CHAPTER - III

METHODOLOGY

In this chapter selection of subjects, selection of variables, pilot study, criterion measures, orientation of subjects, reliability of data, instrument reliability, tester's reliability, subject reliability, administration of tests, training programs and collection of data, experimental design and statistical procedure adapted to analyse the data have been explained.

3.1 SELECTION OF SUBJECTS

The study was designed to find out the effects of Pilates Training and Plyometric Training on motor fitness variables, physiological and psychological variables of college men. To achieve the purpose of the study, 120 college men were randomly selected from Dharamanagar Govt. Degree College in Tripura. Their age ranged from 18 to21 years. They were divided into four equal groups consisting of 30 each (N = 30). The group I was treated with pilates training group (PTTG), group II underwent plyometric training group (PLYTG) and group III was treated with combination of pilates training and plyometric training (CPPTG) and the group IV was considered as control group (CG) and not exposed to any treatment. The experimental groups under gone their respective training for 6 days per week for a period of 12 weeks.

3.2 SELECTION OF VARIABLES

The Research Scholar reviewed the available scientific literature pertaining to Pilates Training and Plyometric Training from books, journals, periodicals, magazines and research papers. Taking into consideration feasibility criteria, availability of

instrument and the relevance of the variables of the present study, the following variables were selected.

3.2.1 DEPENDENT VARIABLES

Pilates training improved flexibility (**suveeporn et al., 2011**). Pilates methods of exercises effective in improving muscular endurance (**Ana et al., 2011**), muscular strength (**Augusto et al., 2011**) and core strength (**Styephen,2012**).Plyometric training can improve athletes agility (**Miller et al., 2006**) plyometric programme increased sprint performance (**Rimmer and Sleivent, 2000**). The improvement in motor fitness variables is found to be highly associated with pilates and plyometric training. Hence, speed, flexibility, agility and muscular strength endurance were selected as dependent variables.

Plyometric depth jumping increased Vo_2 max (**Brown et al., 2010**), plyometric training significantly improved breath holding time (**Vino and Kumaresan,2012**) and anaerobic power (**Lubbers et al., 2003**). Plyometric decreased resting heart rate (**Vallimurugan et al., 2012**). Hence, resting pulse rate, Vo_2max, anaerobic power and breath holding time were selected as dependent variables.

Proper training mostly influenced motor fitness variables and physiological variables, and the alter the psychological status of the trainee. Pilates training made changes in need and perceived stress in college men (**Keran et al., 2010**). Therefore, the psychological variables such as stress, anxiety, aggression and mood state were selected as dependent variables. Totally this study consists of twelve dependent variables.

3.2.2 INDEPENDENT VARIABLES

Pilates offer a gentle but powerful approach to achieve strength, flexibility and stamina. Pilates method is a body conditioning exercise therapy, targeting the deep postural muscles to achieve core stability and strength with improved muscle balance (**Keane, 2005**).

Regular plyometric training increases power by improving the capacity of the muscles and tendons to capture elastic energy and by enhancing the efficiency of communication between the brain and the muscles. Hence, pilates training and plyometric training were selected as independent variables.

The investigator was interested to know whether the pilates training and plyometric training were effective to bring out positive changes in motor fitness, physiological and psychological variables of college men.

Further, an attempt was also made to find out whether the combination of Pilates and plyometric was an appropriate training to bring out the desired results. In this study, there were three independent variables. They were

1. Pilates training

2. Plyometric training

3. Pilates and plyometric training

3.3 PILOT STUDY

A pilot study was conducted to assess the initial capacity of the subject, in order to fix the load and to make sure that the duration of exercise included in the programme was within the limits of the subjects to ensure the satisfactory effect. For this thirty subjects were selected at random and divided into three groups of ten each, in which group I underwent Pilates training, group II underwent plyometric training and group III treated with combination of pilates training and plyometric training under the supervision of the investigator. Based on the response of the subjects in the pilot study, the training programme for the experimental groups to the main study, for the period of 12 weeks was designed. After completion of the pilot study, the present study was conducted on 120 subjects.

3.4 CRITERION MEASURES

By glancing the literature and consultation with the professional experts, the following variables have been selected as the criterion measures for testing the hypothesis

Table - I

Criterion Measures

Sl.No	Criterion Variables	Test Items	Unit of Measurements
Motor fitness Variables			
1	Speed	50 mts dash	Seconds
2	Flexibility	Sit and reach test	Centimeter
3	Agility	4 X 10 Shuttle run	Seconds

4	Muscular Strength endurance	Modified sit-ups	Numbers
Physiological Variables			
1	Resting pulse rate	Bio monitor	beats/min
2	Vo_2 Max	Queens college 3 minutes step test	ml/kg/min
3	Anaerobic power	Margarita Kalamen test	Kilogram/meter/seconds
4	Breath holding time	Control pause test	Seconds
Psychological Variables			
1	Stress	Perceived Stress **Scale Cohen(1983)**	Numbers
2	Anxiety	Beck Anxiety Inventory **Beck(1990)**	Numbers
3	Aggression	Questionnaire by **Buss & Perry (1992)**	Numbers
4	Mood state	Brunel Mood Scale **Terry *et al.,*(2003)**	Numbers

3.5 ORIENTATION OF THE SUBJECTS

Before collection of data, the subjects were oriented about the purpose of the study. The investigator explained the procedure of each test in detail to the subjects. The subjects were motivated in order to perform better during the test. The learning of each test items was made known to the subjects to familiarize them about their performance.

3.6 RELIABILITY OF DATA

The reliability of data was ensured by establishing the instrument reliability and tester's reliability and subject reliability.

3.6.1 INSTRUMENT RELIABILITY

Instruments such as measuring tape, stop watch, flex measure case and bio monitor were used in this study. All the instruments were working in good condition. Their calibrations were tested and found to be accurate enough to serve the purpose of the study. The stop watch which was used in this study compiled with IAAF specification and found reliable.

3.6.2 TESTER'S RELIABILITY

The investigator learned the procedures and methods to handle and operate the instrument to administrate the tests. Measurements were taken by the investigator himself using tape measurements, stop watch and bio monitor Services of qualified assistants were used. Reliability was established by test retest process. The tester collected the data from ten.

To determine the reliability of the measurement involved in the study, the tester corrected the data from ten subjects.

The intra class correlation co-efficient obtained for test- re test data are presented in Table-3.2

Table – 3.2

Intra class correlation co-efficient obtained for test- re test scores

Sl.No.	Tests	Correlation Co-efficient
Motor fitness Variables		
1	Speed	0.91*
2	Flexibility	0.87*
3	Agility	0.90*
4	Muscular Strength endurance	0.86*
Physiological Variables		
1	Resting pulse rate	0.91*
2	Vo_2 Max	0.87*
3	Anaerobic power	0.90*
4	Breath holding time	0.86*
Psychological Variables		
1	Stress	0.92*
2	Anxiety	0.89*
3	Aggression	0.86*
4	Mood state	0.90*

*Significance at 0.05 level of confidence

3.6.3 SUBJECT RELIABILITY

The intra class correlation values of the above tests and retest also indicated subject, tester and instrument reliability as the same subject and instruments were used under similar conditions by the same tester. The coefficient of reliability was significant at the $P < 0.05$ level for the above tests under investigation.

3.7 ADMINISTRATION OF TESTS

3.7.1 MOTOR FITNESS VARIABLES TEST

50 Meters Dash

To find out the speed of the subject, the 50 meters dash was conducted. Stop watch, measuring tape, score sheet, smooth surface for running with start and finish lines are the equipments and facilities needed for the administration of this test. The subjects were asked to stand behind the starting line and the race was started with single clapper sound. The time elapsed from the 'clap sound' to the runner crossing the finish line was taken as the test score. The fractions were rounded to the next target one tenth of a second. Digital electronic watch was used for this purpose. Two trials were conducted with sufficient rest in between and the best performance was recorded. The elapsed time from the starting signal until the runner crosses the finish line is measured to the nearest one tenth of a second.

Sit and Reach Test

To measure the flexibility of the subject the sit and reach test was used. For this purpose Flex measure case with scale and centimeter tape was used. The investigator has directed the subjects to take long sitting position. Hands were kept by the side of his body needs were placed 10 cm apart. The equipment was placed that the 40 cm mark of the

scale with a line on the floor. The subjects were asked to sit erect then slowly rise both the hands till they come to vertical position and plans facing down wards. They were asked to reach forward to the yard stick (scale) and maximum possible measurement was taken to one quarter of the centimeter. The best among the three trials were recorded to one quarter of the centimeter.

Shuttle Run

The shuttle run test was used to measure the agility of the performer in running and changing direction. Stop watches (1/10 of a second), a whistle, score sheets, measuring tape, Chunnam powder and two blocks of wood. Two parallel lines were drawn on a floor 10 meters apart. The blocks were placed behind the line other than the starting line. The subject stood behind the standing line. At the sound of the whistle the subject ran towards the block and at the same time stop watch was started. The subject picked one of the blocks and returned to the starting line (with maximum speed) and placed the block behind the line. The subject followed the same method and picked the second block and returned to the starting line there by covering a distance of 4x10 meters. Two trails were given. The better of two trails were recorded to the nearest one tenth of a second.

Modified Sit - Up

To measure the muscular strength and endurance (abdominal and low back hamstring) of the subject the modified sit up test was used. The subject lies on the back with knees flexed and feet on the floor, heels 12 to 18 inches from the buttocks. Arms are crossed on the chest, with hands on opposite shoulders. The student, by tightening her abdominal muscles, curls to the sitting position, touching elbows to thighs. Arms must remain on the chest, as shoulder the chin. To complete the sit-up, the student returns to the down

position, until the mid-back touches the testing surface. Record the number of correctly executed sit-ups completed in 60 seconds.

3.7.2 PHYSIOLOGICAL VARIABLES TEST

Resting Pulse Rate

The resting pulse rate of the subjects was measured by Bio monitor. The resting pulse rate of the subjects was monitored by using the method of finger plythernography with the help of an auto-electronic transducer on finger. Resting pulse rate of each subject was recorded in the morning time between 6.00 A.M to 6.30 A.M. Before taking the pulse rate, the subjects were asked to sit comfortably on chair for fifteen minutes. The investigator fixed the sensor unit to the finger of the subject. Then the bio monitor was switched on by pressing the on switch. The pulse rate per minute was shown by the digital meter. After a minute, the digital meter showed the subject's pulse rate, scores were recorded in beats per minute.

Queens College 3 Minute Step Test

This test is a best method to measure the Maximum oxygen consumption, For this purpose, the 6.25 inches height step bench, stopwatch, and score sheets were used. The athlete steps up and down on the platform at a rate of 24 steps per minute for males. The subjects have to step using a four-step cadence, 'up-up-down-down' for 3 minutes. The athlete stops immediately on completion of the test, and the heart beats are counted for 15 seconds from 5-20 seconds of recovery. Multiplying this 15 second reading by 4 will give the beats per minute (bpm) value to be used in the calculation below. An estimation of Vo_2Max can be calculated from the test results, using this formula (McArdle, 1972). A rating can be determined using the Vo_2 max Norms. *Men:* Vo_2 max (ml/kg/min) = 111.33 - 0.42 x heart rate (bpm)

Margaria Kalaman Test

The Margaria kalaman test was used to assess anaerobic power (lower extremity) of the subjects. Stopwatch, timing mats (optional), tape was used to measure, flight of 12 steps with a starting line of 6 meters in front of the first step. Each step is approximately 17.5 cm high with the 3^{rd}, 6^{th} and 9^{th} step clearly marked. The vertical distance between the 3^{rd} and 9^{th} step must be accurately measured for using in the results formula. The athlete's weight is determined in kilograms. The athlete is given a few practice runs up and the steps to warm up. The athlete stands ready at the starting line 6 meters in front of the first step. On the command "Go", the athlete sprints to and up the flight of steps, taking three steps at a time (stepping on the 3rd, 6th and 9th steps),attempting to go up the steps as fast as possible. The time to get from the 3rd step to the 9th step is recorded (either using a stopwatch or using switch mats placed on the 3rd and 9th steps). It was started when the foot was in first in contact with the 3rd step, and stopped when the foot contacts the 9th step. Allow three trials of the test, with 2-3 minutes recovery between each trial. Power (Watts) is calculated from the formula below, P = (M X D) X 9.8 **/ t** P = Power (Watts), M = Body mass (kg), D = Vertical distance, between steps 3 & 9 (meters), t = Time (seconds). 9.8 is the constant of gravity.

Control Pause Test – Breath Holding Time

To measure the breath holding time of the subjects the control pause test was used. The subject was asked to sit down and rest for 5-7 minutes to Completely relax all your muscles, including the breathing muscles. This relaxation produces natural spontaneous exhalation (breathing out). Pinch your nose closed at the end of this exhalation and count your BHT (breath holding time) in seconds. Keep nose pinched until you experience the first desire to breath. The scores were recorded in seconds.

3.7.3 PSYCHOLOGICAL VARIABLES TEST

Stress

Perceived Stress Scale (PSS) developed by **Cohen *et al* in 1983** was used to assess the stress level of the subjects. This stress scale consists of 10 questions about the feelings, thoughts and activities of the subjects during the last month including the day which the subjects fill up the questionnaire. Subjects report the prevalence of an item within the last month on a 5 – point scale, ranging from never to very often (0 = Never 1 = Almost Never 2 = Sometimes 3 = Fairly Often 4 = Very Often). The subjects were asked to circle one from these five responses to each question. In this stress scale, items 4, 5, 7 and 8 are positively stated. The scores of this positively stated item are obtained by reversing the scores eg; 0 = 4, 1 = 3, 2 = 2, 3 = 1 and 4 =0. Perceived Stress Scale (PSS) scores are obtained by summing all 10 items. The high score indicates that there is more stress in the subject's life.

Anxiety

The beck anxiety inventory was used to assess the anxiety of the subjects. The beck anxiety inventory consists of 21 common symptoms of anxiety. The subjects were asked to circle the number in the corresponding space in the column next to each symptom that bothered him during the past month including the day which the subject fill up the questionnaire. This inventory consists of 4 point scale such as not at all, mildly, moderately and severely. The points for the above responses are 0, 1, 2 and 3 respectively. The scoring procedure was as follows; Sum each column. Then sum the column totals to achieve a grand score. A grand sum between 0 – 21 indicates very low anxiety and 22 – 35 indicates moderate anxiety. A grand sum that exceeds 36 is a potential cause for concern.

Aggression

To examine the aggression of the subjects, the aggression questionnaire developed by **Buss & Perry in 1992** was used. The procedure of using the questionnaire as follows; This aggression questionnaire consists of 29 statements with five levels of responses, extremely uncharacteristic to extremely characteristic. The subjects were asked to place their response in the box to the right of the statement. For extremely uncharacteristic,1 point is awarded or on the other hand 5 points are awarded for placing extremely characteristic.

1 = extremely uncharacteristic of me

2 = somewhat uncharacteristic of me

3 = neither uncharacteristic nor characteristic of me

4 = somewhat characteristic of me

5 = extremely characteristic of me.

In this questionnaire 9^{th} and 16^{th} questions are reverse scored. e.g; 1 = 5, 2 = 4, 3 = 3, 4 = 2 and 5 = 1.

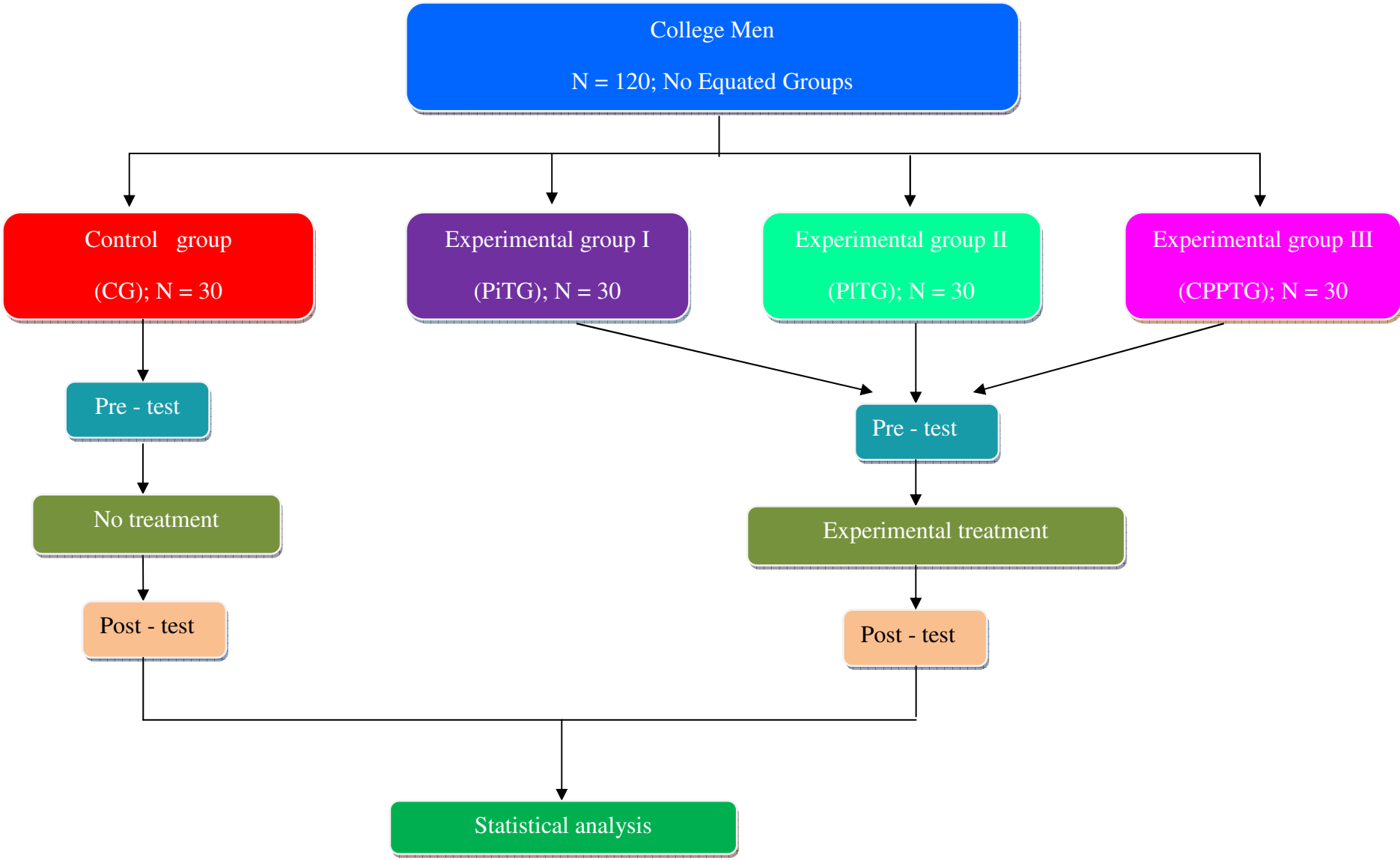
The aggression scale consists of 4 factors, physical aggression (9 questions), verbal aggression (5 questions), anger (7 questions) and hostility (8 questions). The total score for aggression is the sum of the factor scores.

Mood State

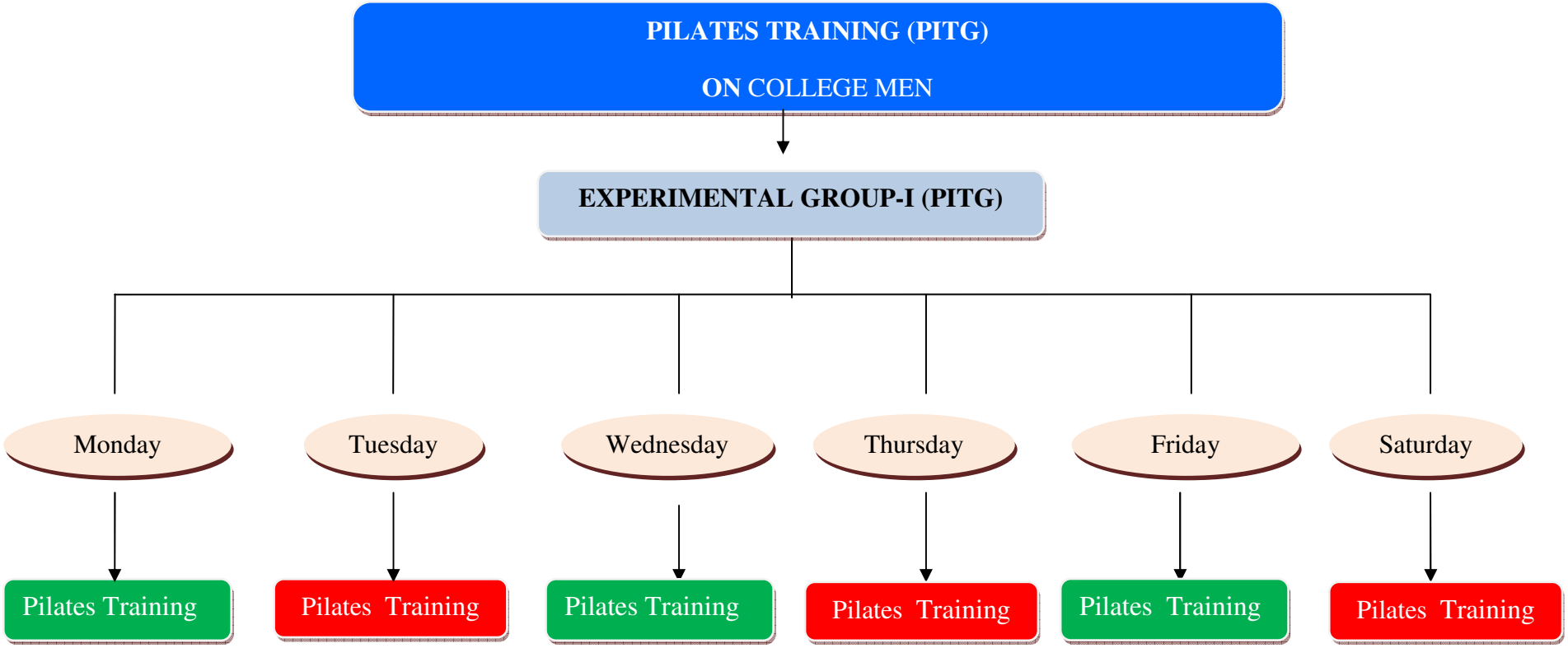
The Brunel Mood Scale (BRUMS) developed by **Terry *et al* (1992)** was used. This Brunel Mood Scale (BRUMS) consists of 24 words that describe feelings. These 24 sitems comprise of six subscales such as anger (items 7, 11, 19, 22), confusion (items 3, 9, 17, 24), Depression (items 5, 6, 12, 16), Fatigue (items 4, 8, 10, 21), Tension (items 1,

13, 14, 18), Vigour (items 2, 15, 20, 23). Each subscale contains four items. When responses from the four items in each subscale are summed, a subscale score in the range of 0 – 16 is obtained. Respondents indicate whether they have experienced such feelings on a 5 – point scale (0 = not at all, 1 = a little, 2 = moderately, 3 = quite a bit, 4 = extremely). The total score for Mood is the sum of the subscale scores. Lower the scores the highest would be the level of mood and vice versa.

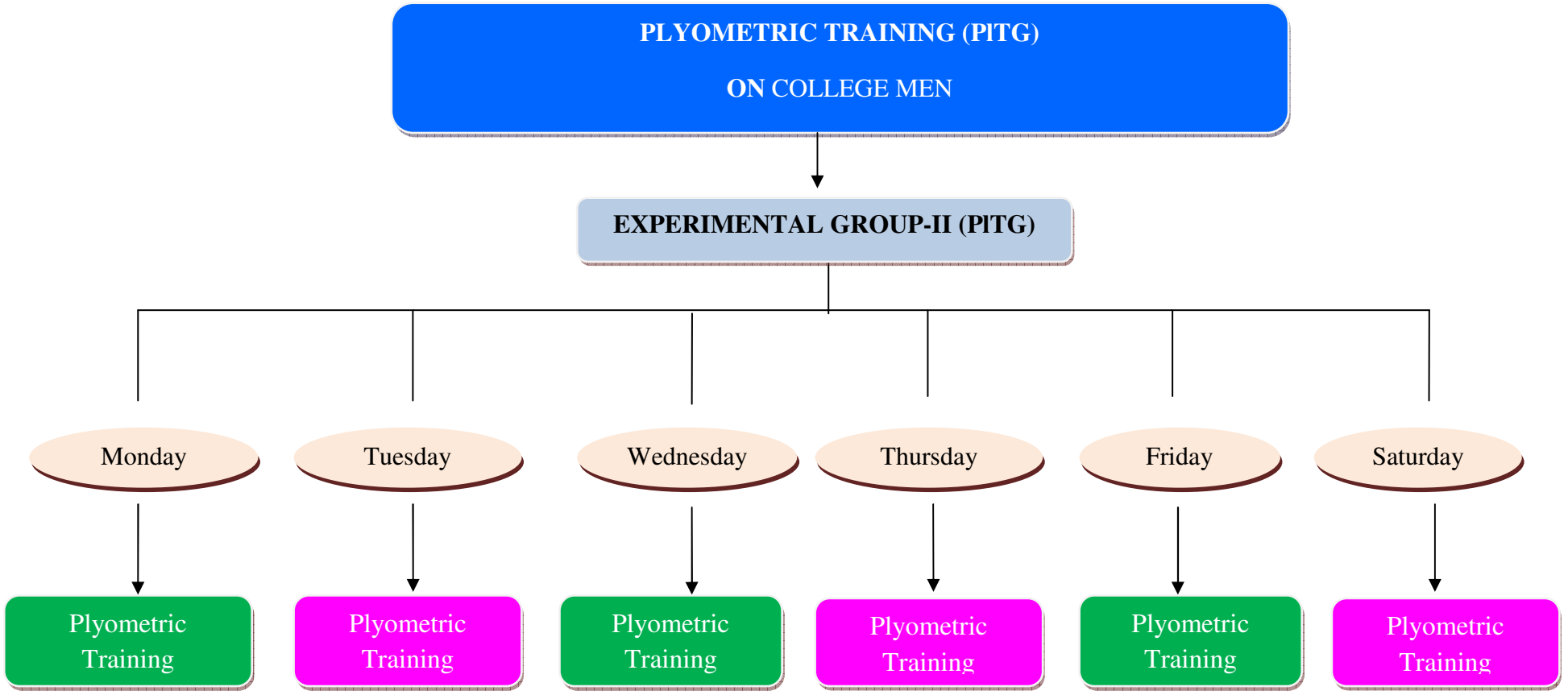
FLOW CHART SHOWING THE METHODOLOGY ADOPTED IN THIS STUDY



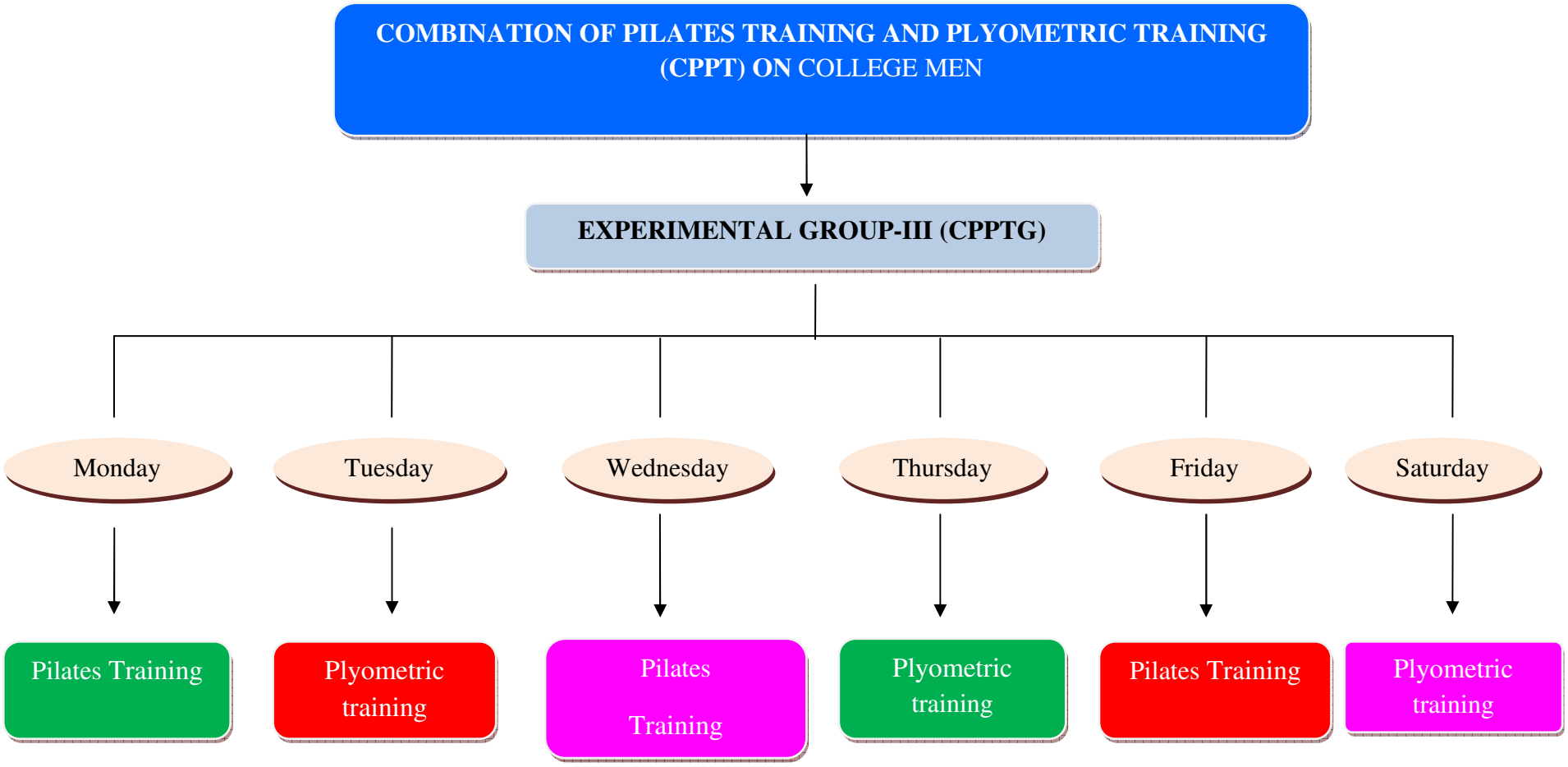
3.2 FLOW CHART SHOWING THE EXPERIMENTAL TREATMENT ADOPTED FOR EXPERIMENTAL GROUP-I



3.3 FLOW CHART SHOWING THE EXPERIMENTAL TREATMENT ADOPTED FOR EXPERIMENTAL GROUP-II



3.4 FLOW CHART SHOWING THE EXPERIMENTAL TREATMENT ADOPTED FOR EXPERIMENTAL GROUP-III



3.8 TRAINING PROGRAMME

One hundred and twenty college men were randomly selected from Dharamanagar Govt. Degree College, North District, Tripura and their age ranged between 18 and 21 years. The selected subjects were divided into four equal groups, each consisting of thirty. The group I was treated with Pilates training (PILTG), group II was trained with plyometric training (PLYTG); group III underwent combination of pilates training and plyometric training (CPPTG) and the group IV was as control group (CG) which was not exposed to any treatment. All the experimental groups were treated with their respective training programs. The training period was 6days per week and for the period of 12 weeks. After the training period, the post test was conducted.

Experimental Group I : underwent Pilates training (PilTG)

Experimental Group II : treated with plyometric training (PlyTG)

Experimental Group III : underwent combination of Pilates training and plyometric training (CPPTG)

In each training session, the training was imparted for a period between 45 and 50 minutes, which included 65 minutes warming up and 5 minutes relaxation procedure after the training programme for six days per week for a period of 12 weeks. The training sessions were held between 6.30 am to 7.30 am, Monday through Saturday. The length of the training intervention for this study was based on the fact that twelve weeks had been shown to be sufficient to provide significant changes in diabetic patients. **Rice *et al., (1999***)

The experimental groups underwent their respective training programmes under the supervision of the investigator. The subjects were carefully monitored and questioned about

their health status throughout the training period. None of them have reported any complication. The control group was not given any treatment apart from their routine. Further, all the participants were instructed neither to change their life style nor to change their dietary intake for the entire duration of the training.

The training schedule for the experimental groups was designed as per the results of the pilot study and also based on the guidelines given by **Baechle (1994)**.

3.9 PILATES TRAINING SCHEDULE

Week 1 to 3	Week 4 to 6	Week 7 to 9	Week 10 to 12
Roll up (5–10 reps)	Swan dive (5 reps)	Roll over (8 reps total)	Shoulder bridge (3 each leg)
Hundred (sets of 10, 20,, 100)	Heel squeeze (6–8 reps)	Scissors (10 reps)	Open leg rocker (10 reps)
One leg circle (10 reps with each leg)	Neck pull prep (5 reps)	One leg kick (alternate 8 reps)	Jackknife (5 reps)
Rolling like a ball (10 reps)	Oblique roll back (5 to each side)	Double leg kick (5 to each side)	Scissors in air (10 reps)
Single leg stretch (5 sets)	Spine twist (5 to each side)	Shoulder bridge prep (3 each leg)	Bicycle in air (10 reps)
Single leg stretch with oblique (5 sets)	Sidekicks (8–10 reps)	Teaser variation (5 reps)	Teaser variation

Double leg stretch (10 reps) Spine stretch forward (5–7 reps) Saw (5 to each side) Breast stroke(5 reps)	Side leg lift series (8–10 reps for each) Teaser preps (5 reps) Seal (10 reps) Slow double leg stretch (10 reps)	Swimming prep (5 reps) Leg pull front prep (5 reps) Side bend prep (5 each side) Push up (3 sets of 3–4 reps)	Swimming (40 counts) Leg pull front (5 reps) Side bends (5 each side) Boomerang (5 reps)

Segal (2004)

3.10 PLYOMETRIC TRAINING SECHUDLE

Training week	Volume(Foot contacts)	Drills	Sets × Reps	Intensity& Rest
I & II	90	Side to side ankle hops Standing jump and reach Front cone hops	2×15 2×15 5×6	Low & Two minutes between the sets
III & IV	120	Side to side ankle hops Diagonal cone hops Hexagonal drill Squat jump	2×15 5×6 2×15 5×6	Low & Two minutes between the sets
V & VI	120	Diagonal cone hops Squat jump Split squat Standing long jump Cycled split & squat jump	2×12 4×6 2×12 3×8	Low & Two minutes between the sets

VII & VIII	140	Diagonal cone hops Medicine ball sit ups Plyometric sit ups Hexagonal drill Front cone hops	4×8 4×8 2×12 4×7 4×6	Low & Two minutes between the sets
IX & X	140	Diagonal cone hops Standing long jump Two foot ankle hops Lateral bound Squat jump Star jump	2×7 4×7 4×7 2×7 4×7 4×7	Low & Two minutes between the sets
XI & XII	120	Diagonal cone hops Hexagonal drill Front cone hops Lateral bound Star jump	2×12 2×12 4×6 3×8 4×6	Low & Two minutes between the sets

3.11 COLLECTION OF DATA

The data on physical, physiological and psychological variables collected by various tests are explained above. The pre-test and post-test data were collected before and after the training program for a period of 12 weeks. All the data were collected in the same day.

3.12 EXPERIMENTAL DESIGN AND STATISTICAL TECHNIQUE

The collected data were in number. Though it is valid and reliable, would not give us useful meaning in terms of what we need. The data has to be processed with the help of statistics, analysed scientifically, interpreted and intelligently concluded. In this study, the data have been collected on variables such as motor fitness variables of speed, flexibility, agility and muscular strength endurance, physiological variables of resting

pulse rate,Vo_2 max, anaerobic power, breath holding time, psychological variables of stress, anxiety, aggression and mood state.

Experimental design is a blue print of the procedure that enables the researcher to test his hypothesis by reaching valid conclusions in testing the relationship between independent variables and dependent variables. The investigator used pre and post test random group design in this study. This procedure involves dividing a sample into two or more groups based on random selection. The investigator did not make any attempt to equate the groups in this study. The selected 120 subjects were divided into four equal groups consisting of 30 each such as experimental group I (n=30), experimental group II (n=30), experimental group III (n=30) and a control group (n=30). The treatment was administered to all the experimental groups for a period of 12 weeks. At the end of twelve week, the post test was administered to all the groups.

Descriptive statistics such as mean and standard deviation were found in order to get basic idea of the data distribution. T- test was done for finding whether there was any statistically significant pre-test to post-test mean differences in their respective variables of each group is pre-test and post-test. ANCOVA test was done to find out the significance of 'adjusted post-test mean' by the differences between the experimental and control groups for each variables. Whenever the 'F' ratios were found to be significant, Scheffe's post hoc test was applied to test the significant difference between the paired adjusted means. In all these statistical tests, level of significance was chosen at 0.05 level of confidence. It was considered as sufficient for the present study. All statistical analysis was carried out with the help of statistical package of SPSS for Windows.