CHAPTER – III

METHODOLOGY

In this chapter, procedures and methods applied in selection of subjects, selection of variables, justification for selecting the variables, Research design, flow chart, selection of tests, pilot study, reliability of the data, instruments reliability, tester’s reliability, reliability of the subjects, orientation of the subjects, collection of data, administration of the test and statistical analysis are presented.

Selection of subjects

The purpose of the study was to predict the playing ability in Kabaddi from the selected anthropometrical, physical, physiological, and psychological variables among College level players. To achieve the purpose two hundred and sixty eight male inter - collegiate Kabaddi players were randomly selected from various colleges in Tamil Nadu state, India and their age ranged between 17 and 25 years. The subjects had past playing experience of at least three years in Kabaddi and only those who represented their respective college teams were taken as subjects.

Selection of variables

The present study mainly focus on selected anthropometrical, physical, physiological, and psychological variables. As far as the performance of Kabaddi team is concerned above said variables are vital. The researcher reviewed number of journals, books, e-resources, unpublished thesis, dissertations and coaching manuals in which he found that the
standard skills of Kabaddi players are based on these selected anthropometrical, physical, physiological, and psychological variables. Based on these observations, the investigator selected the following independent variables for this study.

**Independent variables**


**Dependent variables**

The playing ability of the players was taken as the performance factor, which was subjectively assessed by three qualified Kabaddi coaches.

**Justification for taking - up the variables**

One of the most dynamic team sports which are distinguished for it is highly developed level of anthropometrical, physical, physiological and a psychological characteristic is team Kabaddi. Anthropometric characteristics of athletes determine the success in particular sports events in various ways. The knowledge of these characteristics is necessary to establish their
importance for the success in competitive sport. The research on the influence of these characteristics in sporting games is of particular complexity, because the success in the game depends, among other things, on how the individual characteristics of some players fit into the whole, thus creating a coherent team.

Kabaddi is a sport that consists of activities of short duration but high intensity during the course of the game. There are great physical demands on the functional capabilities of the players. Great physiological demands necessarily influence the morphological characteristics. Team Kabaddi is a complex intermittent game, which requires players to have well developed aerobic and anaerobic capacities.

Kabaddi requires tremendous physical stamina, agility, individual proficiency, neuromuscular coordination, lung capacity, quick reflexes, intelligence and presence of mind on the part of both attackers and defenders. Physical activities that are considered as important aspects of the game and contribute to the high performance of the team.

High level of performance of a Kabaddi might be dependent upon his physiological make up and recognized that physiological fitness was needed for high level performance. Team Kabaddi, nowadays, is becoming a mind game. Despite excellent physical condition, techniques and tactics, some player/teams perform very badly, the reason being lack of mental fitness. In Kabaddi, several psychological parameters play role in performance. To name a few are competitive state anxiety - somatic, cognitive, self confidence, sports achievement motivation and sports competitive anxiety test etcetera. Successful performance requires
combination of all variables like anthropometrical, physical, physiological and psychological response. However, some authors reported that Kabaddi is a sport that demands predominately all characteristics above mentioned.

**Research design**

A prospective research design was used with playing ability in Kabaddi as a criterion and selected anthropometrical, physical, physiological, and psychological variables among college level players.
The table below shows the variables, Test / Tools and the Unit of Measurement of selected Anthropometrical, Physical, Physiological and Psychological Variables used in this study

**Anthropometrical variables**

<table>
<thead>
<tr>
<th>S. No</th>
<th>Variables</th>
<th>Test/Equipment Needed</th>
<th>Measuring Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Body weight</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>Height</td>
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</tr>
<tr>
<td>3</td>
<td>Arm length</td>
<td>Lufkin anthropometric tape</td>
<td>Centimeter</td>
</tr>
<tr>
<td>4</td>
<td>Arm span</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Leg length</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Hand length</td>
<td>Small sliding caliper</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Hand breadth</td>
<td></td>
<td></td>
</tr>
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**Length Measurements**

<table>
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<th>Test/Equipment Needed</th>
<th>Measuring Units</th>
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</thead>
<tbody>
<tr>
<td>8</td>
<td>Chest girth</td>
<td>Lufkin anthropometric tape</td>
<td>Centimeter</td>
</tr>
<tr>
<td>9</td>
<td>Waist girth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Hip girth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Thigh girth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Calf girth</td>
<td></td>
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**Girth Measurements**

<table>
<thead>
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<th>Test/Equipment Needed</th>
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</tr>
</thead>
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<td>50 Meter run</td>
<td>Seconds</td>
</tr>
<tr>
<td>2</td>
<td>Agility</td>
<td>Shuttle run</td>
<td>Seconds</td>
</tr>
<tr>
<td>3</td>
<td>Flexibility</td>
<td>Sit and reach</td>
<td>Centimeter</td>
</tr>
<tr>
<td>4</td>
<td>Leg explosive strength</td>
<td>Standing broad jump</td>
<td>Meters</td>
</tr>
<tr>
<td>5</td>
<td>Muscular endurance</td>
<td>Modified sit – ups</td>
<td>Counts</td>
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Physiological variables

<table>
<thead>
<tr>
<th>S.No</th>
<th>Variables</th>
<th>Equipment Needed</th>
<th>Measuring Units</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Cardiovascular endurance</td>
<td>20 mts multistage Beep</td>
<td>mls/kg/min</td>
</tr>
<tr>
<td></td>
<td></td>
<td>test</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Resting heart rate</td>
<td>Digitalized heart rate</td>
<td>Beats per minute</td>
</tr>
<tr>
<td></td>
<td></td>
<td>monitor</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Peak expiratory flow rate</td>
<td>Peak flow meter</td>
<td>Liters per minute</td>
</tr>
<tr>
<td>4</td>
<td>Breath holding time</td>
<td>Manual nose clip</td>
<td>Seconds</td>
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Psychological variables

<table>
<thead>
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<th>S. No</th>
<th>Variables</th>
<th>Tools used</th>
<th>Measuring Units</th>
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<tr>
<td>1</td>
<td>Somatic anxiety</td>
<td>Martens, Burton, Vealey,</td>
<td>Scores</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bump and Smith (1990)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Cognitive anxiety</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Self confidence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Sports achievement motivation</td>
<td>Kamlesh (1983)</td>
<td></td>
</tr>
</tbody>
</table>

Pilot study

Prior to the formal study sessions, a pilot study was conducted on twenty players who were not subjected of the research. These subjects from Dr. Sivanthi Aditanar College of Engineering, Tiruchendur, Tamilnadu, State, India.

Reliability of data

The reliability of the data was ensured by establishing the instrumental reliability, subject reliability and tester’s reliability.

Instrumental reliability

Rosscraft Electronic weighing machine, Rosscraft Stadiometer, Lufkin anthropometry tape, Rosscraft Campbell Small bone sliding caliper, Omron Digitalised heart rate monitor, Racer Electronic stop watches and Vitalograph Peak flow meter
were used and these instruments were calibrated and standardised one by one by using the equipments available in the Department of Physical Education, Bharathidasan University, Tiruchirappalli, Tamilnadu State, India. These equipments were supplied by reputed scientific firms and the calibrations of the instruments were accepted as accurate. All these said instruments were sufficient for the purpose of the study.

**Validity of the questionnaire**

1. **Competitive State Anxiety Inventory – 2 (CSAI – 2)**

   The American Psychological Association's (1974) standards for educational and Psychological Tests recommends the self report inventories be first validated by demonstrating concurrent validity with previously validated tests. Thus concurrent validity was inferred when a new inventory was congruent with or divergent from theoretically predicted relationships using previously validated tests.

   The concurrent validity of the CSAI – 2 was examined by investigating the relationships between each of the CSAI – 2 sub scales and eight selected A-state and A - trait inventories. The same three samples of athletes that were used to evaluate the CSAI – 2's internal consistency also were tested for the part of the new inventory's concurrent validation.
2. **Sports achievement motivation (SAMT)**

The validity quotient (0.55) obtained by Kamlesh showed marked relationship between the level of achievement motivation and sports achievement. Moreover, he also obtained the reliability quotient of 0.70, which was quite high.

Researchers like Kamlesh, Mc Cleland, Havelka, Becanac, Wills, Singer etcetera had used this SAMT questionnaire for their research. There can be no better evidence to prove the validity of the questionnaire than this.
Table – II

Reliability coefficient of the Subjects in Anthropometrical, Physical, Physiological and Psychological variables by Test and Re-test Methods

<table>
<thead>
<tr>
<th>S.No</th>
<th>Variables</th>
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</thead>
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<td>2</td>
<td>Height</td>
<td>0.89*</td>
</tr>
<tr>
<td>3</td>
<td>Arm length</td>
<td>0.84*</td>
</tr>
<tr>
<td>4</td>
<td>Arm span</td>
<td>0.92*</td>
</tr>
<tr>
<td>5</td>
<td>Leg length</td>
<td>0.91*</td>
</tr>
<tr>
<td>6</td>
<td>Hand length</td>
<td>0.86*</td>
</tr>
<tr>
<td>7</td>
<td>Hand breadth</td>
<td>0.94*</td>
</tr>
<tr>
<td>8</td>
<td>Chest girth</td>
<td>0.87*</td>
</tr>
<tr>
<td>9</td>
<td>Waist girth</td>
<td>0.90*</td>
</tr>
<tr>
<td>10</td>
<td>Hip girth</td>
<td>0.92*</td>
</tr>
<tr>
<td>11</td>
<td>Thigh girth</td>
<td>0.94*</td>
</tr>
<tr>
<td>12</td>
<td>Calf girth</td>
<td>0.89*</td>
</tr>
<tr>
<td>13</td>
<td>Speed</td>
<td>0.81*</td>
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<tr>
<td>14</td>
<td>Agility</td>
<td>0.92*</td>
</tr>
<tr>
<td>15</td>
<td>Flexibility</td>
<td>0.90*</td>
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<tr>
<td>16</td>
<td>Leg explosive strength</td>
<td>0.89*</td>
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<tr>
<td>17</td>
<td>Muscular endurance</td>
<td>0.87*</td>
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<tr>
<td>18</td>
<td>Cardiovascular endurance</td>
<td>0.87*</td>
</tr>
<tr>
<td>19</td>
<td>Resting heart rate</td>
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<tr>
<td>20</td>
<td>Peak expiratory flow rate</td>
<td>0.90*</td>
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<tr>
<td>21</td>
<td>Breath holding time</td>
<td>0.84*</td>
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<tr>
<td>22</td>
<td>Somatic anxiety</td>
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<tr>
<td>23</td>
<td>Cognitive anxiety</td>
<td>0.81*</td>
</tr>
<tr>
<td>24</td>
<td>Self confidence</td>
<td>0.93*</td>
</tr>
<tr>
<td>25</td>
<td>Sports achievement motivation</td>
<td>0.91*</td>
</tr>
</tbody>
</table>

* Established reliability ranged from 0.80 to 0.95

Tester’s reliability

The investigator was well versed in the techniques of conducting the test, the investigator had a number of practice sessions in the teaching procedures. All selected anthropometrical measurements were taken by trained and qualified level one anthropometrist of International Society for the
Advancement of Kinanthropometry (ISAK). All the measurements were taken by the investigator with the assistance of a person well acquainted with tests and their procedures. Tester competency and reliability of test were established by test and retest methods. A very high correlation was obtained, the tester competency in taking measurement and test reliability were accepted.

**Reliability of the subjects**

The subject reliability was established by test and re-test coefficient of correlation for the scores in each of the criterion measures. Re-testing was done within a period of a week of initial tests in each of the criterion measures, to get data for calculating test and re-test coefficient of correlation for reliability of the subject.

**Orientation of the subjects**

The investigator held a meeting with the subjects prior to the administration of tests. The purpose, the significance of this study and the requirements of the testing procedure were explained to them in detail. So that there was no ambiguity in their minds, regarding the efforts required from them. All the subjects voluntarily came forward to co-operate in the testing procedures to put in their best efforts in the interest of the scientific investigation and in order to enhance their own performance. The subjects were very enthusiastic and co-operative throughout the project.
Collection of data

The methods of data collected from the college level Kabaddi players on selected anthropometrical, physical, physiological and psychological variables were explained below.

Administration of the test

I. Anthropometrical variables

Body weight

Purpose: To measure the body weight of the players.

Equipment required: Electronic weighing machine.

Procedure: The subject stands with minimal movement with hands by their side. Shoes and excess clothing should be removed during the administration of the test. This could be estimated by first weighing the same or similar clothing to that which will be worn during measurement and subtracting this from the measured scale mass. Generally the mass in minimal clothing was sufficient accuracy. Check that scale is reading zero. The subject stands on the centre of the scales without support and with the weight distributed evenly on both feet.

Scoring: Record the number showed in the machine as weight of the player in kilograms.

Body height

Purpose: To measure the standing height of the players.

Equipment required: Stadiometer.
Procedure: The subjects stand erect position on the floor board of the stadiometer with his or her back to the vertical backboard of the stadiometer. The weight of the participant is evenly distributed on both feet. The heels of the feet are placed together with both heels touching the base of the vertical board. Place the feet pointed slightly outward at a 60 degree angle. The buttocks, scapulae, and head are positioned in contact with the vertical backboard. The arms hang freely by the sides of the trunk with palms facing the thighs. The subject is asked to inhale deeply and to stand fully erect without altering the position of the heels. The subject’s head is maintained in the Frankfort plane, the measurer applied a gentle upward lift through the mastoid processes. The recorder placed the head board firmly down the vertex, crushing the hair as much as possible. The recorder further assisted by watching that the feet did not come off the floor and that the position of the head is maintained in the Frankfort plane. Measurement is taken at the end of a deep inward breath (Michael, et al., 2006).

Scoring: Standing height measurement of the subjects was recorded in centimeters.

Arm length

Purpose: To measure the arm length of the players.

Equipment required: Lufkin anthropometric tape.

Procedure: The subject assumes a relaxed standing position with the arms hanging by the sides. The right forearm should be pronated. This measurement represented the length of the arm.
Measurement is taken from the acromiale to the dactylion (middle finger).

**Scoring:** Arm length measurement of the subject was recorded as a score in centimeters.

**Arm span**

**Purpose:** To measure the arm span of the players.

**Equipment required:** Lufkin anthropometric tape.

**Procedure:** The subject assumes a relaxed standing position with the arms left and out stretched. This measurement represented the length of the arm span. The subject is standing away from the wall, with back and buttocks touching the arms are stretched out horizontally. Measure from the right of the dactylion to the left of the dactyion (middle finger).

**Scoring:** Arm span measurement of the subject was recorded as a score in centimeters.

**Leg length**

**Purpose:** To measure the leg length of the players.

**Equipment required:** Lufkin anthropometric tape.

**Procedure:** The subject assumes a standing position with the feet together and the arms hanging by the sides. This represented the length of the leg. It is usual practice to have the subject stand on the box during the test. One branch of the steel measuring tape is placed at the Iliospinale and other branch is placed on top of the box. The lufkin anthropometric tape should be held in the vertical
plane. The height from the Iliospinale laterale to the top of the box is then measured (Michael, et al., 2006).

**Scoring**: Leg length measurement of the subject was recorded as a score in centimeters.

**Hand length**

**Purpose**: To measure the hand length of the players.

**Equipment required**: Small sliding caliper.

**Procedure**: The subject assumed a relaxed standing position with the left arm hanging by the side. The right elbow is partially flexed, forearm supinated, and the fingers extended. This represented the length of the hand. The measurement is taken as the shortest distance from the marked midstylion line to the dactylion. One branch of the Small sliding caliper is placed on the marked midstylion line while the other branch is positioned on the dactylion (Michael, et al., 2006).

**Scoring**: Hand length measurement of the subject was recorded as a score in centimeters.

**Hand breadth**

**Purpose**: To measure the hand breadth of the players.

**Equipment required**: Small sliding caliper.

**Procedure**: The subject assumed a relaxed sitting position with the left arm hanging by the side. The right elbow was partially flexed, forearm supinated, and the fingers extended. This represented the breadth of the hand. The measurement was taken as the distance...
between the metacarpophalangeal joints. The wrist was in neutral position with the fingers fully extended. The measurement can be taken on either side of the hand but preferably was taken across the palm. Measurement from the edge of the hand on one side, across the palm to the edge of the hand on the other side, at the level of the metacarpophalangeal joints, with the finger parallel and extended. (Michael, et al., 2006).

**Scoring:** Maximum breadth of the hand breadth was recorded as a score in centimeters.

**Girth Measurement**

**Chest girth**

**Purpose:** To measure the chest girth of the players.

**Equipment required:** Lufkin anthropometric tape.

**Procedure:** The subject assumes a relaxed standing position with the arms hanging by the sides and slightly abducted. This girth is taken at the level of the mesosternale. The anthropometrist stands to the right of the subject who abducts the arms to the horizontal position allowing the tape to be passed around the thorax. The stub of the tape and the housing are then both held in the right hand while the anthropometrist uses the left hand to adjust the level of the tape at the back to the adjudged level of the marked mesosternale. The anthropometrist resumes control of the stub with the left hand and using the cross-hand technique positions the tape in front at the level of the marked mesosternale. The subject is instructed to lower their arms to the relaxed position with the arms slightly abducted. The tape is then readjusted as necessary to
ensure it has not slipped and does not excessively indent the skin. The subject should breathe normally and the measurement is taken at the end of a normal expiration.

**Scoring:** Chest girth measurement of the subject was recorded as a score in centimeters.

**Waist girth**

**Purpose:** To measure the waist girth of the players.

**Equipment required:** Lufkin anthropometric tape.

**Procedure:** The subject assumes a relaxed standing position with the arms folded across the thorax. This girth is taken at the level of the narrowest point between the lower costal border and the iliac crest. The anthropometrist stands in front of the subject who abducts the arms slightly allowing the tape to be passed around the abdomen. The stub of the tape and the housing were then both held in the right hand while the anthropometrist uses the left hand to adjust the level of the tape at the back to the adjudged level of the narrowest point. The anthropometrist resumes control of the stub with the left hand and using the cross-hand technique positions the tape in front at the target level. The subject is instructed to lower their arms to the relaxed position. The tape was then readjusted as necessary to ensure it has not slipped and does not excessively indent the skin. The subject should breathe normally and the measurement is taken at the end of a normal expiration. If there is no obvious narrowing the measurement is taken at the mid-point between the lower costal border and the iliac crest.
Scoring: Waist girth measurement of the subject was recorded as a score in centimeters.

Hip girth (Gluteal)

Purpose: To measure the hip girth of the players.

Equipment required: Lufkin anthropometric tape.

Procedure: The subject assumes a relaxed standing position with the arms folded across the thorax. The subject’s feet should be together and the gluteal muscles relaxed. The girth is taken at the level of the greatest posterior protuberance of the buttocks which usually corresponds anteriorly to about the level of the symphysis pubis. The anthropometrist passes the tape around the hips from the side. The stub of the tape and the housing are then both held in the right hand while the anthropometrist uses the left hand to adjust the level of the tape at the back to the adjudged level of the greatest posterior protuberance of the buttocks. The anthropometrist resumes control of the stub with the left hand, and using the cross-hand technique, positions the tape in front and the sides so that the tape is held in a horizontal plane at the target level. The tape is then readjusted as necessary to ensure it had not slipped and does not excessively indent the skin.

Scoring: Hip girth measurement of the subject was recorded as a score in centimeters.

Thigh girth

Purpose: To measure the thigh girth of the players.

Equipment required: Lufkin anthropometric tape.
**Procedure:** The subject assumes a relaxed standing position with the arms folded across the thorax. The subject stands with the feet slightly apart and mass equally distributed on both feet. The girth of the thigh is taken 1 cm below the level of the gluteal fold, perpendicular to the long axis of the thigh. It is usually helpful to have the subject stand on a box or stool for this measure. The anthropometrist passes the tape between the lower thighs and then slides the tape up to the correct plane. The stub of the tape and the housing are both held in the right hand while the anthropometrist uses the left hand to adjust the level of the tape to the target level. The anthropometrist resumes control of the stub with the left hand and using the cross-hand technique positions the tape so that it was held in a perpendicular plane. The tape is then readjusted as necessary to ensure it has not slipped and does not excessively indent the skin.

**Scoring:** Thigh girth measurement of the subject was recorded as a score in centimeters.

**Calf girth**

**Purpose:** To measure the calf girth of the players.

**Equipment required:** Lufkin anthropometric tape.

**Procedure:** The subject assumes a relaxed standing position with the arms hanging by the sides. The subject’s feet should be separated with the weight evenly distributed. The maximum girth of the calf at the marked medial calf skinfold site. The subject stands in an elevated position. The elevated position will make it easier for the measure to align the eyes with the tape. The
anthropometrist passes the tape around the calf and then slides the tape to the correct plane. The stub of the tape and the housing are both held in the right hand while the anthropometrist uses the left hand to adjust the level of the tape to the marked level. The anthropometrist resumes control of the stub with the left hand and using the cross-hand technique positions the tape so that it is held in a plane perpendicular to the axis of the leg. The tape is then readjusted as necessary to ensure it has not slipped and does not excessively indent the skin.

**Scoring:** Calf girth measurement of the subject was recorded as a score in centimeters.

**II. Physical variables**

**Speed (50 mts. run)**

**Purpose:** To determine speed of the players.

**Equipments & facilities required:** Measuring tape, marked track, stopwatch, cone markers, flat and clear surface of at least 70 meters.

**Procedure:** The test involves running a single maximum sprint over 50 meters, with the time recorded. A thorough warm up should be given, including some practice starts and accelerations. Start from a stationary standing position (hands cannot touch the ground), with one foot in front of the other. The front foot must be behind the starting line. Once the subject is ready and motionless, the starter gives the instructions "set" then "go" The tester should provide hints for maximizing speed and the
participant should be encouraged not to slow down before crossing the finish line.

Results: Two trials are allowed, and the best time is recorded to the nearest two decimal places.

**Agility (4 ×10 yard Shuttle run)**

**Purpose:** To measure the agility of the players.

**Equipments & facilities required:** Stop watch, measuring tape, marker cones, with two lines 10 yards apart.

**Procedure:** A distance of ten yards is marked by two parallel lines. The subject stands behind the starting line. On getting starting signal “Go” he runs fast, towards the other line and touches it with one hand and runs back to the starting line. After touching it, he repeats the shuttle run.

**Scoring:**

The time taken by the performer to complete the course of 4x10 yards to the nearest 1/10th of the seconds is recorded as score in the test.

**Flexibility (Sit and reach test)**

**Purpose:** To measure the amount of trunk flexion and the ability to stretch the back muscles.

**Equipments & facilities required:** Standard sit and reach or alternatively a ruler can be used, and a step or box.
**Procedure:** The subject sits on the floor, legs extended and feet flat against a flexibility bench (box with a ruler attached). The trunk is then flexed and the fingers extended along the scale where they are held for a period of 3 seconds. The legs must remain extended at the knees throughout the test. Three trials are given after the subject has been thoroughly warmed-up. (Singh, 1991)

**Scoring:** The score is recorded in centimeters as either a plus if distances beyond the feet are recorded or a minus if the subject cannot reach his feet.

**Leg explosive strength (Standing broad jump test)**

**Purpose:** To measure the leg explosive strength of the players.

**Equipments & facilities required:** Measuring tape and a mat. Space on the floor or an outdoor jumping pit.

**Procedure:** The subject stands behind a line marked on the ground with feet slightly apart. A two foot take-off and landing is used, with swinging of the arms and bending of the knees to provide forward drive. The subject attempts to jump as far as possible, landing on both feet without falling backwards. Three attempts are allowed.

**Scoring:** The score is the distance between the take-off line and the nearest point where any part of the body touches the floor. It is measured in meters.

**Muscular endurance (Modified sit – ups)**

**Purpose:** To measure the muscular endurance of the players.
**Equipments & facilities required:** Flat cushioned surface, Stopwatch recording sheets, and pen.

**Procedure:** The subject lies flat on the back with knees bent and feet on the floor with the heels no more than 1 foot from the buttocks. The knee angle should be no less than 90 degrees. The fingers are interlocked and placed behind the neck with the elbows touching the floor. The feet are held securely by a partner. The subject then curls up to a sitting position and touches the elbows to the knees.

**Scoring:** One point is scored for each correct sit-up. The score is the maximum number of sit-ups completed in 60 seconds.

**III. Physiological variables**

**Cardiovascular endurance (20 meters – Multistage beep test)**

**Purpose:** To measure the cardiovascular endurance of the players.

**Equipments & facilities required:** Flat non-slip surface, marking cones, 20 mts measuring tape, beep test CD, CD player and recording sheets.

**Procedure:** This test involves continuous running between two lines 20 mts apart in time to recorded beeps. For this reason the test is also often called the 'beep' or 'bleep' tests. The test subjects stand behind one of the lines facing the second line, and begin running when instructed by the CD or tape recorder. The speed at the start is quite slow. The subject continues running between the two lines, turning when signaled by the recorded beeps. After
about one minute, a sound indicates an increase in speed, and the beeps will be closer together. This continues each minute (level). If the line is not reached in time for each beep, the subject must run to the line turn and try to catch up with the pace within 2 more ‘beeps’. Also, if the line is reached before the beep sounds, the subject must wait until the beep sounds. The test is stopped if the subject fails to reach the line for two consecutive ends.

**Scoring:** The athlete’s score is the level and number of shuttles reached before they were unable to keep up with the recording. Record the last level completed. This norms table below is based on personal experience, and gives you a very rough idea of what level score would be expected for adults, using the standard Australian beep test version. There is a more detailed table of norms for the beep test. This level score can be converted to a VO\(_2\) max equivalent score using this calculator.

**Resting heart rate**

**Purpose:** To measure the resting heart rate of the players.

**Equipments & facilities required:** Digitalized heart rate monitor, score sheet, and stop watch.

**Procedure:** For the sake of accuracy, in this study, the resting heart rate is measured in the subject’s hostel rooms as soon as they wake up from their sleep in the morning. They are instructed to remain in their beds till the investigator arrived to measure their resting heart rate. The digitalized heart rate monitor is used to measure the resting heart rate of the players. Two repetitions
of resting heart rate of subjects are conducted one by one at the same time, and the best one of two will be considered.

**Scoring:** Number of beats per minute was counted.

**Peak expiratory flow rate**

**Purpose:** To measure the maximum expiratory pressure of the players.

**Equipments & facilities required:** Peak flow meter and score sheet.

**Procedure:** Peak flow meter gives to the subject and allowed to stand erect at the beginning of the test. Before that the investigator demonstrated to the subject. To ask the subject forcefully inhaled twice before tansy the test. Care was taken by the subject so that the air did not escape through the nose or around the mouth piece. Ask to inhale deeply keep the peak flow meter immediately and forcefully flow the air into the peak flow meter caliber. Using the peak flow meter as described by the proper method explained by peak flow meter procedures and experts. Peak flow meter should be in Horizontal position, won’t touch the finger on the scale and do not block the edge.

**Scoring:** Peak flow meter shows the measurement in liters per minutes shortly L/MIN. Recorded the score for subject and taken the value in to the collection of the data.

**Breath holding time**

**Purpose:** To measure the breath holding time of the players.

**Equipments & facilities required:** Stopwatch and score sheet.
**Procedure:** The subject was asked to stand at ease and inhale deeply after which he held his breath as long as possible. The index finger of the subject served as an indicator for the investigator to know the start and end of recording time. To prevent exhalation or inhalation through the mouth during the recording time the subject was asked to couple his lips tightly. Two trials were permitted for each subject with a gap of five minutes and the better time was recorded.

**Scoring:** The time of holding the breath till the subject lets the air out was recorded to the nearest one tenth of a second using a stop watch.

**IV. Psychological variables**

**Competitive State Anxiety Inventory – 2** (cognitive anxiety, somatic anxiety and self confidence)

**Purpose:** To assess the level of cognitive anxiety, somatic anxiety and self confidence of the players.

**Tools Used:** Competitive state anxiety inventory prepared by Martens, Burton, Vealey, Bump and Smith (1990) was used. The CSAI-2 questionnaire was given to all the subjects before the competition.

**Procedure:** The tool was used to find the level of cognitive anxiety, somatic anxiety and self confidence. This inventory consists of 27 statements about the subject’s feeling. The response sheet is scored in accordance with the response intensity key. The CSAI-2 is scored by computing a separate total for each of the three sub scales. The scores that can be obtained
by a subject are 9 points and the maximum is 36 points. The cognitive anxiety subscale is scored by adding the responses for the following 9 items: 1, 4, 7, 10, 13, 16, 19, 22 and 25. The somatic anxiety state subscale is scored by adding the responses to the following 9 items: 2, 5, 8, 11, 14, 17, 20, 23 and 26. Scoring for the item 14 must be reversed in calculating the score for the somatic A-state subscale as indicated below:

Not at all – 4
Somewhat – 3
Moderately so – 2
Very much so – 1

The state self-confidence subscale is scored by adding the following items: 3, 6, 9, 12, 15, 18, 21, 24 and 27.

For all the questions except – 14
Not at all – 1
Somewhat – 2
Moderately so – 3
Very much so – 4

There is no right or wrong answers. The subjects are not allowed to spend too much time on any statement. The subjects are asked to choose the word that described how best they usually feel when participating in sports and games. A copy of the questionnaire is given in the appendix – I.
Sports achievement motivation

Purpose: To assess the level of sports achievement motivation of the players.

Tools Used: Sports achievement motivation questionnaire prepared by Kamlesh (1983) was used. The Sports achievement motivation (SAMT) questionnaire is given to all the subjects before the competition.

Procedure: The standard psychological tool was used to find the level of Sports achievement motivation of the players. This test consists of 20 partly completed sentences. Each partly completed sentence has two answers, which are equally good to make the incomplete sentences meaningful and complete. Among the two answers the most appropriate one is the correct response. The respondents must make a tick mark (√) on any one of the two answers that fits to them best. The inventory was revalidated by the investigator by administering it on inter-college men Kabaddi players. Hence the inventory in its original form is used in this investigation. A copy of questionnaire is given in appendix – III.

Scoring: The inventory is scored with the help of a scoring key. Among them, for question 1, 3, 4, 9, 10, 11, 12, 13, 15, 16, 17, 18 and 20 the expected answer is ‘a’. For the question 2, 5, 6, 7, 8, 14, and 19 the expected answer ‘b’. For correct statement two marks and for incorrect statement zero marks are awarded. The obtained score for each partly completed sentence is added and it is considered as individual score. The range of score is 0 to 40. The larger the score the higher the achievement motivation of the subject.
V. Overall playing ability

The criterion measure of overall playing ability was measured by a panel of experts consisting three persons. They were outstanding players at state level yester years in the game of Kabaddi and have been serving as renowned & qualified coaches for about a decade. The experts were asked to make a subjective assessment of the overall playing ability of the players using the 100 point scale which consist of 10 factors. The average rating of the three experts on the overall playing ability was considered as the score of subjects. To see the degree of agreement between the three qualified coaches, rank order correlation was used in this study. The results revealed high correlation, which means that there was a close agreement in rating between the coaches. The guidelines for rating was provided by the investigator, which is in appendix – I.

Statistical analysis

Mean and Standard deviations were calculated for each of the selected variables. The inter-relationship among the selected anthropometrical, physical, physiological, psychological variables and Kabaddi playing ability, were computed by using Pearson’ product-moment correlation coefficients. The computation of multiple regression was also used. In multiple regressions, a criterion variable from a set of predictors was predicted. Step wise argument methods of multiple regression was used in this study to find out the predictor variable that has the highest correlation with the criterion variables were entered in the equation depending on the contribution of each predictor. The SPSS 15 version package was used to determine the predictive equation.
The prediction formula resulting from multiple regression was basically an extension of the two variables model, \( Y = a + bx \). In this research study there were thirty three predictor variables and hence the following statistical regression equation was used. The step wise multiple regression method was used for the selection of variables.

\[
Y' = a + b_1x_1 + b_2x_2 + \ldots \ldots b_nx_n
\]

Where \( Y' = Y \) Predictor

\( a = \) Constant

\( b_1, b_2 = \) Beta weights for predictor variables

\( X_1, X_2 = \) predictor variables