CHAPTER IV
METHODOLOGY

This research study was conducted to investigate the differences in emotional intelligence, executive functions and explanatory style in experimental group (EG) - the group exercising Mallakhamb, which learnt and practiced competitive skills on Mallakhamb, an Indian sport, for one year, compared to those who do not practice any competitive sport- Control Group (CG) - group not exercising Mallakhamb. All the participants were pre - tested on the above 3 variables - emotional intelligence, executive functions and explanatory style. The intervention of Mallakhamb training was introduced for a year for the EG, followed by Post-testing of all the participants on the 3 variables.

4.1 Aim
To study the effect of participation in Indian Physical Sport Mallakhamb on Emotional Intelligence, Executive Functions and Explanatory Style

4.2. Objectives

4.2.1 Emotional Intelligence: The objectives for Emotional Intelligence are as follows,
To compare the pre intervention and post intervention scores of Emotional Intelligence of group exercising Mallakhamb and group not exercising Mallakhamb by considering the Pre-Emotional Intelligence as a covariate.

The objectives for each of the sub scales of Emotional Intelligence are,

4.2.1 a. Intrapersonal Scale: To compare the pre intervention and post intervention scores of Intrapersonal component of group exercising Mallakhamb and group not exercising Mallakhamb by considering the Pre- Intrapersonal component as a covariate.

4.2.1 b. Interpersonal Scale: To compare the pre intervention and post intervention scores of Interpersonal component of group exercising Mallakhamb and group not exercising Mallakhamb by considering the Pre- Interpersonal component as a covariate.

4.2.1 c. Stress Management Scale: To compare the pre intervention and post intervention scores of Stress Management of group exercising Mallakhamb and group not exercising Mallakhamb by considering the Pre- Stress Management as a covariate.

4.2.1 d. Adaptability Scale: To compare the pre intervention and post intervention scores of Adaptability of group exercising Mallakhamb and group not exercising Mallakhamb by considering the Pre- Adaptability as a covariate.
4.2.1 e. **General Mood Scale:** To compare the pre intervention and post intervention scores of General Mood of group exercising Mallakhamb and group not exercising Mallakhamb by considering the Pre- General Mood as a covariate.

4.2.1 f. **Emotional Quotient Scale:** To compare the pre intervention and post intervention scores of Emotional Quotient of group exercising Mallakhamb and group not exercising Mallakhamb by considering the Emotional Quotient as a covariate.

4.2.1 g. **Positive Impression Scale:** To compare the pre intervention and post intervention scores of Positive Impression of group exercising Mallakhamb and group not exercising Mallakhamb by considering the Pre- Positive Impression as a covariate.

4.2.2 **Executive Functions:** The objectives for Executive Functions are as follows,

To compare the pre intervention and post intervention scores of various aspects of Executive Functions of group exercising Mallakhamb and group not exercising Mallakhamb by considering the Pre- Executive Functions as a covariate.

The objectives for each of the sub scales of Executive Functions are,

4.2.2 a. **Focused Attention:** To compare the pre intervention and post intervention scores of Focused Attention of group exercising Mallakhamb and group not exercising Mallakhamb by considering the Pre- Focused Attention as a covariate.

4.2.2 b. **Sustained Attention:** To compare the pre intervention and post intervention scores of Sustained Attention of group exercising Mallakhamb and group not exercising Mallakhamb by considering the Pre- Sustained Attention as a covariate.

4.2.2 c. **Response Inhibition:** To compare the pre intervention and post intervention scores of Response Inhibition of group exercising Mallakhamb and group not exercising Mallakhamb by considering the Pre- Response Inhibition as a covariate.

4.2.2 d. **Goal setting and Planning:** To compare the pre intervention and post intervention scores of Goal setting and Planning of group exercising Mallakhamb and group not exercising Mallakhamb by considering the pre - Goal setting and Pre - Planning as a covariate.

4.2.2 e. **Speed:** To compare the pre intervention and post intervention scores of Speed of group exercising Mallakhamb and group not exercising Mallakhamb by considering the Pre - Speed as a covariate.

4.2.3 **Explanatory Style:** The objectives for Explanatory Style are as follows,

To compare the pre intervention and post intervention scores of Explanatory Style of group exercising Mallakhamb and group not exercising Mallakhamb by considering Pre-Explanatory Style as a covariate.
EI, Executive Function and Explanatory Style in Mallakhamb

The objectives for each of the sub scales of Explanatory Style are,

4.2.3 a. **Optimism:** To compare the pre intervention and post intervention scores of Optimism of group exercising Mallakhamb and group not exercising Mallakhamb by considering Pre- Optimism as a covariate.

4.2.3 b. **Hope:** To compare the pre intervention and post intervention scores of Hope of group exercising Mallakhamb and group not exercising Mallakhamb by considering Pre- Hope as a covariate.

### 4.3 Hypotheses

#### 4.3.1 Emotional Intelligence

The broad hypothesis for Emotional Intelligence is,

‘Emotional intelligence of the group exercising Mallakhamb is significantly higher than the emotional intelligence of the group not exercising Mallakhamb’.

Stephens, Craig and Ferris (1986) analyzed data from 56,000 participants and concluded that the level of physical activity is positively associated with good mental health in household population of the US and Canada, when mental health is defined as positive mood, general well being, and relatively infrequent symptoms of anxiety and depression. It was found that exercise and physical activity can be related to a participant’s self – concept, self – esteem and self – efficacy. One research study by Hansen, Stevens and Coast (2001) showed increase in positive mood states with as little as 10 minutes of moderate exercise, highlighting the notion that short bouts of exercise can produce positive psychological benefits.

Mallakhamb is a competitive sport activity which requires control over the limbs, neuromuscular coordination and acute sense of balance. It requires the performer to perform movements in the face of fear. Since precision of movements is a necessity, maintaining calm, regulating one’s emotions is required. An anxious, tensed and stressed person will find it difficult to learn and perform Mallakhamb.

It is thus felt that learning Mallakhamb will result in better regulation of emotions and thus Mallakhamb players will be high in emotional intelligence as compared to the control group who neither do Mallakhamb nor are part of any competitive sport activity.

Based on the review of work in this field, the hypotheses for the subscales of Emotional Intelligence are,

4.3.1 a. The adjusted mean score of **Intrapersonal** component of group exercising Mallakhamb is significantly higher than group not exercising Mallakhamb by considering the Pre-Intrapersonal component as a covariate.
4.3.1 b. The adjusted mean score of **Interpersonal** component of group exercising Mallakhamb is significantly higher than group not exercising Mallakhamb by considering the Pre-Interpersonal component as a covariate.

4.3.1 c. The adjusted mean score of **Stress Management** of group exercising Mallakhamb is significantly higher than group not exercising Mallakhamb by considering the Pre-Stress Management as a covariate.

4.3.1 d. The adjusted mean score of **Adaptability** of group exercising Mallakhamb is significantly higher than group not exercising Mallakhamb by considering the Pre-Adaptability as a covariate.

4.3.1 e. The adjusted mean score of **General Mood** of group exercising Mallakhamb is significantly higher than group not exercising Mallakhamb by considering the Pre-General Mood as a covariate.

4.3.1 f. The adjusted mean score of **Emotional Quotient** of group exercising Mallakhamb is significantly higher than group not exercising Mallakhamb by considering the Pre-General Mood as a covariate.

4.3.1 g. The adjusted mean score of **Positive Impression** of group exercising Mallakhamb is significantly higher than group not exercising Mallakhamb by considering the Pre-Positive Impression as a covariate.

4.3.2 **Executive Function**

The broad hypothesis for Executive Functions is,

‘The executive function of the group exercising Mallakhamb is significantly higher than the executive functions of the group not exercising Mallakhamb’

Stanley and Arthur (2003) conducted a meta-analytic study to examine the hypothesis that aerobic fitness training enhances the cognitive vitality of healthy but sedentary older adults. Eighteen intervention studies published between 1966 and 2001 were entered into the analysis. Several theoretically and practically important results were obtained. Most important, fitness training was found to have robust but selective benefits for cognition, with the largest fitness-induced benefits occurring for executive-control processes. The magnitude of fitness effects on cognition was also moderated by a number of programmatic and methodological factors, including the length of the fitness-training intervention, the type of the intervention, the duration of training sessions, and the gender of the study participants. Kramer et al. (1999) studied the relationship between ageing, fitness and neurocognitive function. Attempt was made to see whether greater aerobic fitness in adults would result in selective improvements in executive control processes, such as planning, scheduling,
inhibition and working memory. It was found that those who received aerobic training showed substantial improvements in performance on tasks requiring executive control compared with anaerobically trained participants. A number of studies in the past few years have provided evidence that physical exercise can ameliorate the effects of aging on the brain, in terms of either preventing or postponing dementia, and reducing the more normal age-related decline in cognitive function. The reasons for the effect are almost certainly multiple. Unfortunately, there have been far fewer studies involving young people. However, one study (Kubota et al. 2001), reported at the 2001 Society for Neuroscience conference, found that, following a 12 week regimen of jogging for 30 minutes two to three times a week, young adults significantly improved their performance on a number of cognitive tests. The scores fell again if participants stopped their running routine. Preliminary results from a series of studies undertaken with elementary school children do indicate a strong relationship between academic achievement and fitness scores. One study found that physically fit children identified visual stimuli faster. Brain activation patterns provided evidence that the fit children allocated more cognitive resources towards the task, as well as processing information faster.

Mallakhamb essentially exercises the entire body. Its practice requires good concentration, judgment and proper focus. Both physical and psychological skills are tuned in during the practice of Mallakhamb. It is thus felt that learning Mallakhamb will result in better developed cognitive skills as compared to the control group who neither do Mallakhamb nor are part of any competitive sport activity.

Based on the review of work in this field, the hypotheses for various scales of Executive Functions are,

4.3.2 a. The adjusted mean score of **Focused Attention** of group exercising Mallakhamb is significantly higher than group not exercising Mallakhamb by considering the Pre- Focused Attention as a covariate.

4.3.2 b. The adjusted mean score of **Sustained Attention** of group exercising Mallakhamb is significantly higher than group not exercising Mallakhamb by considering the Pre- Sustained Attention as a covariate.

4.3.2 c. The adjusted mean score of **Response Inhibition** of group exercising Mallakhamb is significantly higher than group not exercising Mallakhamb by considering the Pre- Response Inhibition as a covariate.
4.3.2 d. The adjusted mean score of **Goal Setting and Planning** of group exercising Mallakhamb is significantly higher than group not exercising Mallakhamb by considering the pre - Goal setting and Pre- Planning as a covariate.

4.3.2 e. The adjusted mean score of **Speed** of group exercising Mallakhamb is significantly higher than group not exercising Mallakhamb by considering the Pre- Speed as a covariate.

4.3.3 **Explanatory Style**

The broad null hypothesis for Explanatory Style is,

‘There is no significant difference in Explanatory Style of the group exercising Mallakhamb and group not exercising Mallakhamb’.

Relatively few studies have investigated the link between explanatory style and athletic performance. In a cross-sectional survey with 50 young elite tennis players, Prapavessis and Carron (1988) found that players presenting cognitive, motivational and emotional maladaptive achievement patterns gave ratings that were internal, persistent and recurrent for explaining failure performances and were judged by their coaches to be less persistent in their matches. Two other studies using Content Analysis of Verbatim Explanation (Peterson & Park, 1998) were reported by Rettew and Reivich (1995). Baseball and basketball teams with a more optimistic explanatory style won more games in the target season and performed significantly better in games following a loss than teams with a pessimistic explanatory style. Studies using explanatory styles have focused more on how explanatory style influences competitive performance of the sportsman. In this study, an attempt is made to identify whether explanatory style changes due to participation in sport.

Performance on Mallakhamb involves lot of acrobatic movements with varieties of turns and twists, moving against the gravity and good control over ones movements. It is thus felt that the explanatory style is likely to move from pessimistic to optimistic, owing to small but regular success experiences in the context of regular practice. Since not much research is found in the area of Explanatory Style for sports, the null hypotheses for various measures of Explanatory Style are,

4.3.3 a. There is no significant difference in adjusted mean scores of **Optimism** aspect of Explanatory Style of group exercising Mallakhamb and group not exercising Mallakhamb by considering Pre- Optimism aspect of Explanatory Style as a covariate.

4.3.3 b. There is no significant difference in adjusted mean scores of **Hope** aspect of Explanatory Style of group exercising Mallakhamb is significantly higher than
EI, Executive Function and Explanatory Style in Mallakhamb

Once confined to enthusiasts in particular disciplines, interests in sports and games, including tournaments and meets, held in distant lands, has spread far and wide among general public. Yet, most viewers are passive audience due to the lack of knowledge of rules and regulations about the sports (Ghosh, 1997). Also, there is dearth of good research studies on Indian sports. Exercise is accessible to nearly everyone, low cost and low tech, thereby allowing for potentially widespread participation. It has multifaceted benefits ranging from physical benefits to emotional and psychological health, in all the age groups and in both males and females. Thus, staying physically healthy can maintain and even enhance cognition and brain function, as well as, reduce the risk of age associated neurological disorders, such as Alzheimer disease (Kramer et al., 2006). One striking feature of Indian forms of Physical Culture is that it not only gives good exercise to the entire body, it requires very meager apparatus and space, when compared to those in western form of exercises and thus, turns out to be very cost effective. The system of developing the body and mind and the capacity of sustaining power also have been prominent features of different forms of Indian Physical Culture.

This research is a sincere effort to understand the value of Indian Physical Culture, so that we learn to appreciate its glorious past, and study its real contribution in the development of Emotional Intelligence, Executive Function and Explanatory Style.

4.4 Method

4.4.1 Sample:

The total sample used in the study was 106 participants. Of this, 48 participants participated in pilot study, in which 24 participants were in the experimental group and 24 were in the control group. In all, 58 participants participated in the final study, of which, 29 participants practiced Mallakhamb for one year and 29 participants were not involved in any competitive sport activity. The participants in the experimental group came to Shree Samarth Vyayam Mandir, Dadar for the training in Mallakhamb, 5 days a week for one hour. The age range of the participants was 10 to 13 years and they were taking age appropriate formal education. They all lived in or around Dadar area and mostly came walking to the Institution. In all, 53 students went to English medium schools and 6 went to Marathi medium school. Although the medium of language was English in English medium schools, the preferred language of communication was Marathi with friends and with teachers too, outside the classroom. The mother tongue of all the participants except one (Kannada),
was Marathi. Most of the participants belonged to middle income group. In experimental group, there were six 10 year olds, nine 11 year olds, eleven 12 year olds and three 13 year old girls. The participants of the experimental group had voluntarily come to the Sports Institution and were requested to participate in the study, with minimum commitment of one year. Fig 4.1 is a Pie chart showing the age group of the participants in the Experimental Group.

![Fig 4.1 Experimental Group: Pie Chart showing the age group of the participants](image)

In the control group 3 were 10 year olds, four 11 year olds, fourteen 12 year olds and eight 13 year old girls. The control group participants were friends from school or acquaintances from the building or the society were the participants resided. None of them were actively involved in any competitive sport activity. Fig 4.2 is the Pie chart showing the age group of the participants in the control group.

![Fig 4.2 Control Group: Pie Chart showing the age group of the participants](image)
4.5 Tests

The tests of Emotional Intelligence (EI), Executive Function (EF) and Explanatory Style (ES) were used to assess the participants.

4.5.1. Emotional Intelligence:


It is a sixty item test with no time limit, although around 20-25 minutes are required to complete the test. With the score on total EQ, scores on Intrapersonal Scale, Interpersonal Scale, Adaptability, Stress management, General mood, positive impression scale and inconsistency index are obtained.

The Internal Consistency for females in the relevant age group ranged between $r_{tt} = 0.74$ to $0.90$ covering all the subtests of this scale. The Test-Retest Reliability ranged between $r_{tt} = 0.77$ to $0.89$ and the Construct Validity ranged between $r_{tt} = 0.56$ to $r_{tt} = 0.88$ in Bar-On (1997) EQi scale (the Youth version)

4.5.2. Executive Function:

4.5.2. (a). The Color Trails Test (D’Elia, Satz, Uchiyama & White, 1996):

This is a test of **Focused Attention**. The Color Trails 1 consists of a practice sheet and a test sheet. In the practice sheet, numbers 1-8 are randomly spread in a square box. The numbers are printed in black on a pink (for odd numbers) or yellow (for even numbers) circle. Beneath the box is a row of number 1-8 arranged in a serial order. Arrows connect these numbers in an ascending order, which exemplifies the principle that the numbers inside the box should be pointed to in an ascending serial order. In the main part of Color Trails 1, numbers 1-25 are randomly spread, odd numbers in pink circles and even numbers in yellow ones. The participant is asked to point to successive numbers in ascending order from 1-25.

In Color Trails 2, there is a practice sheet and a test sheet. In practice sheet, all numbers from 2-8 are presented twice, once on the pink circle and once on the yellow circle. The number 1 is presented only once, in a pink circle. These numbers are randomly arranged in a box. Beneath the box are two rows of numbers in serial order. The first row consists of numbers printed on pink circles and the second row of numbers printed on yellow circles. Arrows point to alternate pink and yellow circles progressing in an ascending order, which exemplifies the principle that the numbers inside the box should be pointed to in an ascending serial order, with the colors alternating between successive numbers. In the main test of Color Trails 2, numbers from 2 through 25 are printed twice, once on pink circles and once on yellow circles. These are randomly arranged on the test sheet. The participant is asked to point to numbers in alternating colors with the successive numbers being in an ascending
order. The main parts of the test for Color Trails 1 and 2 are given only after the participant understood the principle involved and has performed the practice sheet satisfactorily and the performance was noted.

For Color Trails Test Test-Retest Reliability ranges from $r_t = 0.64$ to $r_t = 0.79$ and convergent validity (in comparison to the TMT) range from $r_g = 0.41$ to $r_g = 0.49$ in healthy individuals.

**Score**: The time taken to complete the main parts of Color Trails 1 and 2 are noted down.

**Duration**: The test takes about 10 minutes.

**4.5.2. (b). The Digit Vigilance Test (Lezak, 1995):**

This is a test of **Sustained Attention**. It consists of numbers 1 to 9 randomly ordered and placed in rows on a page. There are 30 digits per row and 50 rows on the sheet. The digits are closely packed on the sheet. The same level of mental effort or attention deployment is required over a period of time. The Participant has to focus on the target digits i.e. 6 and 9 amongst other distracter digits. Inability to sustain and focus attention leads to both increased time to complete the test as well as errors.

**Score**: There are 2 scores,
1. The time taken to complete the test.
2. Error Score – Sum total of the number of omissions, i.e. the number 6 and 9 which have not been cancelled and the number of commissions, i.e. the number of digits other than the target digits which have been cancelled.

**Duration**: The test takes about 15 minutes.

**4.5.2. (c). Stroop Task: NIMHANS Version:**

This is a test of Response Inhibition. The color names ‘Blue’, ‘Green’, ‘Red’ and ‘Yellow’ are printed in capital letters on a paper. The color of the print occasionally corresponds with the color designated by the word. The words are presented in 16 rows and 11 columns.

**Score**: The reading time and the color naming time were converted into seconds. The reading time was subtracted from the naming time to get the stroop effect score. Uncorrected errors were noted down separately for both the phases.

Stroop effect score = time taken to name colors - time taken to read words.

**Duration**: The test takes about 20 minutes.

**4.5.2. (d). Tower of London Test (Shallice, 1982).**

This is a test of Planning. The test evaluates the participant’s ability to plan and anticipate the results of their actions to achieve a predetermined goal. The test consists of 2
identical wooden boards. Each board measures 38 cms long and 13 cms wide. Each board is fitted with 3 round pegs of different sizes. The first peg is 18 cms in height, the second peg is 11 cms in height and the third is 7 cms in height. There are three wooden balls, painted red, green and blue respectively. Each ball has a bore in the middle. The tallest peg can hold 3 balls. The second tallest peg can hold 2 balls, while the shortest peg can hold 1 ball.

**Score**:
In each problem, the time taken from start to finish is noted. This is defined as the time from when the goal state board is placed in front of the participant till the time when the participant finishes the problem. The next score is the number of moves used per problem. This is the number of times that the participant lifted the ball in his hand. Thus the scores for each category of problems i.e. 2 moves, 3 moves, 4 moves, and 5 moves problems are,

1. Mean time to solve the problem: average time taken to solve the problems for 2 moves, 3 moves, 4 moves, and 5 moves problems are calculated separately.
2. Mean number of moves: The mean number of moves taken to solve 2 moves, 3 moves, 4 moves, and 5 moves problems are calculated separately.
3. Number of problems solved with the minimum number of moves for each of the 2 moves, 3 moves, 4 moves, and 5 moves problems are noted down separately. For e.g. in the 3 moves problem set, there are 3 problems. The number of problems solved with 3 moves is the score under the number of problems solved with the minimum number of moves.
4. There is also an overall score of the total number of problems solved with the minimum number of moves. This is obtained by totaling the number of problems solved with minimum number of moves in each category of problem.

**Duration**: Approximately 30 minutes.


This is a test of visuomotor coordination, motor persistence, sustained attention and response speed. Rapid information processing is required in order to substitute the symbols accurately and quickly. The test consists of a sheet in which numbers 1 to 9 are randomly arranged in four rows of 25 squares each. The participant substitutes each number with a symbol using the number-symbol key given on the top of the page. The first 10 squares are for practice.

**Score**:
1. The time taken to complete the test forms the score.
2. Errors made are noted.

**Duration**: The test takes about 7 minutes.
4.5.3. Explanatory Style:
4.5.3. (a). The Children’s Attributional Style Questionnaire (CASQ) (Seligman, 1990).

The Children’s Attributional Style Questionnaire consists of 48 items, each item having 2 choices A and B. The scores are obtained on Permanent Bad, Permanent Good, Pervasive Bad, Pervasive Good, Personalization Bad score, Personalization Good score, Hope score and Optimism score. The Hope and Optimism score were used for analysis. The Test-Retest Reliability ranged between for various aspects ranged from \( r_{tt} = 0.66 \) to \( r_{tt} = 0.73 \) on this scale.

4.6 Design

Non Randomized control group pre test - post test design.
Training in Mallakhamb v/s no training in any competitive sport activity.

IV: Training in Mallakhamb- The experimental group participants were given competitive training in Rope Mallakhamb for one year. They practiced regularly, 5 days a week for at least one hour. The control group participants were not involved in the training of any competitive sport.

DV: The measurement of Emotional Intelligence, Executive Functions and Explanatory Style.

CV: The controlled variables were,

1. The participants were a homogeneous group roughly matched on age, gender and educational grades.
2. The pre and post testing for both the experimental and the controlled group was done simultaneously in 7 days.
3. Most of the students were from English medium schools, with S.S.C. Board
4. The mother tongue of all the participants except one (Kannada) was Marathi.
5. Most of the participants belonged to middle income group.

4.7 Operational Definitions

4.7.1 Independent Variable: Training in Mallakhamb:

It refers to the learning of Competitive Skills on Rope Mallakhamb. The rule book on Mallakhamb - ‘Code of Points’ has classified the Mallakhamb elements in 3 categories, viz ‘A’ parts (easy elements), ‘B’ parts (elements with medium difficulty level) and ‘C’ parts (Difficult elements). Each element has specific points. There are rules about how many elements of each category should be in the competitive set and also there are requirements about how these elements should be combined. The Code of Points also specifies points to be
awarded for the ‘execution of elements’, i.e. how the elements are performed. Points to be deducted for errors – minor, moderate and major are clearly specified. There are certain requirements in terms of total number of elements in the competitive set, the area of the Rope Mallakhamb used while performing the set and instructions about deductions are given, if these requirements are not met during the course of the performance. The entire training of one year of the participants was based on the guidelines given by the Code of Points.

A detailed training program was designed and month wise schedule of the same was told to the participants in the experimental group. The first week of training involved orienting the participants to do exercises, teaching them step by step 5 sets of warming up exercises, basic climbing on the Rope Mallakhamb and cooling down exercises, which involved variety of stretching postures. Warming up before the beginning of the training session and cooling down exercises at the end of every session was done diligently to avoid any injury. The focus of the first month was learning of ‘Simple Jump’ with help and then performing the same without help, in the second month. Simple Jump is the basic inverted position on the Rope and mastery over this position is crucial, as most of the positions learnt later need the transition from Simple Jump. Also, in Simple Jump the participant has to suspend the body in inverted position, the fear has to be dealt with and confidence has to be built up. This phase of learning was dealt with at a slow pace, also because initial learning of Mallakhamb is painful, gripping the Rope in toes, applying horizontal pressure hurts, and at times the skin peels off.

By the end of the second month, the participants became familiar with the exercise schedule, their mastery over grip on the Rope improved and they were introduced to variety of positions involving Yogic postures, movements and positions with tying knots around their body, joints etc. These positions were Simple Cross, Upper Cross, Paschimottanasana, Padhastasana, Padmasana, Vadi, Rikeb, Shavasana etc. The training in 4th and 5th month, involved practicing these positions more intensively, teaching them to do these elements on the Rope without help, improve the execution of the same and make an attempt to do them with minimum touches.

In the sixth month, acrobatic movements were introduced, involving simple drops and catches. The participants learnt movements and transitions such as Cross to Simple Jump and back to Cross, Vadi to Bajrang Pakad and Padahasasana to Cross, without touching their hands to the Rope. Adequate care was taken to use safety crash mats during the practice sessions, both to avoid injury and to build up confidence. The students also practiced these skills, in small groups, assisting each other. Since performing all these requires adequate
practice, one full month was devoted for the same and then in the 8th month all these elements were combined into small combinations. The participants were encouraged to perform these moves, specially the drops and catches alone, without any assistance.

Dismount, coming down from the Rope was introduced in the 10th month. Combinations started getting combined to set up a competitive set and the focus was also on mastery of the skills, learnt till then. In last month, the competitive set was practiced with time and without help.

All through the training period, individual differences, in the abilities of the participants, were considered. A small presentation of the competitive sets by the participants in front of senior coaches marked the end of the training.

4.7.2 Dependent Variables:

4.7.2 a. Emotional Intelligence was defined in terms of the scores obtained on the Bar-On (1997) EQi scale (the Youth version).

4.7.2 b. Executive Function was defined in terms of the scores obtained on the five tests.

4.7.2 c. Explanatory Style was defined in terms of the scores obtained on the Children’s Attributional Style Questionnaire (CASQ) (Seligman, 1990).

4.8 Procedure

4.8.1 Pre - testing

The participants who volunteered for the learning of Mallakamb made up the experimental group. A meeting of the parents with all the participants was called to give a general idea of the training program, emphasizing the need of regular attendance. The participants were given an appointment for testing. The testing was done by trained personal strictly adhering to the procedure of the tests. In all 3 types of tests were administered and one-third of the participants were administered the EI test first, followed by the EF and the ES tests, one-third of the participants were administered the EF test first, followed by the ES tests, and the EI tests, and remaining one-third of the participants were administered the ES tests first, followed by the EI and the EF tests. A break of 10 minutes was given between all the tests. The entire testing was for about 2 hours. Since the EF tests consisted of five subtests, all these subtests were randomly presented.

The school classmates or friends, who were not actively involved in any competitive sports, formed the control group. The procedure of testing used for the control group participants was the same as that of the experimental group participants.
All the experimental group participants were given one year intervention-the training in competitive Rope Mallakhamb by trained trainers. The training duration was one hour, 6 days a week, excluding Sundays and public holidays. The practice session would start with running and warm up exercises, followed by training on Rope Mallakhamb. The training concluded with cooling down exercises. The attendance of the students was monitored regularly.

4.8.2 Post - testing

The post testing, using the same tools was done for the experimental group at the end of one year intervention of Mallakhamb training. All the participants of the control group, who were not involved in the practice of any competitive sport, were also tested, along with the experimental group participants.

4.8.3 Testing procedure with instructions

The procedure used and the instructions given to each participant, for each test is as follows:

After making all the necessary arrangements, the participant was called inside the testing hall and made to sit comfortably. The Bar On Emotional Quotient Inventory: Youth Version (Bar On EQ-I: YV) to measure Emotional Intelligence was placed before the participant and the following instructions were given,

‘Read each sentence and choose the answer that best describes you. There are FOUR possible answers. 1 = Very Seldom True of Me; 2 = Seldom True of Me; 3 = Often True of Me; 4 = Very Often True of Me. Tell us how you feel, think, or act MOST OF THE TIME IN MOST PLACES. Choose one, and only ONE answer for each sentence, and circle the number that matches your answer. For example, if you answer is “Seldom True of Me,” you would circle the number 2 on the same line as the sentence. This is not a test; there are no “good” or “bad” answers. Please circle an answer for every sentence’.

After the participant handed back the test, whether all the statements have been answered was checked, and the participant was thanked for her participation.

The Color Trails Test sheet was placed before the participant, with the following instructions,

Color Trails 1 Practice ‘You see at the bottom of the box there are numbers in a line arranged in a serial order. The hand is pointing to number 1 at the beginning of the line and the hand showing the stop sign is at the end of the line at the last number i.e. 8. The arrows are pointing to numbers in an ascending order. You have to point similarly in this box but the
numbers are not in a line here. There are several numbers in this box. The numbers are in black color and are printed on pink or yellow circles. Start with the number to which the hand is pointing and end with the number where the hand shows the stop sign. Please hold this pencil and point to the numbers in an ascending order as fast as you can. How you understood? Now let’s do the practice trial’. After the participant did the practice trial correctly, the instructions for the main task were given.

Color Trails 1 Main Test ‘There are more numbers on this page from 1 to 25. They are printed on pink or yellow circles. You have to point to them in an ascending order as before. Start with the number 1 which is being pointed by the hand and continue till you see the stop sign. Point to the numbers as fast as you can. Please begin’ The performance of the participant was timed carefully and noted down. Same procedure was repeated for the Color Trails 2, with the following instructions,

Color Trails 2 Practice ‘You see that at the bottom of this box there are two rows of numbers. The first row has numbers 2 to 8 printed in black on pink circles. The second row has numbers 2 to 8 printed in black on yellow circles. The number 1 printed on the pink circle is placed in between the two rows at the beginning. The hand is pointing to the number 1. The first arrow points to the number 2 printed on the yellow circle in the bottom row. The second arrow points to the number 3 printed on the pink circle in the top row. You see that the successive arrows point to the numbers in ascending order but in alternate colors. Have you understood this? If not please ask me for clarification. Point to the numbers with this pencil according to the arrows here. Now see this box. There are numbers 1 to 8 with each number printed twice, once on a pink circle and once on a yellow circle. Start with the number 1 where the hand is pointing. This is printed on a pink circle. Next point to the number 2, which is printed on a yellow circle. Next point to the number 3, which is printed on a pink circle. You see, that you have to point to the numbers in an ascending order but in alternating colors. Point to the numbers with this pencil as fast as you can. Now you can start.’ After the participant did the practice trial correctly, the instructions for the main task were given.

Color Trails 2 Main Test- ‘Start at the number 1 in the pink circle to which the hand is pointing. Next point to the number 2 in the yellow circle, third point to the number 3 in the pink circle. Continue in this manner, pointing to the numbers in ascending order, but alternating between the colors. Use the pencil to point. Point as fast as you can’. The performance of the participant was timed carefully.

After a short break, the Digit Vigilance Test was presented with the following instructions,
‘Please look at this sheet. There are different digits arranged in rows. The digits are randomly arranged. Please cancel the digits 6 and 9 as fast as you can. Do not cross other digits and be sure not to miss any of the target digits. Do as fast as you can. Please start’.

The participant was given a sharpened pencil and was timed carefully for the performance.

After a short break, the Stroop task was presented with the following instructions,

‘You see this sheet with words printed in different colors. Read the words column wise as fast as you can. You can correct yourself if you make mistakes.’ After checking that the participant had understood the task, she was given ready signal to begin the task and was timed carefully.

After the participant completed the reading task, the next instruction was given,

‘Now you have to name the color in which the word is printed. Please do so as fast as you can.’ Here too, the performance was timed carefully.

After a short break, the Tower of London was presented.

The Tower of London board was kept in front of the participant. The board with the goal state of the arrangement of the 3 balls was placed near the examiner. The arrangement of the balls on the other board near the participant was the initial state. The participant has to arrive at the goal state in the board placed on her side. This can be done with a minimum of 2 moves (2 moves problems), 3 moves (3 moves problems), 4 moves (4 moves problems), and 5 moves (5 moves problems). The participant is instructed to move the balls in the board in such a way that the arrangement is similar to the board near the examiner. The test started with the simple level i.e. the 2 moves problems. This was followed by 3 moves, 4 moves and 5 moves problems in that order. There were two problems with 2 moves for demonstration. The test had a total of 12 problems. The first 2 problems could be solved with 2 moves. The next 4 problems could be solved with 3 moves. The next 4 problems with 4 moves and last 4 problems could be solved with 5 moves. The participant is made aware of the constraints and is asked to follow these constraints and then minimum number of moves to achieve the final goal state. The following instructions were given,

‘You see here there are 2 boards. They are identical. There are three sticks on each board. There are 3 balls which are placed on the pegs. The balls are red, green and blue in color. Please observe that the arrangement of the balls is different between the two boards. The board nearer to me is the goal. You have to arrange the balls on the board near you in such a way that the pattern of the balls on the board near you is the same as that on the board near me. While you are doing this please observe the rules that I am going to tell you. Think
well and plan your moves before you lift the ball. You should not hold the ball in your hand and then think where to place it. You can lift only one ball at a time. Please do not lift more than one ball at a time. Once you lift the ball, you should place it on one of these pegs and not on the table or the board or keep in your hand. Have you understood? If you have any questions, please clarify now’. Please start.

The participant solved 2 demonstration problems. After making sure that the participant has clearly understood the task, each of the problems was presented one by one. In this way, the participant solved all the 12 problems. The time taken to solve each problem and the number of moves required to solve each problem were carefully noted.

After a small break, Digit Symbol Substitution Test was presented to the participant. The participant was seated comfortably and the test sheet was placed in front of her. The instructions given were as follows,

‘There are 4 rows of digits in this sheet. Beneath each row of digits, there is a blank row. Each digit has a symbol. You have to substitute a symbol for each digit. You have to go row by row. (Demonstration for substitution was given for the first three digits by the examiner. The principle of substituting symbols for digits was explained again). You can start now. (Practice was given for the first 10 squares). Yes that is correct. Have you understood? Please start now. Do as fast as you can’.

The time taken by the participant to complete the task was carefully noted.

After a small break, Children’s Attributional Style Questionnaire (CASQ) (Seligman, 1990) was presented to measure Explanatory Style of the participant. The instructions were as follows,

‘Here is a bunch of questions about what you think. Each question is like a little story, there are 2 ways in which you might react. Imagine that each of these little stories happened to you, even if they never have. Tick either ‘A’ or ‘B’ answers – the one that best describes the way you feel. There is no right or wrong answers.’ After the participant handed back the test, whether all the statements have been answered was checked. The participant was thanked for her participation. Same procedure was used for all the participants except for the change in the order in which the tests were presented.

4.9 Analysis of Data

The following statistical analysis was used,

1. Descriptive statistics – Mean and standard deviation for all the set of scores was calculated for the pilot study, the pretesting and the post testing of both the experimental and the control group.
EI, Executive Function and Explanatory Style in Mallakhamb

2.  *t* Test- Independent group *t* test was used to calculate the significance of difference between the 2 sets of scores obtained for the EG and the CG in the pilot study. It was also used to compare the significance of difference in the two groups on all the measures for pretesting.

3. Analysis of Covariance (ANCOVA) - Since Pre and post testing was done, ANCOVA was used. The pre testing scores were used as a covariate to reduce error variance and eliminate any other systematic bias.

4.10 Pilot Study

A pilot study was conducted on 48 participants, of which 24 participants were taking competitive training in Mallakhamb for 2 years, in various Sport Institutions in Mumbai and their performance was compared to 24 participants who were not involved in organized sport activity. The age range was 14 to 18 years. A random group design with 2 levels of IV was used and the measurement of Emotional Intelligence, Executive Functions and Explanatory Style were the dependent variables.

**Results and Discussion**

Independent group *t* test was used to calculate the significance of difference between the experimental group and the control group on various tests.

**Emotional Intelligence**

It was proposed that ‘Emotional intelligence of the group exercising Mallakhamb is significantly higher than the emotional intelligence of the group not exercising Mallakhamb’.

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean-EG</th>
<th>SD</th>
<th>Mean-CG</th>
<th>SD</th>
<th>df</th>
<th><em>t</em></th>
<th><em>p</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bar On - Intrapersonal</td>
<td>100.75</td>
<td>13.55</td>
<td>93.54</td>
<td>0.56</td>
<td>46</td>
<td>2.05</td>
<td>0.02*</td>
</tr>
<tr>
<td>Bar On - Interpersonal</td>
<td>100.70</td>
<td>13.45</td>
<td>96.08</td>
<td>5.68</td>
<td>46</td>
<td>1.09</td>
<td>ns</td>
</tr>
<tr>
<td>Bar On - Stress mgment</td>
<td>91.04</td>
<td>9.95</td>
<td>87.58</td>
<td>5.47</td>
<td>46</td>
<td>0.92</td>
<td>ns</td>
</tr>
<tr>
<td>Bar On - Adaptability</td>
<td>103.25</td>
<td>10.92</td>
<td>94.25</td>
<td>2.98</td>
<td>46</td>
<td>2.59</td>
<td>0.006*</td>
</tr>
<tr>
<td>Bar On - Mood</td>
<td>99.58</td>
<td>11.22</td>
<td>92.04</td>
<td>6.38</td>
<td>46</td>
<td>1.86</td>
<td>0.03*</td>
</tr>
</tbody>
</table>
The Bar-On Emotional Quotient Inventory Youth Version has 7 subscales and additional score is obtained on the inconsistency index. The significance of difference between experimental and control groups was analyzed for all these subscales and the scores of the same are presented in table 4.1.

The difference in mean score on Intrapersonal Scale for the EG (100.75, $SD = 13.55$) and mean score for the CG (93.54, $SD = 10.56$) was significant ($t = 2.05, p < .02, df = 46$). The intrapersonal scale measures emotional awareness, assertiveness, self regard, self actualization and independence. Individuals scoring high on this scale understand their emotions, are able to express and communicate their needs. Precision of movements is a necessity for Mallakhamb. The Mallakhamb player performs these movements in the face of fear. Thus, remaining calm, regulating one's emotions is necessary while performing on Mallakhamb. It is probably due to this reason; the mean score (100.75) of the group practicing Mallakhamb was significantly higher on intrapersonal scale than the mean score (93.54) group not practicing Mallakhamb on the Bar On’s Inventory. The difference in mean score on Interpersonal Scale for the EG (100.70, $SD = 13.45$) and that for the CG (96.08, $SD = 15.68$) was not significant ($t = 1.09, ns$). The difference in mean score on Stress Management for the EG (91.04, $SD = 9.95$) and for the CG (87.58, $SD = 15.47$) was not significant ($t=0.92, ns$). Although the mean score of the EG (100.70) was higher than the mean score of CG (96.08) on interpersonal scale, which measures empathy, social responsibility and interpersonal relationship and also on the Stress Management scale, EG (91.04) and CG (87.58), which measures stress tolerance and impulse control, the difference between them was not statistically significant. The difference in mean score on Adaptability Scale for the EG (103.25, $SD = 10.92$) and that for the CG (94.25, $SD = 12.98$) was significant ($t = 2.59, p < .00, df = 46$). This may be due to the fact that the Mallakhamb player has to accommodate himself in the practice and competitive conditions, which are generally adverse. In India, the sport competition schedule gets decided at the last moment, travelling unreserved is very common. Also the competitions may not be indoors, resulting in adjustment to environmental conditions and the apparatus in these conditions. The
accommodation is over-crowded, the toilet facilities are inadequate and the competitors
develop a skill to adjust to any and all such situations. This probably must have increased the
score on adaptability scale. The difference in mean score on **General Mood Scale** for the
EG (99.58, $SD = 11.22$) and that of CG (92.04, $SD = 16.38$) was significant ($t = 1.86, p < .03,
df = 46$). This scale measured optimism and happiness and this could be because of the
tendency to regulate emotions. The difference in mean score on **Emotional Quotient** for the
EG (97.16, $SD = 12.80$) was found to be significantly higher than that of CG (89.20, $SD =
12.55$) ($t = 2.17, p < .01, df = 46$). The mean EQ score of the EG was in the range of average
scores (97.16) and the score indicated average emotional and social capacity. The mean EQ
score of the CG was in the range of lower scores (89.20), indicating underdeveloped
emotional and social capacity, with some room for improvement. These results are in
accordance with the findings of study conducted by Stephens, Craig and Ferris (1986) which
showed that level of physical activity is positively associated with, good mental health, when
mental health is defined as positive mood, general well being and relatively infrequent
symptoms of anxiety and depression. There is ample scientific evidence that suggests
physical activity contributes to good physical as well as mental health. The results are in line
with Guyot, Fairchild and Hill (1981) who found that students who scored above 70th
percentile on physical fitness test had significantly high self-concept. Demands of artistic
sports generate a high degree of perceived pressure. Success, in face of very demanding
conditions, call for a considerable degree of mental skill or emotional intelligence (Smith,
1998). Artistic sport involves precision in movements, meticulously rehearsed routines,
grace, and nearly perfect performance. Since movements in Mallakhamb also involve the
same, Mallakhamb is also an artistic sport and its regular practice is related to better
emotional intelligence. As far as the scale of **Positive Impression** was concerned, the mean
score for the EG (107.95, $SD = 13.91$) and the mean score for the CG (89.95, $SD = 26.73$)
was also found to be significant ($t = 2.92, p < .002, df = 46$). This indicated that the group as
a whole attempted to create an overly positive self impression. This could probably because
the player has to create a positive impression about oneself in front of the spectators, the
judges and that too in face of the adverse conditions. The score of 10 or above on
inconsistency index indicates that all the other scores obtained on this scale are not reliable.
The mean score on the **inconsistency index** of the both the CG (7.45) and that of the EG
(6.62) were on the lower side indicating that the scores on the other scales are reliable.

Thus the hypothesis that ‘Emotional intelligence of the group exercising Mallakhamb is significantly higher than the emotional intelligence of the group not
exercising Mallakhamb’ was supported for Intrapersonal, Adaptability, General Mood, Emotional Quotient and Positive Impression.

Executive Function

The Color Trails, Digit Vigilance task, Stroop task, Tower of London and Digit Symbol Substitution were the tests of executive functions. It was proposed that ‘The executive function of the group exercising Mallakhamb is significantly higher than the executive functions of the group not exercising Mallakhamb’. The results of obtained on the scales of executive functions are presented in Table 4.2.

Table 4.2: *t* scores of the EG and CG on various scales of Executive Functions

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean-EG</th>
<th>SD</th>
<th>Mean-CG</th>
<th>SD</th>
<th>df</th>
<th><em>t</em></th>
<th><em>p</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Color Trails-I</td>
<td>35.95</td>
<td>9.65</td>
<td>31.75</td>
<td>.63</td>
<td>46</td>
<td>1.84</td>
<td>0.035*</td>
</tr>
<tr>
<td>Color Trails-II</td>
<td>73.87</td>
<td>18.41</td>
<td>76.87</td>
<td>9.84</td>
<td>46</td>
<td>0.54</td>
<td>ns</td>
</tr>
<tr>
<td>Stroop-Words</td>
<td>86.87</td>
<td>15.76</td>
<td>95.95</td>
<td>5.74</td>
<td>46</td>
<td>1.99</td>
<td>0.02*</td>
</tr>
<tr>
<td>Stroop-Color</td>
<td>225.16</td>
<td>46.32</td>
<td>229.41</td>
<td>5.59</td>
<td>46</td>
<td>0.32</td>
<td>ns</td>
</tr>
<tr>
<td>Stroop C-W</td>
<td>138.20</td>
<td>42.08</td>
<td>133.87</td>
<td>2.47</td>
<td>46</td>
<td>0.35</td>
<td>ns</td>
</tr>
<tr>
<td>Digit Vigilance-time</td>
<td>448.79</td>
<td>89.15</td>
<td>439.83</td>
<td>2.03</td>
<td>46</td>
<td>0.36</td>
<td>ns</td>
</tr>
<tr>
<td>Digit Vigilance-Errors</td>
<td>4.91</td>
<td>3.44</td>
<td>6.83</td>
<td>.76</td>
<td>46</td>
<td>1.59</td>
<td>0.05*</td>
</tr>
<tr>
<td>TOL-minimum moves 2</td>
<td>1.83</td>
<td>0.37</td>
<td>1.70</td>
<td>.54</td>
<td>46</td>
<td>0.91</td>
<td>ns</td>
</tr>
<tr>
<td>TOL-minimum moves 3</td>
<td>3.41</td>
<td>0.50</td>
<td>3.12</td>
<td>.79</td>
<td>46</td>
<td>1.51</td>
<td>ns</td>
</tr>
<tr>
<td>TOL-minimum moves 4</td>
<td>2.45</td>
<td>0.77</td>
<td>2.41</td>
<td>.87</td>
<td>46</td>
<td>0.17</td>
<td>ns</td>
</tr>
<tr>
<td>TOL-minimum moves 5</td>
<td>1.75</td>
<td>0.84</td>
<td>1.33</td>
<td>.91</td>
<td>46</td>
<td>1.63</td>
<td>0.05*</td>
</tr>
<tr>
<td>TOL-minimum moves T</td>
<td>9.45</td>
<td>1.61</td>
<td>8.48</td>
<td>.01</td>
<td>46</td>
<td>1.65</td>
<td>0.05*</td>
</tr>
<tr>
<td>TOL-No. of moves 2</td>
<td>2.16</td>
<td>0.35</td>
<td>2.22</td>
<td>.48</td>
<td>46</td>
<td>0.50</td>
<td>ns</td>
</tr>
<tr>
<td>TOL-No. of moves 3</td>
<td>3.22</td>
<td>0.29</td>
<td>3.57</td>
<td>.57</td>
<td>46</td>
<td>2.56</td>
<td>0.006*</td>
</tr>
<tr>
<td>Test</td>
<td>Mean Time 2</td>
<td>Mean Time 3</td>
<td>Mean Time 4</td>
<td>Mean Time 5</td>
<td>NS</td>
<td></td>
<td></td>
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<td>-----------------------------</td>
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<td>-------------</td>
<td>-------------</td>
<td>-------------</td>
<td>--------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOL - No. of moves 4</td>
<td>4.79</td>
<td>6.46</td>
<td>16.87</td>
<td>20.02</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOL - No. of moves 5</td>
<td>7.31</td>
<td>8.18</td>
<td>14.82</td>
<td>21.88</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOL - Mean time 2</td>
<td>4.79</td>
<td>4.75</td>
<td>14.82</td>
<td>21.88</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOL - Mean time 3</td>
<td>6.46</td>
<td>8.875</td>
<td>21.88</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOL - Mean time 4</td>
<td>16.87</td>
<td>14.82</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOL - Mean time 5</td>
<td>20.02</td>
<td>21.88</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digit Symbol Substitution</td>
<td>136.45</td>
<td>143.25</td>
<td>5.92</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Color trails test** was administered to study focused attention. For the Color Trails Form I, the mean time taken by the EG (35.95 sec., $SD = 9.65$) was significantly higher than the mean time taken by the CG (31.75 sec., $SD = 5.63$) ($t = 1.84, p < .03, df = 46$), showing the CG to be superior in sustained attention, perceptual tracking and simple sequencing. For the Color Trails Form II, the difference in mean time taken by the EG (73.87 sec., $SD = 18.41$) and mean time taken by the CG (76.87 sec., $SD = 19.84$) was not significant ($t = 0.54, ns$). With sustained attention, perceptual tracking and simple sequencing, color trails II also require mental flexibility. Performance of intricate movements requires sustained and focused attention, it also requires quick judgment, so it was expected that the EG would perform better than the CG, although these results were not obtained.

Unexpected results were obtained for another test of sustained attention **Digit Vigilance Test** too. The difference in mean time taken by the EG (448.79 sec., $SD = 89.15$) and that by the CG, (439.83 sec., $SD = 82.03$), was not found to be significant ($t = 0.36, ns, df = 46$), these results were not in the expected direction. For the Digit Vigilance task, the mean errors committed by the EG (4.91, $SD = 3.44$) were significantly lower than the mean errors by the CG (6.83, 4.76) ($t = 1.59, p < .05, df = 46$). This performance may be reflecting the speed accuracy trade off function, in which the participants compromise the speed for accuracy. In evaluation of Mallakhamb performance, the perfection of the movements is given much higher weightage, which may have got reflected in the performance here too.

**Stroop task** is one major task that measures the executive function. For the Stroop task, Words alone condition, the mean time taken by the EG (86.87 sec., $SD = 15.76$) was significantly lower than the mean time taken by the CG (95.95 sec., $SD = 15.74$) ($t = 1.99,
This indicates that the two groups were not equated in the baseline task. For the Stroop task, in the colours alone condition the mean time taken by the EG (225.16 sec., $SD = 46.32$) was lower than the mean time taken by the CG (229.41 sec., $SD = 45.59$). The obtained $t$ value $0.32$ ($df = 46$), was not significant. For the Stroop task, in colour minus words condition, the mean time taken by the EG was 138.20 sec., $SD = 42.08$ and that by the CG was 133.87 sec, $SD = 42.47$. The obtained $t$ value $0.35$ ($df = 46$) was not significant. These results were not in the expected direction. Since the two groups were not equated in the baseline task, the results are not reliable.

**Tower of London task** is the task of planning, i.e. ability to set goals, to monitor performance so as to reach the goals and to make corrections in the course adopted, in order to ensure that the goal is attended. Performance in any competitive level sport will involve this kind of planning and so it was proposed that the EG will perform better in this task than the CG. The analysis of performance on the Tower of London test was done in 3 ways. The first analysis was to find the difference between the numbers of problems solved with minimum moves; the second was the mean number of moves taken to solve the problems and the third was the mean time taken to solve the problems.

Number of problems solved with minimum moves: For the 2 move problems, the mean number of problems solved with minimum moves by EG (1.83, $SD = 0.37$) and by the CG (1.70, $SD = 0.54$) were not significantly different ($t = 0.91$, $ns$). For the 3 move problems, the difference in mean number of problems solved with minimum moves by EG (3.41, $SD = 0.50$) and by the CG (3.12, $SD = 0.79$) was not significant. ($t = 1.51$, $df = 46$, $ns$). For the 4 move problems, the mean number of problems solved with minimum moves by EG (2.45, $SD = 0.77$) and those by the CG (2.41, 0.87) did not differ significantly. The $t$ value of 0.17 ($df = 46$) was not significant. For the 5 move problems, the difference in mean number of problems solved with minimum moves by EG (1.75, $SD = 0.84$) and by the CG (1.33, 0.91) was significant ($t = 1.63$, $p < .05$, $df = 46$). The total of minimum moves required by the EG (9.45, $SD = 1.61$) and that by CG (8.58, $SD = 2.01$) was significantly different ($t = 1.65$, $p < 0.05$, $df = 46$). Thus, the mean number of problems solved by minimum number of moves in the 2, 3 and 4 move problems did not differ significantly in EG and CG, but for 5 move problems the EG (1.75) performed significantly better than the CG (1.33).

The mean number of moves taken to solve the problems: For the 2 move problems, the difference in mean number of moves required to solve problems by EG (2.16, $SD = 0.35$) and by the CG (2.22, $SD = 0.48$) was not significant ($t = 0.50$, $ns$, $df = 46$). The mean number of moves required to solve 3-move problems were 3.22, $SD = 0.29$ for the EG and 3.57, $SD =
EI, Executive Function and Explanatory Style in Mallakhamb

0.57 for the CG. This difference was found to be significant ($t = 2.56, p < .00, df = 46$). For the 4 move problems, the mean number of moves required to solve problems by EG (6.20, $SD = 1.42$) were significantly lower than that by the CG (7.15, $SD = 2.54$) ($t = 1.59, p < .05, df = 46$). There was a significant difference in mean number of moves required to solve 5-move problems for the EG (7.31, $SD = 1.49$) and for the CG (8.18, $SD = 2.08$). The $t$ value was 1.66 and it was significant at 0.05 level ($df = 46$). Thus, it can be seen that the EG took less number of moves to solve all the problem sets and the mean number of moves taken by the EG and CG were significantly different for the 3, 4 and 5 move problems.

The mean time taken to solve the problems: The mean time required to solve 2 move problems, by EG (4.79 sec., $SD = 0.20$) and that by the CG (4.75 sec., $SD = 1.82$), ($t = 0.07, ns$), the mean time required to solve 4 move problems, by EG (16.87 sec., $SD = 7.14$) and that by the CG (14.82 sec., $SD = 7.22$) ($t = 0.98, df = 46, ns$) and also the mean time required to solve 5 move problems, by EG (20.02 sec., $SD = 8.13$) and that by the CG (21.88 sec., $SD = 8.06$) ($t = 0.79$) were not significant. For the 3 move problems, the difference in mean time required by EG to solve problems (6.46 sec., $SD = 2.22$) and that by the CG (8.87 sec., $SD = 8.06$) was found to be significant ($t = 2.11, p < .01, df = 46$). It is seen that the mean time taken to solve 3 move problems by the EG was significantly less than the CG. The mean time taken to solve 2 and 4 move problems by the EG was slightly higher than that of the CG, and for 5 move problem the mean time taken to solve the problem by the EG was slightly lesser than that of the CG, although none of these differences were significant. Overall, these results indicated that the Mallakhamb exercise group was more efficient in solving the problems by taking less number of moves, showing that the group planned better and executed the plans little faster than that of the CG.

**Digit Symbol Substitution Test** is the test of visuomotor coordination, motor persistence, sustained attention and response speed. For this task, the mean time taken by the EG (136.45 sec., $SD = 19.12$) and that by the CG was (143.25 sec., $SD = 25.92$). The obtained $t$ value of 1.03 ($df = 46$) was not found to be significant. Movements on Mallakhamb require precise visuomotor coordination, motor persistence and sustained attention. Both gross motor skill and fine motor skill develop with regular practice. So it was expected that the Mallakhamb exercise group will perform better than the CG.

Thus, the hypothesis ‘The executive function of the group exercising Mallakhamb is significantly higher than the executive functions of the group not exercising Mallakhamb’, was supported for the errors in the Digit Vigilance task, word task of the
Explanatory Style

The Explanatory Style was measured using The Children Attribitional Style Questionnaire. The null hypothesis proposed was ‘There is no significant difference in the optimistic explanatory style scores of the experimental and the control group’.

The score on optimism and hope were obtained for both the experimental and the control group and the results of the same are presented in table 4.3.

Table 4.3: t scores of the EG and CG on various Optimism and Hope

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean-EG</th>
<th>SD</th>
<th>Mean-CG</th>
<th>SD</th>
<th>df</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimism</td>
<td>4.75</td>
<td>4.60</td>
<td>3.79</td>
<td>.34</td>
<td>46</td>
<td>0.82</td>
<td>ns</td>
</tr>
<tr>
<td>Hope</td>
<td>4.58</td>
<td>2.20</td>
<td>4.87</td>
<td>.82</td>
<td>46</td>
<td>0.49</td>
<td>ns</td>
</tr>
</tbody>
</table>

Optimism: The mean score for Optimism for the EG was 4.75, $SD = 4.60$ and that for CG was 3.79, $SD = 3.34$. This difference was not significant ($t = 0.82, df = 46$). The mean score for Hope for the EG was 4.58, $SD = 2.20$ was lower than that of CG 4.79, $SD = 1.82$. However, this difference too was not significant ($t = 0.35, df = 46$).

Overall, the null hypothesis that ‘There is no significant difference in the optimistic explanatory style scores of the experimental and the control group’ was supported.

Conclusion

Thus the hypothesis that,

1. ‘Emotional intelligence of the group exercising Mallakhamb is significantly higher than the emotional intelligence of the group not exercising Mallakhamb’ was supported for Intrapersonal, Adaptability, General Mood, Emotional Quotient and Positive Impression.

2. ‘The executive function of the group exercising Mallakhamb is significantly higher than the executive functions of the group not exercising Mallakhamb’, was supported for the errors in the Digit Vigilance task, word task of the Stroop test, mean moves taken in 3, 4 and 5 moves problem and mean time taken in 3 moves problem of Tower of London’.

The null hypothesis,
3. ‘There is no significant difference in the optimistic explanatory style scores of the experimental and the control group’ was supported.

Based on the insights gained from the results of pilot test, the main study was planned and conducted. The results and discussion of the main study is reported in the next chapter.