In this chapter the methodology used in the study such as the selection of subjects, selection of variables, research design, criterion measures, pilot study, orientation of subjects, test administration and statistical analysis have been presented. The purpose of the study was to find out the relationship of game performance with selected anthropometrical, psychological and physical fitness variables of university male football players.

3.1 SELECTION OF SUBJECTS

To achieve the purpose of the study, the investigator selected hundred sixty five inter university male football players from different university teams participated in South Zone Interuniversity Football Tournament (Men) 2011-12 organized by University of Kerala, Thiruvanthapuram held on October 2nd to 7th October 2012. The subjects selected were in the age group between 18 to 25 years.

3.2 SELECTION OF VARIABLES

The investigator reviewed number of books, journals, research articles, coaching manuals and found that game performance (Overall skills/playing abilities) of a football may have relationship with selected anthropometrical, psychological and physical fitness variables. Based on these observations, the investigator selected the following variables for this study

**Anthropometrical Measurements :**

1. Standing Height
2. Body Weight
3. Arm Length  
4. Leg Length  
5. Calf Girth  
6. Thigh Girth  

**Psychological Variables**  
1. Sports Achievement Motivation  
2. Aggression  
3. Self Confidence  

**Physical Fitness variables**  
1. Speed  
2. Agility  
3. Leg Explosive Power  
4. Muscular Strength  
5. Flexibility  
6. Cardiovascular Endurance  

**3.3 RESEARCH DESIGN**

A repeated measure research design was used with game performance in football as the criterion variable and selected the anthropometrical, psychological and physical fitness variables as the correlated variables.

**3.4 CRITERION MEASURES**

By reviewing the literature and in consultation with professional experts the following variables were selected to study the relationship of selected Anthropometrical, psychological and physical fitness variables with the game performance of football players
### Table-3.1
**Criterion Measures**

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Variables</th>
<th>Equipments/Tests used</th>
<th>Criterion Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>Game Performance</td>
<td>The overall skill performance of football players was measured by coaches rated 10 point scale</td>
<td>Scores</td>
</tr>
</tbody>
</table>

#### B. Anthropometric Measurements
1. Standing Height | Stadiometer | Centimeter |
2. Body Height | Electronic Weighing Machine | Kilogram |
3. Arm Length | Measuring tape | Centimeter |
4. Leg Length | Measuring tape | Centimeter |
5. Thigh Girth | Measuring tape | Centimeter |
6. Calf Girth | Measuring tape | Centimeter |

#### C. Psychological Variables
1. Sports Achievement Motivation | Questionnaire developed by Kamlesh M.L. | Scores |
2. Aggression | Questionnaire developed by Anand Kumar and Prem Shankar | Scores |
3. Self Confidence | Agnihotri Self Confidence Inventory (ASCI) developed by Rekha Agnihotri | Scores |

#### D. Physical Fitness variables
1. Speed | 50 Yard dash | Time recorded in Secs. |
2. Agility | 4 x 10 Mtrs. Shuttle Run | Time recorded in Secs. |
3. Leg Explosive Power | Standing broad jump | Distance in Meters |
4. Muscular Strength | Push-ups | Maximum in numbers |
5. Flexibility | Sit & Reach Test | Centimeters |
6. Cardiovascular Endurance | 1000 Mtrs Run and Walk | In Minutes and Secs. |
3.5 PILOT STUDY

The investigator conducted a pilot study with ten players who were not subjects of the research study to determine the methods of testing, evaluate the competency of the investigator testing, recording the timings and scores and field equipments used in the present investigation.

3.6 RELIABILITY OF DATA

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

Instrument Reliability

Six electronic stop watches (Casio, Japan), non stretchable steel tapes, Wet Spirtometers, and Digital Heart Rate and Blood Pressure Machine (Made in Japan), were used in this study. The instruments were used from standard companies and their calibrations were accepted as reliable at par with international standards. The measurements were collected twice and correlated for reliability. The intra class correlation coefficient obtained by test, retest method is presented in Table-3.2.

The validity and reliability of psychological questionnaires administered were already determined by the authors and they were accepted for this study as reliable.

Tester's Reliability

The tester's competency was established together with reliability of test. To determine the reliability of the test, the performance of ten subjects were recorded twice under similar conditions by the investigator. This was done by the test and retest method on consecutive days. The repeated measurement of
subjects was conducted on the selected predictor variables to determine reliability in an univariate situation.

**Table-3.2**

The Reliability Coefficient of the Subjects in Anthropometrical, Psychological, Physical Fitness Variables and Game Performance by Test and Retest Method

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Test Items</th>
<th>Coefficient of Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Game Performance</td>
<td>0.82</td>
</tr>
<tr>
<td></td>
<td><strong>Anthropometrical Measurements</strong></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Standing Height</td>
<td>0.89</td>
</tr>
<tr>
<td>2.</td>
<td>Body Weight</td>
<td>0.91</td>
</tr>
<tr>
<td>3.</td>
<td>Arm Length</td>
<td>0.88</td>
</tr>
<tr>
<td>4.</td>
<td>Leg Length</td>
<td>0.90</td>
</tr>
<tr>
<td>5.</td>
<td>Calf Girth</td>
<td>0.92</td>
</tr>
<tr>
<td>6.</td>
<td>Thigh Girth</td>
<td>0.92</td>
</tr>
<tr>
<td></td>
<td><strong>Physical Fitness Variables</strong></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Speed</td>
<td>0.88</td>
</tr>
<tr>
<td>2.</td>
<td>Agility</td>
<td>0.80</td>
</tr>
<tr>
<td>3.</td>
<td>Leg Explosive Power</td>
<td>0.90</td>
</tr>
<tr>
<td>4.</td>
<td>Muscular Strength</td>
<td>0.88</td>
</tr>
<tr>
<td>5.</td>
<td>Flexibility</td>
<td>0.87</td>
</tr>
<tr>
<td>6.</td>
<td>Cardiovascular Endurance</td>
<td>0.88</td>
</tr>
</tbody>
</table>

* Significant at 0.01 level

**Reliability of the Subjects**

The co-efficient of Correlation in Table-3.2 also indicated the subject reliability because the same subjects were used under similar conditions by the same test. No motivation techniques were used at the time of the testing periods.
3.7 ORIENTATION OF THE SUBJECTS

In order to get the full co-operation from the subjects, the investigator explained to the subjects the purpose of the study, tests to be administrated and procedure to be followed in the administration of the test. Practice trials were conducted to help the subjects to understand the method of testing.

3.8 TEST ADMINISTRATION

The following tests were administered to measure the selected anthropometrical, psychological, physical fitness and game performance variables. The method of data collected from the male interuniversity football players on selected variables were explained below.

A. GAME PERFORMANCE

To determine the game performance of the football players, the selected subject’s game performance was assessed by three experts subjectively. Three qualified coaches who served as experts rated each individual football player in the game situation. The individual and team performance related football skills were selected as criteria for subjective ranking of football game performance by the experts. The criterion score were for a total of 100 marks (Table-3.3). The average of the marks of the experts was taken as the criterion score.

Skills: The following skills were selected, namely, dribbling, kicking, stopping, tactics (scoring rate) supporting ability, passing abilities, positional play in defense, control, past and present achievement and general behaviour. Ten marks were awarded for each skill for a total of 100 marks.

Testing Arrangements: To determine the subjects playing ability in actual playing situation, the subjects were required to play in a regular football court.
**Test Administration:** The experts ranked the skills of the subjects in a ten versus ten playing situations. In this way twelve subjects were subjectively rated on the ten individual skills.

**Scoring:** Three experts gave marks according to the game performance of the subjects as detailed in table. The following individual contribution to the team were selected, namely, dribbling, kicking, stopping, tactics (scoring rate) supporting ability, passing abilities, positional play in defense, control, past and present achievement and general behaviour. Ten marks were awarded for each skill for a total of 10 marks (Table-3.3).

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Skills</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Dribbling Ability</td>
<td>10</td>
</tr>
<tr>
<td>2.</td>
<td>Kicking Ability</td>
<td>10</td>
</tr>
<tr>
<td>3.</td>
<td>Stopping Ability</td>
<td>10</td>
</tr>
<tr>
<td>4.</td>
<td>Tactics (Scoring Rate)</td>
<td>10</td>
</tr>
<tr>
<td>5.</td>
<td>Supporting Ability</td>
<td>10</td>
</tr>
<tr>
<td>6.</td>
<td>Passing Ability</td>
<td>10</td>
</tr>
<tr>
<td>7.</td>
<td>Positional Play in Defence</td>
<td>10</td>
</tr>
<tr>
<td>8.</td>
<td>Control</td>
<td>10</td>
</tr>
<tr>
<td>9.</td>
<td>Past and Present Achievement</td>
<td>10</td>
</tr>
<tr>
<td>10.</td>
<td>General Behaviour</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

**Testing Arrangements:** To determine the subjects playing ability in actual playing situation, the subjects were tested during actual game situation in matches. The experts ranked the individual contribution to the team in a playing situation. In this way twelve subjects were subjectively rated on the ten individual contributions to the team during match situations.
B. ANTHROPOMETRICAL MEASUREMENTS

1. Standing Height

The height of the subject was taken with the help of wall scale and hard board. Subjects were suggested to standing erect without shoes against a wall marked scale, subjects were instructed to keep the heels together body touching the wall with heels, buttocks and back, head erect without tilt and to take and hold a full breath and standing erect while height measurement was taken. A stiff hard board was held horizontally on his head, slightly pressing the head and touching the scale marked on the wall, at right angle. The subject was asked to step out by lowering the head and reading indicated by the lower end of the hard board was taken. The measurement was taken correct to the nearest half of a centimeter.

2. Body Weight

The weight of the subject was taken with a laboratory anthropometric weighing machine. The subject wearing shorts and vest only stood at the centre of the machine and the weight was recorded from the indicator needle of the dial. The weight was read and recorded correct to a half of a kilogram

3. Arm Length

The arm length was measured by using flexible steel tape. The subject stood in a side view and arm length measured putting the steel tape from acromion process above the shoulder joint to the tip of the middle finger.
4. **Leg Length**

Leg length of the subject was measured with flexible steel tape from the bottom outside edge of the centre of foot to the upper edge of the greater trochanter. Leg length was recorded correct to the nearest centimeter.

5. **Calf Girth**

Calf girth was taken with flexible steel tape at the maximum circumference of calf in a plane at right angle to its long axis. The leg was held hanging over the table top so that tape measure were in horizontal plane in this position the calf muscle is quite relaxed. The measurement was taken to the nearest centimeter.

6. **Thigh Girth**

Thigh girth was measured with a steel tape placed around the thigh horizontally with its top edge under the fold of the buttocks. The subjects were asked to stand with his weight equally distributed on both feet. A cross handed technique was used to raise the tape to this level on the inner thigh.
C. PSYCHOLOGICAL VARIABLES

1. Sports Achievement Motivation Test

Purpose

The purpose of the test was to measure achievement motivation level of university football players.

Procedure

1. The sports achievement motivation test was administered before the competition.

2. Necessary instruction that required before answering the questionnaire was explained to the subjects.

3. The subjects were assembled in a group. The purpose of the study was clearly explained.

4. After making sure that subjects understood the instruction the questionnaire were distributed to groups. Enough time was given to answer the questionnaire. The questionnaires were taken back after it was duly completed.

5. Thorough screening was done to check that no question was left unanswered.

Scoring:

1. The sports achievement test has twenty test items; response value of test extends from 0 to 40.

2. Each item carries a maximum score of two and the minimum of zero.

3. When the subject ticked the high pole part, he was given two points, when he ticked the low pole no score was awarded.

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2. Aggression

The aggression questionnaire developed by Anand Kumar and Prem Shankar\(^2\) was administered to each subject to estimate the aggression level of football players. The aggression questionnaire inventory consisted of 25 items in which 13 items were keyed ‘Yes’ and rest of 12 were keyed ‘No’. The statements which had keys ‘yes’ were 1, 4, 5, 6, 9, 12, 14, 16, 18, 21, 22, 24, 25 and the statements which were keyed ‘No’ were 2, 3, 7, 8, 10, 11, 13, 15, 17, 19, 20 and 23. The higher the score the higher was the aggression level.

**Scoring** : One point was awarded for right answer. For each item the score was ‘1’. The maximum score was ‘25’ and minimum score was ‘0’.

3. Self-Confidence

Self Confidence Inventory (ASCI) developed by Agnihotri\(^3\) was administered to estimate self-confidence of football players selected as subjects. The ASCI Questionnaire was administered to all the subjects to measure self-confidence. All the statements were adopted for this investigation.

**Scoring Key** : The subjects were instructed to make tick (\(\checkmark\)) mark on any one of the responses to each item according to how they generally felt in competitive sports situation. The purpose of the study was clearly explained to them so that there was no ambiguity among the subjects regarding the efforts which they had to put for the successful completion of the investigation. The ASCI questionnaire was distributed to the football players who were selected as


subjects and the direction were read by the investigator at a dictation speed to make the subjects understand about what they were exactly required to do. The inventory could be scored by hand. A score of one was awarded for a response indicating lack of self-confidence, that is, making cross (×) to wrong response to item numbers 2, 7, 23, 31, 40, 41, 43, 44, 45, 53, 54, 55 and 56 for making cross (×) to right response to the rest of the items (the true answers were 1, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 24, 25, 26, 27, 28, 29, 30, 32, 33, 34, 35, 36, 37, 38, 39, 42, 46, 47, 48, 49, 50, 51, 52). The lower the score the higher be the level of self-confidence and visa versa.
D. PHYSICAL FITNESS VARIABLES

1. 30 Meters Dash

**Purpose:** To assess the speed of the subject.

**Equipments:** Stop watches, 30 meters, straight smooth space and free of obstacle.

**Procedure:** The subject stood on the starting line. On the command of starter, the subject ran towards the finishing line. At the same time the time keeper started the stop watch and stopped after touching the finishing line by the subject. No trials were given.

**Scoring:** The score was recorded to the nearest of one tenth of a second.

2. 4 × 10 M Shuttle Run

**Purpose:** The purpose of the shuttle run was to measure the agility of the performer in running and changing direction.

**Equipment:** Measuring tape, stop watches and wooden blocks.

**Procedure:** Each subject was asked to start behind the starting line after the signal ‘go’. The subject ran from starting line to blocks which were placed at a distance of 10 meter from starting line and pick one of the block, returned to the starting line and placed the block behind the line. The same process was repeated in the second block. Two trials were permitted for each subject.

**Scoring:** The score for each subject was the time taken to complete the distance of 4 x 10 meter shuttle run measured in the nearest 1/100th of a second. Two trials were given, the best out of the two recorded times was taken as subject score.
3. **Standing Broad Jump**

**Purpose:** To measure the explosive strength of the legs of the subjects.

**Equipment:** A long jump landing pit with sand, a measuring tape and a take off line was marked in front of the pit 50 centimeter away.

**Procedure:** The subject stood behind the take off line with feet parallel to each other. The performer flexed his knees and took his arms backward, then with a vigorous forward swing of arms and extension of flexed knees he took off in one chance and jumped on the landing pit as far forward as possible. These trials were given after adequate rest.

**Scoring:** Best of the three trials in meters was considered as the performance of the subject in the test.

4. **Push-Ups**

**Purpose:** To estimate the muscular strength of the upper body

**Equipment:** Gymnastic Mats

**Procedure:** The subject being tested took prone lying position on the ground with the hands under the shoulders and fingers stretched, legs straight and parallel with comfortably apart and the toes tucked under the feet. On the command ‘go’ the subject performed push ups with the arms and extended it completely. The legs and the back were kept straight throughout the test. Then the subject lowered his body using the arm until it came to 90 degree angle and upper arms were parallel to the ground. The action was repeated as many times as possible.

**Scoring:** Total number of correct push ups was recorded as the score of the test.
5. Sit and Reach Test

**Purpose:** To measure the flexibility of the subjects.

**Equipment:** Constructed box (12” x 12” x 21”) with measuring scale in which 23 centimeter is at the level of the feet.

**Procedure:** The subjects were asked to remove their foot wears and assume the long sitting position with the knees fully extended and feet against the apparatus with shoulder width apart. The subject’s arms were extended forward with one hand placed on top of the other, palms down, bending toward along with the measuring scale. Subjects were instructed to keep the palms even and slowly stretch forward four times and hold the position of maximum reach as the fourth count. The maximum reach was held for one second with the knees in full extension while the feet are in contact with the apparatus.

**Scoring:** The point zero was kept on the edge of the apparatus on the top, where the subjects kept their feet. From the zero point towards the other end of the apparatus it was marked positive and towards the body of the subject it was negative. If the subjects were unable to reach the top of the apparatus with their finger tips where zero was marked, the distance was counted in minus and if the subject crossed zero point further forward the maximum distance reached was measured to the nearest centimeter as positive.  

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6. **1000 Mtrs. Run/Walk**

**Purpose:** To measure cardiovascular endurance.

**Facilities and Equipment:** A track or an area within a football field or a square 50 yards on each side of a playground. Stop watch.

**Procedures:** Subjects may run individually or they may run in groups of a dozen or more. When subjects run in groups, they should be paired into partners. While one subject runs, the partner listens for the timer to call out his partner’s time when he crosses the finish line and relay this time to the scorer. Subjects may inter space running with periods of walking and should be encouraged to pace themselves. When a group is running, the timer can call out times as each subject crosses the finish line.

**Scoring:** The score is the elapsed time in minutes and second.
3.9 STATISTICAL ANALYSIS

The relationship between dependent variables (game performance) and independent variables (anthropometrical measurement, psychological and physical fitness variables) was established by computing Pearson’s Product Moment Coefficient of Correlation (r). For testing the hypothesis the level of significance was set at 0.05 and 0.01 levels. To determine the significance of the differences between the group means in different variables for the defenders, mid fielders and attackers, the One-way ANOVA (Analysis of Variance) was used for each variable separately. The significant was set at 0.05 and 0.01 levels of confidence. To see the significant difference between the mean scores among different play positions (defenders, midfielders and attackers) of football players, Scheffe test was used for post hoc analysis. To identify the significant predictors and to develop solutions for the regression equations of game performance of football players multiple correlation and regression was used. The data were analyzed by using SPSS (Statistical Package for Social Science) version 11.5.
Investigator measuring Body Weight of the subject

Investigator measuring Arm Length of the subject
Investigator measuring Leg Length of the subject

Investigator measuring Calf Circumference of the subject
Investigator administering 50 Yard Dash to measure speed

Investigator administering shuttle run to measure agility
Investigator administering standing broad jump to measure explosive power
South Zone Inter University Foot Tournament organized by University of Kerala

The coaches rating the performance of the players
The Investigator administering psychological questionnaires to know the achievement motivation, aggression and self confidence

Another view of the researcher administering psychological questionnaires to know the achievement motivation, aggression and self confidence