliability of subjects by test and retest method

3.7 RELIABILITY OF INSTRUMENTS

The research scholar used the following instruments such as stop watch, measuring tape, starting clapper, meter scale and wet spirometer to find out the reliability of the instruments. Further those instruments have been calibrated in standard units, each of the variables are recorded. All the instruments were in good working condition. Their calibration was tested and found to be accurate enough to serve the purpose of the study.

The questionnaires used in this study to measure the psychological variables were standard ones and being used by researchers in the field. Moreover, the authors of the questionnaires have determined the validity and reliability of the tools and hence, the reliability was accepted for this study.

3.8 TESTER'S RELIABILITY

To determine the reliability of measurements involved in this study, the data were collected from 15 handball players. To ensure that the investigator was well versed in the technique of conducting the tests, the investigator had a number of practice sessions in the testing procedures. The investigator took all the measurements with the assistance of persons well acquainted with the tests and their procedures. Tester's competency and reliability of tests were established by Test, Retest, process. Table I shows the test and re-test correlation coefficient.

Table I

Intra Class Correlation Coefficient of Test - Retest Scores

S.No	Variables	Test	Obtained 'r'
1	Speed	50 M Run	0.89*
2	Abdominal Strength	Sit ups	0.91*
3	Flexibility	Sit and Reach	0.87*
4	Forced Vital Capacity	Spirometer	0.85*
5	Breath Holding Time	Nose and Clip method	0.84*
6	Cardiovascular Endurance	12 Min walk / Run Test	0.82*
7	Achievement Motivation	Sports Achievement Motivation (Kamlesh, 1993)	0.79*
8	Self Confidence	Self Confidence Test Basavanna (1971)	0.78*
9	Anxiety	Sinha's Comprehensive Anxiety Test	0.81*
10	Dribbling	Handball Dribbling Test	0.79*
11	Shooting	Handball Shooting Test	0.78*

3.9 SUBJECT RELIABILITY

The intra class correlation coefficient values received from test-retest scores also confirmed the reliability of subjects as the same tester had conducted test-retest for the same subjects in the same conditions.

3.10 CIRCUIT TRAINING PROGRAMME

While training for experimental group I, the circuit training was given. The circuit was structured to develop the physical fitness, physiological and psychological variables of handball players. The following circuit exercises were selected so that they could develop the physical fitness abilities mentioned against each:

1) Four – count squat Thrusts - Speed
2) Abdominal Sit – Backs - Agility /Abdominal Strength
3) Scissor step – ups - Leg Strength
4) Squats to Presses - Muscular Strength
5) Overhead Barbell Press - Upper-body Strength
6) Push – Ups - Cardiovascular Endurance
7) Free Jump Squats - Core Strength / Endurance
8) Bicycle Kicks - Abdominal Strength / Flexibility

Table II
TWELVE WEEKS OF TRAINING SCHEDULE FOR CIRCUIT TRAINING PROGRAMME

WEEK	EXERCISE		CIRCUITS	
	WORK	REST	REPETITION	REST
1.	30 Sec	30 Sec	2	2 min
2.	30 Sec	30 Sec	2	2 min
3.	30 Sec	30 Sec	2	2 min
4.	30 Sec	30 Sec	2	2 min
5.	35 Sec	35 Sec	3	2 min 30 Sec
6.	35 Sec	35 Sec	3	2 min 30 Sec
7.	35 Sec	35 Sec	3	2 min 30 Sec
8.	35 Sec	35 Sec	3	2 min 30 Sec
9.	40 Sec	40 Sec	4	3 min
10.	40 Sec	40 Sec	4	3 min
11.	45 Sec	45 Sec	5	3 min 30 Sec
12.	45 Sec	45 Sec	5	3 min 30 Sec

3.11 INTERVAL TRAINING PROGRAMME

Experimental II underwent Interval Training as per schedule presented in Table III. Care taken that the training session started with 5 minutes warm up consisting of slow walk and slow jogging and ends up with cool down session with slow jogging and slow walking. The intensity level of 60 – 70% was maintained with maximum heart rate (RPE of 5-6 of the 10 on the 10-point scale) during warm up and cool down and recovery intervals. The interval training was based on progressive loading.

Table III

TWELVE WEEKS OF TRAINING SCHEDULE FOR INTERVAL TRAINING PROGRAMME

Week	Warm up	Work Interval (Max Intensity)	Recovery Interval (60-70% MHR)	Repeat	Cool down	Total Workout Time
1	5 min.	1 min.	4 min.	2 times	5 min.	20 min.
2	5 min.	1 min.	4 min.	3 times	5 min.	25 min.
3	5 min.	1 min.	4 min.	4 times	5 min.	30 min.
4	5 min.	1.5 min.	4 min.	2 times	5 min.	21 min.
5	5 min.	1.5 min.	4 min.	3 times	5 min.	26.5 min.
6	5 min.	1.5 min.	4 min.	3 times	5 min.	26.5 min.
7	5 min.	1.5 min.	4 min.	4 times	5 min.	32 min.
8	5 min.	1.5 min.	4 min.	4 times	5 min.	32 min.
9	5 min.	2 min.	5 min.	3 times	5 min.	31 min.
10	5 min.	2 min.	5 min.	3 times	5 min.	31 min.
11	5 min.	2 min.	5 min.	4 times	5 min.	38 min.
12	5 min.	2 min.	5 min.	4 times	5 min.	38 min.

3.12 STAIR CASE TRAINING PROGRAMME

Training for experimental group III, the stair case training was given. The stair case training was structured to develop the physical fitness and performance of the volleyball players. The following stair case training were selected so that they could develop the physical fitness abilities.

1. Sprinting up and down
2. Zig zag running in the steps (diagonally up and down)
3. Up – up down-down (on the same step)
4. Alternate steps (on the same step)
5. Hopping in one leg
6. Jumping with both legs

TABLE IV

TWELVE WEEKS OF TRAINING SCHEDULE FOR STAIR CASE TRAINING PROGRAMME

EXERCISE	I TO IV WEEKS		V TO VIII WEEKS		IX TO XII WEEKS	
	Time (in min)	Rest (in min)	Time (in min)	Rest (in min)	Time (in min)	Rest (in min)
Sprinting Up and Down	3	2	4	2	5	2
Zig Zag running in the Steps	3	2	4	2	5	2
Up-Up, Down-Down (on the same step)	3	2	4	2	5	2
Alternate Step (on the same step)	3	2	4	2	5	2
Hopping in one Leg	3	2	4	2	5	2
Jumping with both Legs	3	2	4	2	5	2

Prior to the experimental treatments such as circuit training, interval training, and stair case training, the subjects were given 5 minutes warm up and after completion of the training, the session was completed with 5 minutes cool down process. The exercises were structured so that there would be progressive work load on the training.

3.13 TEST ADMINISTRATION

3.13.1 Speed

50 Mts. Run

Purpose

The purpose of the test was to measure the speed of the subject.

Equipment

An area on a track, football field or playground with a starting line a 50 mts. run, and a finish line and two stop watches.

Procedure

After a short warm-up period the subject took a position behind the starting line. Best results are obtained when 2 subjects run at a time for competition. The starter uses the command, “ready” and “Go”. The later was accompanied by a downward sweep of the arm as a signal to the timer to start the stop watch. The subject ran across the finish line. One trial was permitted.

Scoring

The score was the clasped time to the nearest tenth of a second from the starting signal to the instant the subject a crossed the finish line.

13.3.2 Abdominal Strength

Sit-Ups

Purpose

The purpose of the test was to measure the abdominal strength of the subjects.

Equipment

Mats

Procedure

The starting position of the test was a back lying position with knees flexed, feet on floor and heels between one foot from the buttocks. The hands are positioned behind the neck and fingers are clasped. A partner held the examinee's feet to keep him in contact with the testing surface. The examinee curled to a sitting position, touching the elbows to the opposite knee. The examinee curled back down to the floor until the mid-back contacted the testing surface another sit-up was then attempted.

Scoring

One point was scored for each correct sit-up. The score was the maximum of sit-ups completed in 60 seconds.

3.13.3 Flexibility

Sit and Reach Test

Purpose

The objective of this test is to test the flexibility of the subjects.

Equipment

A 'sit and reach table with a ruler and Score Sheets.

Procedure

The subject was asked to sit on the floor with shoes removed, feet flat against the table and legs straight. The subject was asked to reach forward and push the fingers along the table as far as possible. The distance from the finger tips to the edge of the table represents the score of that subject.

Scoring

The distance from the finger tips to the edge of the table represented the score of the subject recorded in centimeters. Subject was allowed to three trials and the best one was taken as the score of the subject in flexibility.

3.13.4 Cardiovascular Endurance

Cooper's 12 Minutes Run/ Walk

Purpose

To measure cardiovascular endurance of the subjects

Equipment

A 400 meters track was marked and placed with cones with each 10 meters distance to quickly determine the exact distance covered in 12 minutes. A stopwatch, whistle, score sheets, chest numbers and distance markers were used for testing.

Procedure

Each subject was assigned to a spotter. The subjects were asked to start behind a line and upon the starting signal, run /walk as many laps as possible around the course within the 12 minutes. The spotters maintain a count of each lap, and when the signal to stop was given, they immediately run to the spots at which their runners were at the instant the whistle or command to stop was given.

Scoring

Score in meters was determined by multiplying the number of laps completed plus the number of cones passed plus the distance in meters off the last cone he passed.

3.13.5 Vital Capacity

Purpose

The purpose of this test was to find out the maximum quantity of air that can be expired after a full inspiration.

Equipment

Spiro meter, mouth pieces and nose clips.

Procedure

Vital capacity was measured by wet spirometer in liters. The wet spiro meter was equipped with a good length of rubber hose. The wet spiro meter placed at a height where by all the subject can stand erect at the beginning of the test. The mouth piece was disinfected by an antiseptic solution after use by each subject. The subjects were asked to take a deep breath for test: There after the fullest possible inhalation, the subject exhaled slowly and steadily bending forward over the hose till the air within his control was expelled. Care was taken to prevent air from escaping either through nose or around the edges of mouth piece and was also ensured that a second breath was not taken by the subject during the test. In case of doubt the test was repeated. Care was taken to lower the drum without spilling the water, each time after use.

Scoring

The score was taken from the dial of the Spiro meter which was recorded in milliliters.

3.13.6 Breath Holding Time

Purpose

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

Equipment

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

Procedure

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

3.13.7 Achievement Motivation

Sports Achievement Motivation Questionnaire (SAMQ) developed by Dr. M.L. Kamlesh (1993) was administered to assess the achievement motivation of the subjects.

The questionnaire consists of twenty statements with response from the subject ‘Yes’ or ‘No’. Based on the response of the subject, their achievement motivation was measured using the key of the score of the author.

Scoring

Each right response was awarded two Total score was the number of correct responses multiplied by two, of the subject and it was the achievement motivation of the subject.

3.13.8 Self-Confidence

Standard questionnaire consisting of one hundred statements were administered for evaluating self-confidence of the subjects. The test consists of hundred questions with True / or False response. The respondents were made to '√" the appropriate number which suited their attitude.

Scoring

This scoring range of this questionnaire was 100 to 0. The higher score indicates the high level of self-confidence.

Negative Questions

Of the one hundred questions with serial numbers 1 to 100, the following statements with serial numbers are negative statements. If the subject scored the negative statement as 'True' the score would be '0'.

1, 5, 7, 8, 9, 10, 11, 12, 14, 15, 16, 17, 18, 19, 20, 22, 23, 25, 26, 28, 33, 34, 35, 36, 37, 38, 43, 44, 45, 49, 51, 52, 53, 54, 55, 47, 58, 59, 60, 61, 63, 63, 66, 69, 70, 71, 72, 73, 74, 75, 76, 77, 80, 82, 83, 84, 85, 89, 90, 94, 97, 98, and 99.

Positive Questions

Of the one hundred questions with serial numbers 1 to 100, the following statements with serial numbers are positive statements. If the subject scored the positive statement as 'True' the score would be '1'.

2, 3, 4, 6, 13, 21, 24, 27, 29, 30, 31, 32, 39, 40, 41, 42, 46, 47, 48, 50, 56, 64, 65, 67, 68, 78, 79, 81, 86, 87, 88, 91, 92, 93, 96, and 100

3.13.9 Anxiety

Anxiety was measured through the anxiety questionnaire. The anxiety questionnaire was designed to measure the degree of anxiety experience prior to the competition.

It was developed by A.K.P. Sinha and L.N.K. Sinha (2002), and the questionnaire is popularly known as 'Sinha's Comprehensive Anxiety Test (SCAT). Anxiety questionnaire was given to all subjects. The complete questionnaire is scores as follows:

Description of the Questionnaire

The anxiety questionnaire (SCAT) consists of ninety statements. The subject had to answer all the ninety statements which are asked in Yes or No answer pattern.

For all 'Yes' answers to the statement, one point and for all the 'No' responses got '0' point.

Scoring

Score is the number of points scored by the subject out of ninety.

3.13.10 Dribbling

Purpose

To determine the dribbling ability of the subjects.

Equipment

Stop watches, measuring tape, standard hand ball, 4 dumbbells, chalk pieces and whistle

Court marking

Horizontal line of 6 feet long was marked as a shooting and finishing line. From starting line to the fourth dumbbell the marked distance was 30 feet long. The distance between the starting line to the first dumbbell was 12 feet and the reaming 3 dumb bells were placed at every 6 feet in between them.

Procedure

The subject starts at the shooting line, which was 6 feet long. She dribbles through the prescribed area, rotate as rapidly as possible for thirty seconds.

Scoring

The player score is the number of dumbbells which he passes in thirty seconds. Three trials were given and the best one was considered.

3.13.11 Shooting

Purpose

To determine the shooting ability of the subjects

Equipment

Stop watches, measuring tape, standard hand ball, two chairs, chalk pieces, rope, wooden stand and whistle

Court Marking

The rope was tied in the goal post in a design such as in the corners and the center. The students were asked to shoot the ball from penalty line which was seven meters from goal line. If she shoots the ball towards the corner then 5 points were awarded. If she shoots the ball at the center then 3 points were awarded. The scores were allotted according to the following marking

GOAL POST

5	3	6
3	2	3
5	1	5

Procedure

The subject stood behind the free throw line, within the 3 steps. She takes jump shot without touching 6 M line and travel towards the penalty line in the air bend her body and jump for selecting right angle and shoots into the particular marking point of goal. The player stands out of the 6 meters line and in any position as he desires.

Scoring

Three chances were given. The average of three trials were taken as score. Points were given for each throw according to particular marking area on the net.

3.13.12 Wing Shot Shooting

Purpose

To assess the wing shot shooting performance of the subjects.

Court Marking

The handball goal post was divided into nine targets by using ropes. Thus, the top and bottom right corner boxes were 75 cm x 50 cm, top and bottom left corner boxes were 75 cm x 50 cm; The top and bottom middle boxes were 150 cm x 50 cm. Left and right middle boxes measures 75 cm x 100 cm, while the middle box was 150 cm x 100 cm. The respective boxes were assigned scores from 1 to 3.

Procedure

On signal the subject came to the position marked for wing shooting and shoots into the goal post. The ball pierce into any one of the boxes and the scorer would award mark. The scoring was awarded to the respective boxes on the assumption that at the time of wing shooting from the right, the 'defender goal keeper' would guard the goal at the extreme left side of the goal post to block the ball. When the shooter shoots the ball from the left the goal keeper came to the right side of the goal post.

Scoring

Each subject would be given 5 trials from right wing and 5 trials from left wing. The total of the 10 trials would be the score of the subject, that is, his wing shooting performance.

3.14 COLLECTION OF DATA

Circuit training, interval training and stair case training were given as per the training schedule of 12 weeks. The pre and post test data on the selected dependent variables were collected by administering the tests as per the standardised procedures before and after the 12 weeks of the training programme.

3.15 STATISTICAL TECHNIQUES

The following statistical techniques were used to find out the effects of varied capsules of fitness training such as circuit training, interval training and stair case training on selected physical, physiological, psychological and skill variables among college level men handball players.

Analysis of covariance (ANCOVA) statistical 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 R., 1997).