METHODOLOGY
Chapter III

In this chapter the selection of subjects, selection of variables, orientation of subjects, reliability of data, time schedule for collection of data, administration of the tests, and statistical techniques are discussed.

Selection of Subjects

The subjects for the present study were selected from the colleges and universities of Karnataka State by adopting purposive random sampling technique. Six hundred male sports persons from eight selected sports disciplines and three different levels, namely collegiate, university and state levels were used as subjects. They all volunteered to take part in the study. The number of sports persons tested in various selected sports disciplines and performance levels are given in table 1.

**Table 1**

**Number of Players Tested in Various Sports Disciplines and Performance Levels**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Sports Disciplines</th>
<th>Performance levels</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Collegiate</td>
<td>University</td>
</tr>
<tr>
<td>1</td>
<td>Athletics</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>2</td>
<td>Football</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>3</td>
<td>Hockey</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>4</td>
<td>Kabaddi</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>5</td>
<td>Kho-Kho</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>6</td>
<td>Swimming</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>7</td>
<td>Volleyball</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>8</td>
<td>Weight Lifting</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>200</td>
<td>200</td>
</tr>
</tbody>
</table>
The means and standard deviations of the physical characteristics of the sports persons tested are presented in Table 2.

### Table 2

**Means and Standard Deviations of the Physical Characteristics of the Sports Persons**

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Sports Disciplines</th>
<th>Physical Characteristics</th>
<th>Levels of Sports Persons</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Collegiate</td>
</tr>
<tr>
<td>1</td>
<td>Athletics</td>
<td>Height ( cms )</td>
<td>174.1 ± 4.11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Weight ( kgs )</td>
<td>60.2 ± 3.96</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Age ( years )</td>
<td>18.1 ± 1.83</td>
</tr>
<tr>
<td>2</td>
<td>Football</td>
<td>Height ( cms )</td>
<td>173.4 ± 3.63</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Weight ( kgs )</td>
<td>60.8 ± 5.51</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Age ( years )</td>
<td>17.6 ± 1.40</td>
</tr>
<tr>
<td>3</td>
<td>Hockey</td>
<td>Height ( cms )</td>
<td>174.1 ± 3.37</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Weight ( kgs )</td>
<td>60.9 ± 4.66</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Age ( years )</td>
<td>17.4 ± 1.48</td>
</tr>
<tr>
<td>4</td>
<td>Kabaddi</td>
<td>Height ( cms )</td>
<td>168.0 ± 4.32</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Weight ( kgs )</td>
<td>59.3 ± 3.51</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Age ( years )</td>
<td>17.6 ± 1.01</td>
</tr>
<tr>
<td>5</td>
<td>Kho-Kho</td>
<td>Height ( cms )</td>
<td>165.2 ± 2.83</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Weight ( kgs )</td>
<td>62.8 ± 2.41</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Age ( years )</td>
<td>17.2 ± 1.33</td>
</tr>
<tr>
<td>6</td>
<td>Swimming</td>
<td>Height ( cms )</td>
<td>179.3 ± 5.20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Weight ( kgs )</td>
<td>58.1 ± 3.18</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Age ( years )</td>
<td>16.8 ± 1.66</td>
</tr>
<tr>
<td>7</td>
<td>Volleyball</td>
<td>Height ( cms )</td>
<td>179.8 ± 4.10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Weight ( kgs )</td>
<td>63.3 ± 1.76</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Age ( years )</td>
<td>17.3 ± 1.21</td>
</tr>
<tr>
<td>8</td>
<td>Weight Lifting</td>
<td>Height ( cms )</td>
<td>170.6 ± 3.61</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Weight ( kgs )</td>
<td>55.6 ± 3.31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Age ( years )</td>
<td>17.8 ± 1.97</td>
</tr>
</tbody>
</table>
Selection of Variables

There are always some differences between two human beings. The differences can be either in height or weight or speed qualities or strength qualities or endurance qualities or flexibility or coordination or technical perfection or body composition or mechanical application or intelligence. Thus two human beings are never the same. This study took an approach towards this direction. The different coordinative abilities present among the collegiate, university and state level sports persons may be different in different sports disciplines. It is also to emphasise that the coordinative abilities of different sports persons, playing various games are also dominating in various degrees. Hence there is a strong influence of doing physical exercises to develop the dominating coordinative abilities for optimum performance.

In this study, sports persons who have taken part in the collegiate, university and state level competitions were considered as one of the categorical variables. Eight sports disciplines, selected for this study were considered as another categorical variable. The coordinative abilities selected for this study were kinesthetic differentiation ability of upper limbs, kinesthetic differentiation ability of lower limbs, space orientation ability, complex reaction ability and
dynamic balancing ability. The names of coordinative abilities and the tests conducted are given in table 3.

TABLE 3

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of the coordinative abilities</th>
<th>Name of the tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kinesthetic differentiation ability of upper limbs</td>
<td>Backward ball throw (BBT)</td>
</tr>
<tr>
<td>2</td>
<td>Kinesthetic differentiation ability of lower limbs</td>
<td>Jump down on the line (JDL)</td>
</tr>
<tr>
<td>3</td>
<td>Space orientation ability</td>
<td>Numbered medicine ball run (NMR)</td>
</tr>
<tr>
<td>4</td>
<td>Complex reaction ability</td>
<td>Ball reaction exercise (BRE)</td>
</tr>
<tr>
<td>5</td>
<td>Dynamic balancing ability</td>
<td>Balancing with long nose (BLN)</td>
</tr>
</tbody>
</table>

Even though there are more number of coordinative abilities mentioned in various literatures, the abovesaid important and very common coordinative abilities, as explained by Hirtz⁷ were used to find out the relationship between different selected sports disciplines and at different levels of performance.

Orientation of Subjects

Before the sports persons were subjected to the test procedure, all were very clearly and thoroughly oriented about the purpose of the study, that is, to find out the relationship of the

⁷ P. Hirtz, Koordinative Fähigkeiten im Schulsport, pp 132-141
coordinative abilities with different selected sports disciplines and at different levels of performance.

The investigator had explained about the tests and given the required instructions to the sports persons about the procedure to be adopted by them to complete all the tests. One trial was given to all sports persons before the actual test.

Reliability of Instruments and Tests

Standard instruments like electronic stop watch, steel tape and play equipment like medicine balls, base balls, football, jumping box, balancing beam, gymnastic mat and other materials like whistle, number plates, wooden planks, hoop, tape and wall bars were used to conduct the tests. All the instruments and equipment were in good working condition. They were tested and found to be accurate enough. The scholar learnt the procedure and methods to handle and operate the instruments to administer the tests. All the tests were conducted by the scholar himself. A pilot study was conducted with a mixed group of sports persons to test the reliability by test-retest method. The correlation coefficients obtained for test-retest data for the selected tests are presented in table 4.
Significant at +01 level of confidence

**Table 4**

**Intraclass Correlation Coefficients of Test - Retest Scores**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Tests</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Backward ball throw</td>
<td>.80*</td>
</tr>
<tr>
<td>2</td>
<td>Jump down on the line</td>
<td>.93*</td>
</tr>
<tr>
<td>3</td>
<td>Numbered medicine ball run</td>
<td>.91*</td>
</tr>
<tr>
<td>4</td>
<td>Ball reaction exercise</td>
<td>.94*</td>
</tr>
<tr>
<td>5</td>
<td>Balancing with long nose</td>
<td>.88*</td>
</tr>
</tbody>
</table>

* Significant at .01 level of confidence

**Time Schedule for Collection of Data**

All the sports persons were tested in the indoor hall of Sports Authority of India, Netaji Subhas Southern Centre, Bangalore, only in the evenings between 4.00pm and 6.30 pm. The collected data is entered in the individual performance card and the model card is given in Appendix A.

**Administration of the Tests**

1. **Backward Ball Throw Test**

**Aim**

To measure the kinesthetic differentiation ability of upper limbs.

**Equipment**

Medicine ball of 1 kilogram weight, one number. Base balls six numbers. Steel measuring tape. Gymnastic mat one number (2m x 1m) and a Hoop with 40cm diameter.
Procedure

A Gymnastic mat of 2m x 1m was kept on the ground widthwise, two metres away from the start line. The hoop was placed on the middle of the mat. A medicine ball weighing one kilogram was placed in the middle of the hoop. Each subject was given five chances. The subjects were asked to throw the base balls backwards over the head, aiming at the medicine ball, kept in the middle of the hoop, one after another, taking not more than 15 sec after each throw, which is given in figures 1.1 and 1.2.

When the thrown ball touched the medicine ball, four points were awarded. When the thrown ball touched the mat between the medicine ball and the hoop, three points were awarded. When the thrown ball touched the hoop, two points were awarded. When the thrown ball touched the mat outside the hoop, one point was awarded⁹.

Scoring

All the points scored were added and recorded as the total score in the individual performance card.

2. Jump Down on the Line Test

Aim

To find put the kinesthetic differentiation ability of lower limbs.

¹Ibid., p.132.
Figure 1.1
Backward Ball Throw
(Initial Position)
Figure 1.2
Backward Ball Throw
(Final Position)
**Equipment**

One vaulting box of 90cm height. Gymnastic mat. Steel measuring tape and Colour tape.

**Procedure**

The subjects were asked to jump down from a 90cm high vaulting box on a line marked one metre away from the base of the box on the gymnastic mat. This line was marked with the help of colour tape as shown in figures 2.1 and 2.2. Each subject was given two chances.

**Scoring**

The deviation from the marked line and the landing point was measured for both the chances and the average was recorded in the individual performance card.

3. **Numbered Medicine Ball Run Test**

**Aim**

To evaluate the space orientation ability

**Equipment**

Three kilogram medicine ball, five numbers. Four kilogram medicine ball one number, electronic stop watch, steel measuring tape, colour tape, whistle and number plates.

**Procedure**

Five medicine balls of 3 kilogram weight were arranged in a semicircle with a distance of 1.5 metres from the mid point of each ball.

*Ibid., p.133.*
Figure 2.1
Jump Down on the Line
(Initial Position)
Figure 2.2
Jump down on the line
(Final Position)
Single digit number plates were kept visible behind all the five balls. The sixth ball which is of four kilogram, was placed 3 metres from the ball kept at the centre, inside the semicircle. The sports person was asked to stand near that ball, facing the opposite side. On blowing the whistle, the sports person had to turn, try to run and touch the particular ball, the number of which was called out by the scholar, along with the signal. The stop watch was also switched on simultaneously. After touching the ball called by the scholar, the sportsperson had to run and touch the 4 kilogram medicine ball, which can be also called "leader ball". As the sports person touched the leader ball, the scholar called out another number and the sports person made an attempt to touch that ball which was kept near the particular number plate. He then rushed back and touched the leaderball. As he touched the leaderball, the scholar called out another number for the third time. Sports person ran, touched the ball and rushed back to touch the leaderball. When the sports person touched the leaderball the third time, the stop watch was switched off. The whole process continued without any break. This was considered as one chance. This is shown in figures 3.1, 3.2 and 3.3.

**Scoring**

Two chances were given to all the subjects. The least time was recorded. The number plates were interchanged after every chance, to ensure a fresh all-out trial.

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\(^{100}\) Ibid., p.134.
Figure 3.1
Numbered Medicine Ball Run
(Initial Position)
Figure 3.2
Numbered Medicine Ball Run
(Ball touching Position)
Figure 3.3
Numbered Medicine Ball Run
(Leader Ball Touching Position)
4. Ball Reaction Exercise Test

Aim
To assess the complex reaction ability

Equipment
Two wooden planks of four metre length, ten centimetres width, two centimetres thick, one football, steel measuring tape, wall bar of 120cm height and whistle.

Procedure
Two wooden planks were kept supported from the wall bar of 1.20 m high parallelly. The other end of the planks were supported on the ground. There was sufficient gap in between the planks for the football to roll freely. Graduated scales in centimetres, were fixed on the sides of the planks. The sports person was asked to stand on the starting point, which is 1.50 metres away from the lower end of the plank, towards the left side and facing the opposite side. The scholar stood near the top of the wooden planks, supporting a foot ball, kept in between the planks. As soon as the whistle was blown, the sports person turned around and rushed towards the wooden planks and tried to stop the rolling ball which was let loose by the scholar simultaneously. The ball must be stopped with both the hands as shown in figures 4.1 and 4.2101.

101 Ibid., p.136.
Figure 4.1
Ball reaction exercise
(Initial Position)
Figure 4.2
Ball reaction Exercise
(Final Position)
Scoring
The distance the ball travelled was measured from the graduated scale. Each subject was given two attempts. The least distance was recorded in the individual performance card.

5. Balancing with Long Nose Test

Aim
To measure the dynamic balancing ability

Equipment
One balance beam of 4 metres length, electronic stop watch, one medicine ball of 2 kilogram, one base ball, colour tape and whistle.

Procedure
The balance beam was kept on an even surface 10cm above the ground. A start line was drawn 1.50 metres away from one end of the beam. The 2 kilogram medicine ball was kept over the other end of the beam. The sports person was asked to stand behind the start line with his best hand stretched forward, parallel to the ground and supporting the base ball. The other hand is brought below the outstretched arm and was asked to hold the opposite earlobe. On blowing the whistle, the sports person had to run as fast as possible on the beam. On reaching the medicine ball, must push the ball down, turn
around and try to cross the start line as quickly as possible. This is shown in figures 5.1, 5.2 and 5.3\textsuperscript{102}.

**Scoring**

Time was taken for the whole exercise and recorded. Two attempts were given. The least time is recorded in the individual performance card.

**Statistical Techniques**

To find out the percentage of association, among different coordinative abilities from different sports disciplines and at different levels of performance, *Pearson Product Moment Correlation* was applied and then percentage was computed by using the formula $r^2 \times 100$.

To determine the dominating coordinative abilities in each sports discipline, *multiple stepwise logistic regression procedure* was applied. These two statistical applications are descriptive in nature.

The *goodness of fit test* was applied utilising the selected dominating coordinative abilities to compare the actual number of players possessing the selected dominating coordinative abilities with that of others, in all the selected sports disciplines.

\textsuperscript{102}Ibid., n.13A
Figure 5.1
Balancing with Long Nose
(Initial Position)
Figure 5.2
Balancing with Long Nose
(Ball Pushing Position)
Figure 5.3
Balancing with Long Nose
(Final Position)
Two way analysis of variance of independent group was applied to find out (1) Whether there was any significant variation in selected coordinative abilities among different sports disciplines (2) Whether there was any significant variation in the selected dependent variables at different levels of performance. (3) Whether there was any interaction between sports disciplines and levels of performance.

When the obtained 'F' ratios for sports disciplines and levels of performance were found significant, Scheffe's test of significance was applied as a post hoc test. When the interaction was found significant, simple effect test was applied.