Chapter III

Methodology

The methodology adopted by the researcher in making the selection of the subjects, selection of variables, collection of data, criterion measures, reliability of data, administration of tests, tester's reliability and the statistical techniques employed for the analysis of data have been explained in this chapter.

Selection of subjects

The subjects selected for this study were 120 elite female handball players who play in national premier and super leagues in Iran. The selection of the subjects was made on random basis. The subjects selected were in the age range of 18-25 years.

Selection of variables

Previous studies revealed that few psychomotor variables are related to performance. Therefore, in this research investigator selected the familiar psychomotor variables according to other related studies and available scientific literature pertaining to the area of this research, comprising, both the critical and the allied literature, from the various sources available in the Library of the University of Mysore in India and somewhere else too.

The investigator also had consultations and discussions with the experts in the field of research regarding the relevance and the appropriateness of variables for this work.

In the light of the experts' opinion, availability of subjects, administrative feasibility, measuring and recording the data, availability of testing equipment and
materials and also the availability of expertise, the following variables were selected for the purpose of this study:

Table 3.1: Variables, Tests and Criterion Measures

<table>
<thead>
<tr>
<th>No</th>
<th>Variables</th>
<th>Tests</th>
<th>Criterion Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Explosive power</td>
<td>Sargent jump (jump and reach test)</td>
<td>Centimeter</td>
</tr>
<tr>
<td>2</td>
<td>Speed of movement</td>
<td>Nelson Test</td>
<td>Centimeter</td>
</tr>
<tr>
<td>3</td>
<td>Agility</td>
<td>SEMO – Agility Test</td>
<td>Millisecond</td>
</tr>
<tr>
<td>4</td>
<td>Kinesthetic perception</td>
<td>Horizontal Space Test</td>
<td>Centimeter</td>
</tr>
<tr>
<td>5</td>
<td>Flexibility</td>
<td>Upward- Backward Movement of Arms Test</td>
<td>Centimeter</td>
</tr>
<tr>
<td>6</td>
<td>Orientation</td>
<td>Numbered Medicine Ball Run Test</td>
<td>Millisecond</td>
</tr>
<tr>
<td>7</td>
<td>Differentiation</td>
<td>Backward Medicine Ball Throw Test</td>
<td>Point</td>
</tr>
<tr>
<td>8</td>
<td>Rhythm</td>
<td>Straight and Rhythm Run Test</td>
<td>Millisecond</td>
</tr>
</tbody>
</table>

**Dependent and Independent variables**

The Performance was the dependent variable in this research.

The Psychomotor variables were the independent variables in this research.
Administration of tests

The administration of tests was done in coach camping in different cities of Iran. Sincere assistance and cooperation was wanted from the well qualified and trained personnel of Physical Education and the experts in the field of Handball, after thorough explanation and description of the testing procedures. Before the actual administration of tests, the subjects were given apt and sufficient instructions and were provided with adequate number of practice trials.

Procedure for administration of tests

1. Explosive Power: Sargent Jump Test

Objective:

To measure of the explosive power of the legs in a vertical jump

Equipment:

Measuring Tape; Chalk Powder; Pencil, paper, pad and Smooth vertical wall for making jump and reach

Procedure:

The subject stood with her side towards the wall with heels together on the floor. From this position, her standing reach was marked by making her reach as high as possible with heels completely intact with the floor and make a mark on the wall with the chalked tip of the finger. The subject then swung her arms forward and backward, took a crouched position with the knees bent at about right angle and leapt as high and quickly as possible with the upward swinging action of her arms and straightening of her legs. During the course of this explosive act, the subject made another mark on the wall with the same chalked finger at the highest point of her jump reach above the initial one made while in the position.
Figure 3.1: Perform of Sargent Test
Scoring

Each subject was given three consecutive trials and the best of this jump and reach was considered as the final score of the subject (Johnson & Nelson, 1979).

The distance between her standing reach and the jumping reach was recorded to the nearest centimeter as the score of the subject.

Explosive power of the subject was measured by using jump and reach test (Sargent Jump).

2. Speed of Movement: Nelson Speed of Movement Test

Objective:

To measure combined reaction and Speed of Movement of hands and the arms

Equipment:

Wooden meter scale; Table, chair and ruler; Measuring tape; Chalk/market; Pencil, paper, pad; and Quiet room for testing

Procedure:

The performer sat on the table with her hands resting on the edge of the table, palms facing each other with the inside of the little fingers 30 cm apart and first in lines marked on the table. The tester held the timer i.e., wooden meter scale near its top and it hung right midway between the subject's palms with the base line of the timer positioned evenly with the upper edges of the subject's index fingers. After the preparatory command 'ready' was given, the timer was dropped and the subject attempted with a horizontal movement and stopped it as quickly as possible by clapping the hands together. Twenty trials were given in all for every one of the subjects.
Figure 3.2: Perform of speed of movement Test
Scoring

The score for the combined response movement was read from the timer at the point just above the upper edge of the hand after the catch was made. The five slowest and the five fastest trials were discarded and an average of the middle ten – trial was recorded as the subject's score (Johnson & Nelson, 1979).

Instructions

1. The testing environment was such that the subject was able to concentrate.
2. Before the commencement of the actual test, all details of the test were clearly explained to the subject.
3. The subject was allowed a requisite number of practice trials just to familiarize herself the procedure.
4. The time interval between the preparatory command of "ready" and the release was extremely important. It was varied in order to prevent the subject from becoming accustomed to a constant pattern. On the other hand, this interval remained within a range of not less than 1/2 seconds and nor longer than 2 seconds.
5. Obvious anticipations were discarded and not counted as one of the twenty trials.
6. The tester was careful enough to see whether the subject's thumb or index finger touch the timer.
7. After the subject had her hands in the ready position, a 30 cm ruler was utilized to ensure that the hands are correctly placed apart.
8. A small mark made exactly in the center of this 30 cm line on the table (distance between the two hands) to facilitate the positioning of the timer before the release.
9. The subject was not allowed to wear any ring etc, during this testing procedure.

3. Agility: SEMO-Agility Test

Objective:

To determine the general agility of the body in maneuvering forward, backward and sideward movements

Equipment:

Stopwatch; Clapper; Measuring tape; Four card-board cones 9"*9" with 12" height placed squarely one in each corner of the rectangular floor marking; and Well-leveled and smooth area 12'*19'with adequate running space around it

Procedure:

The cones were placed squarely as shown in floor marking in figure 3.3. The subject was made to stand at the starting point with her back to the marked area. The subject on receiving signal "ready - go" from the tester, side-stepped from 'A' to 'B' and passed outside the corner cone at 'B'. Then from 'B' to 'D', the subject back-pedaled and passed to the inner side of the corner cone at 'D'. The subject then sprinted from 'D' to 'A' and after passing outside the corner cone at 'A', back pedaled the distance from 'A' to 'C' and passed inside of the corner cone at 'C'. The subject sprinted the distance between 'C' and 'B' and side-stepped the distance from 'B' to 'A' thereby reaching the finishing point (See figures 3.3 and 3.4).

Instruction

1. In performing the side-step the cross-over step was not allowed.

2. In performing back-pedal, the subject kept her back perpendicular to an imaginary line connecting the corner cones.
3. Although an incorrect procedure constituted an unsecured trial, the subject was tested till the completion of one legitimate trial.

4. At least one practice trial was given to every subject.

Scoring

The better of the two trials (recorded to the nearest 0.01 of a second) was recorded as the score of the subject (Johnson & Nelson 1982).

Figure 3.3: SEMO Agility Test Diagram
Figure 3.4: Perform of SEMO Agility Test
4. Kinesthetic Perception: Horizontal Space Test

Objective:

To measure the Kinesthetic Perception ability to determine specific positions along the horizontal line.

Equipment:

Yard stick; and Blindfolds and Chair.

Procedure:

The yard stick was placed on the wall so that it was approximately at eye level while the subject was in the sitting position. The subject was asked to sit the chair facing the yard stick and attempted to establish in her mind a sense of its position. While blindfolded and without a practice trial she pointed the index finger of her right hand to the point indicated by the tester.

Scoring

The score was the deviation from the desired mark measured to the nearest centimeter. The final score was the total of the deviations on three trials (Johnson & Nelson 1982).
Figure 3.5: Perform of Kinesthetic Perception Test
5. Flexibility: Upward- Backward Movement of Arms Test

Objective:

To measure the flexibility of the shoulder and shoulder girdles

Equipment:

Measuring tape, 2ft; Long stick; and Mat

Procedure:

The subject lay in a prone position on a mat with her chin touching the mat and her arms reaching forward directly in front of her shoulders. She held the stick horizontally with both the hands keeping her elbows and wrists straight and her chin on the mat; she raised her arms upward and backward as far as possible.

Scoring:

The vertical distance from the bottom of the stick to the mat was recorded in centimeters as the measure of flexibility of the shoulder and shoulder girdles (Johnson & Nelson 1982)
Figure 3.6: Perform of Flexibility Test
6. Orientation Ability: Numbered Medicine Ball Run Test

Objective:

To measure of the Orientation Ability of the subjects

Equipment:

6 Cone; Stopwatch; Five Card-board numbered plates (One sq. foot each); and Clapper, Pencil, paper and pad

Procedure:

All the medicine balls were arranged on an even and smooth piece of ground. Five medicine balls weighing three kg each were arranged in a semi-circle with a distance of one and half meters in between them. The sixth medicine ball weighing 4 kg was placed 3 meters away from all these 5 medicine balls, 3 kg each. Five cardboard numbered plates of one square foot size each were kept indicating numbers from 1-5 prominently on them. Before the start of the test, the subject stood behind the 6th or 4 kg center medicine balls facing toward the opposite direction i.e., with her back toward the ball. On signal, the subject touched the central ball, turned and ran towards the number called by the tester and touched that numbered ball and ran back to touch the central medicine ball. The moment the subject touched the 6th medicine ball, another number was called by the tester instantly. In the same way, the tester called the number of these (3 kg each) one by one, a total of three times in an indefinite sequence as decided by the tester herself and the subject performed accordingly (See figures 3.7 and 3.8).
Instructions

1. Prior to the commencement of the actual test, the tester explained the whole testing procedure.

2. One practice trial was also given to each one of the subjects.

Scoring

The time taken by the subject to complete the course (a total of three times) was recorded in seconds. Two trials were given to every one of the subjects. The better one of the two trials was considered the subject’s score (Hertz 1985).

Figure 3.7: Orientation Ability Test Diagram
Figure 3.8: Perform of Orientation Test
7. Differentiation Ability: Backward Medicine Ball Throw Test

Objective:

To measure of the Differentiation Ability of the subjects

Equipment:

A gymnastic mat (size 3'*6'); One 2kg medicine ball; Five Medicine balls (1kg); and Pencil, paper and pad

Procedure:

A gymnastic mat was placed two meters away from the throwing line and a circle with a radius of 40 cm was drawn in the center of the mat. A 2kg medicine ball was placed in the center of circle as shown in the floor pattern. The subject was made to stand behind the throwing the facing the opposite direction i.e., with her back towards the gymnastic mat, at a distance of two meters. The subject was then made to make five overhead throws with both the hands throwing one kg medicine ball each time in an attempt to target the 2kg medicine ball lying in the middle of circle drawn in the center of gymnastic mat (See figures 3.9 and 3.10).

Instructions

1. Prior to the commencement of the actual testing every subject was provided a practice trial.

2. The subjects were not allowed took back while making throws.

Scoring

The scoring of points consisted of the below given procedure (Hertz 1985).

1. Medicine ball touching the gymnastic mat = one point

2. Medicine ball touching the circle = two points
3. Medicine ball falling inside the draw circle = three points

4. Medicine ball touching the 2kg medicine ball placed in the circle = four points.

5. Points were decided considering the first pitch of the ball. The score of the subject was the total points scored in all the five attempts.

Figure 3.9: Differentiation Ability Test Diagram
Figure 3.10: Perform of Differentiation Test
8. Rhythm Ability: Straight and Rhythm Run Test

**Objective:**

To measure the Rhythm Ability of the subject

**Equipment:**

Stopwatch; Measuring tape; Clapper and Eleven gymnastic hoops of one meter diameter each

**Procedure:**

The subject had to run a distance of 30 meters with maximum sprinting speed, marked between the two lines. The sprinting time of each subject was taken with the help of a stop watch. In the second attempt, the subject ran at a particular rhythm with maximum speed through eleven gymnastic hoops of one meter diameter each arranged systematically as shown in the fig., 13. Three hoops were kept in a sequence adjacent to each other at a distance of 5 meters from the starting line. Similarly another three hoops were placed 5 meters prior to the finish line. Five more hoops were arranged sequentially in the middle of the running distance. The subject had to run these hoops by stepping in each one of them adjusting herself to new self – rhythm (See Figures 3.11, 3.12 and 3.13).

**Instruction**

1. Before putting the subject to the actual test, the tester explained the test through demonstration.

2. Each subject was given one practice of straight run and rhythm run.
Scoring

The time difference between the straight run and the rhythm run was taken as the true score of the subject.

Figure 3.11: Rhythm Ability Test Diagram
Figure 3.12: Perform of Rhythm Test without hoops

Figure 3.13: Perform of Rhythm Test with hoops
Construction of Rating Scale

The Handball playing ability of the subjects was assessed by the application of a Handball Rating Scale. Handball performance (rating scale) was prepared by a panel of experts comprising two experienced Handball coaches and a very Senior National Level Handball player. With the help of this Rating Scale, the researcher enabled herself to assigning a numerical (quantitative) value to the subjective (qualitative) judgment of the experts. The objective, description and the scoring of the Handball Rating Scale is mentioned below:

Objective of Rating Scale

Handball Rating Scale was used to measure the overall playing ability of subjects through the subjective evaluation of the experts in the field of Handball.

Description of Handball Rating Scale

Each of the seven components of Handball playing ability namely 1- Passing, 2- Dribbling, 3- Shooting Penalty, 4- Shooting 9m, 5- Defense, 6- Offence, 7- Overall game had a point value of 5 and was scored on a 5-4-3-2-1 basis as given under:

5 point: Exceptional ability, near perfect for the age and sex of the subject.

4 point: Above average ability, not perfect, but quite skillful for the age and sex of the subject.

3 point: Average ability, typical for the age and sex of the subject.

2 point: Below average ability, characterized by more mistakes than was typical for the age and sex of the subject.

1 point: Inferior ability, far below typical performance for the age and sex of the subject.
Scoring:

The scoring for each of the subjects was done strictly in accordance with the distribution of points as given against each subheading of the 3 components of Handball playing ability by engirding the appropriate score.

<table>
<thead>
<tr>
<th>Table 3.2: Handball Rating Scale</th>
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<tbody>
<tr>
<td><strong>Skills</strong></td>
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<td><strong>Passing</strong></td>
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<tr>
<td><strong>Dribbling</strong></td>
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<tr>
<td><strong>Shooting penalty</strong></td>
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<td><strong>Shooting 9m/6m</strong></td>
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<td></td>
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<td><strong>Defense</strong></td>
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<td><strong>Offense</strong></td>
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<td><strong>Overall game</strong></td>
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<tr>
<td></td>
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<tr>
<td><strong>Total Score</strong></td>
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</tbody>
</table>
Methodology

Table 3.3: Scoring schedule

<table>
<thead>
<tr>
<th>Level of ability</th>
<th>Very poor</th>
<th>Poor</th>
<th>Good</th>
<th>Very good</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scores</td>
<td>20 and below</td>
<td>21 - 25</td>
<td>26 – 30</td>
<td>31 – 35</td>
<td>36 and above</td>
</tr>
</tbody>
</table>

Criterion Measures

Handball playing ability of the subjects was assessed by using a Handball Rating Scale.

Collection of data

Before the administration of tests for the collection of data, the research scholar had a meeting with her subjects, experts and other technical personal of physical education to ensure sincere efforts on their part. She explained to them in plain and simple words the purpose and significance of the research work being undertaken, by her. The procedure of tests was also explained to them in detail so as to remove any sort of doubt or ambiguity regarding the efforts and hard work they had to put in for the successful completion of this investigation. The subjects were fully convinced and assured the investigator of their sincere and whole-hearted cooperation. The technical staff comprising the coaches in Handball and other trained officials in the field voluntarily agreed to extend their full cooperation and earnest assistance in the interest of this scientific investigation.

Even though no motivational technique was employed in the study the subjects were found to be encouragingly enthusiastic and cooperative throughout this project.
The experts were quite independent of one another while making their subjective evaluation of subjects' overall playing ability using Handball rating scale. They submitted their evaluation after observing and evaluating them in game situations. Then the investigator worked out the final grading by averaging the three independent observations. This averaged evaluation of the subjects' Handball playing ability served as the criterion for the purpose of this study.

In order to ensure uniform conditions for all the subjects, the tests were administered in the morning session between 8 to 12 pm. The duration of the test was adjusted in such a way so that fatigue could be avoided. Sufficient time was provided in between the tests to enable the subjects to put in their best efforts.

The subjects took the entire test in their proper playing – kit. No special motivational technique was used to enhance their performance but the tests proved to be so relevant and appropriate that subjects performed each test with considerable degree of zeal and enthusiasm and in the true sporting spirit.

**Reliability of tests**

The tests used in this research study for the collection of data were the standardized tests and hence the data obtained through their administration was quite reliable.

The tests were administered by the same tester under similar conditions for all the psychomotor variables.
Statistical Techniques used for Analyses of Data

1. Descriptive statistics was employed for psychomotor variables data and elite female handball player's Performance.

2. Pearson's correlation was used for finding out relationship between psychomotor variables and elite female handball player's Performance in different positions.

3. One-way ANOVA test was used for finding out significant differences between psychomotor variables and elite female handball player's Performance in different positions and also scheffe's post hoc test was performed.

4. Stepwise multiple Regression analyses were made for psychomotor variables to predict elite female handball player's Performance.

5. All statistical analyses are carried out with the SPSS (version14) statistical package (SPSS Inc., Chicago, IL).