CHAPTER - III

METHOD AND PROCEDURE

The material and methods used to arrive at the results of the study are discussed in this chapter. These include the selection of subjects, selection of motor fitness variables, criterion measures, reliability of data, collection of data and statistical procedure used for analyzing the data.

Selection of subjects

To accomplish the study random sampling technique has been used to select the subjects. The subjects were thirty-two male and twenty-two female inter college level table tennis players between 18 to 25 years of age. These students were studying in various affiliated colleges and various Departments of Panjab University, Chandigarh. All the players used as a subject had participated in the Panjab University inter college Table tennis competition for men and women during the month of September year 2003.

All the subjects were ensured about their health status from college and department health record, which was regularly maintained by their respective colleges and departments, and it was found that all the selected subjects were medically fit for going through the testing procedure.

Prior to the administration of test, the requirements of the testing procedure were explained to them in details, so that there was no ambiguity in their mind regarding the efforts required of them and the strain that they had to endure in addition to their participation in the competition. All the subjects agreed voluntarily to cooperate in testing procedure explained to them in the interest of scientific investigation and enhancing their own performance. Though no special techniques were
used to motivate the subjects to put in their best efforts, the subjects were enthusiastic and cooperative throughout the project.

**Selection of Motor fitness Variables**

The selection of motor fitness variables was done by using the following criteria:

The research scholar gleaned through the scientific literature pertaining to motor fitness variables from different library sources available at the library of the department of Physical Education, Panjab University, Chandigarh and library of N.S.N.I.S Patiala and also consulted experts in these area to select motor fitness variables regard to the purpose of the study. Along with the said literature and expert opinion, the administrative feasibility in term of availability of instruments and expertise for measuring and recording of data was also given due consideration while selecting motor fitness variables.

Based on the above-mentioned criteria the following variables were selected.

**Independent variables**

**Motor fitness variables**

1. **Speed**
   a. Reaction ability.
   b. Speed of movement.
   d. Acceleration speed.

2. **Flexibility**
   a. Wrist flexibility.
      - Planter flexion
      - Dorsi flexion
   b. Trunk flexibility.
3. **Power**
   a. Leg explosive power (Vertically)
   b. Leg explosive power (Horizontally)

4. **Agility**
   a. Running and Changing direction
   b. Lateral movement

5. **Endurance**
   a. Agility and Speed Endurance
   b. Abdominal muscle strength and endurance

**Criteria Measure**

The criterion – measure for the study was - Overall table tennis playing ability.

**Reliability of Data**

The reliability of data was ensured by establishing the instruments reliability, tester competency and reliability of tests and subject reliability.

**Equipment and Instrument Reliability**

Stopwatch, Flexo measure case with Yard stick, Scale, Goniometer etc were obtained from standard firm which cater to the needs of various research laboratories in India. The reliability of these instruments and equipments was ensured and calibrated by their manufacturers and their reliability was further ensured by their repeated use on the same subject by the same tester under similar condition.

**Tester Competency and Reliability of the tests**

The tester competency was evaluated with the reliability of tests. To determine the reliability of tests, the scholar recorded the performance of five subjects selected at random on the selected variables twice under similar condition. A Person’s Product Moment Coefficient of Correlation
was computed between the two measures of each variables and these reliability coefficient has shown in table no. 3.1.

**Table 3.1**

**Reliability coefficient of test – retest scores of test variables**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Test Variables</th>
<th>Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Speed of Reaction. (Nelson Hand Reaction Test)</td>
<td>.925</td>
</tr>
<tr>
<td>2</td>
<td>Speed of Movement. (Nelson Speed of Movement Test)</td>
<td>.891</td>
</tr>
<tr>
<td>3</td>
<td>Choice – Response –Movement Ability. (Nelson Choice-Response Movement Test)</td>
<td>.882</td>
</tr>
<tr>
<td>4</td>
<td>Acceleration Speed. (30m Fly Start)</td>
<td>.891</td>
</tr>
<tr>
<td>5</td>
<td>Wrist Flexibility. (Wrist Planter flexion)</td>
<td>.95</td>
</tr>
<tr>
<td>6</td>
<td>Wrist Flexibility. (Wrist Dorsi flexion)</td>
<td>.95</td>
</tr>
<tr>
<td>7</td>
<td>Trunk Flexibility. (Bend and Reach Test)</td>
<td>.94</td>
</tr>
<tr>
<td>8</td>
<td>Power. (Sargent Jump)</td>
<td>.93</td>
</tr>
<tr>
<td>9</td>
<td>Power. (Standing Broad Jump)</td>
<td>.93</td>
</tr>
<tr>
<td>10</td>
<td>Agility. (Shuttle Run)</td>
<td>.89</td>
</tr>
<tr>
<td>11</td>
<td>Lateral Movement. (Side Step Test)</td>
<td>.91</td>
</tr>
<tr>
<td>12</td>
<td>Agility and Speed endurance. (Side Stepping Test)</td>
<td>.90</td>
</tr>
<tr>
<td>13</td>
<td>Abdominal Muscle Strength Endurance (One Minute Sit Ups Test)</td>
<td>.98</td>
</tr>
</tbody>
</table>

The correlation coefficient indicated that the reliability of test and retest scores was found very high.
Subjects Reliability

The above test-retest coefficient of correlation method also established that subjects reliability was significant at .01 level of confidence, as the tester used the same subjects under similar conditions and no motivational technique was used nor any training was given.

Tools used to measure the motor fitness variables

Speed
Reception time (Nelson Hand Reaction Test 1967): To measure the speed of reaction with response to a visual stimulus.

Speed of movement (Nelson Speed of Movement Test 1967): To measure combined reaction and speed of movement of the hands.

Choice-Response-Movement ability (Nelson Choice-Response Movement Test 1967): To measure the ability to react and move accurately in accordance with a choice stimulus.

Acceleration Speed (30m Fly start): To measure the acceleration speed.

Flexibility

Wrist Planter Flexion: To measure the wrist planter flexion of the playing hand.

Wrist Dorsi Flexion: To measure the wrist dorsi flexion of the playing hand.

Trunk Flexion Test (Bend and Reach Test): To measure the trunk flexibility in a standing position.

Power

Sargent Jump Test (Sargent, D.A. 1921): To measure the leg explosive power vertically.

Standing Broad Jump (AAHPER Youth Fitness Test Battery 1976): To measure leg explosive power horizontally.
Agility

**Shuttle Run Test** (AAHPER Youth Fitness Test Battery 1976): To measure the agility of the subjects in running and changing direction.

**Side Step Test** (Modified Test of HD Edgren (1932) by Johnson and Nelson): To measure the rapidity by which lateral movements can be made and change to the opposite direction.

Endurance

**Side Steping Test** (North Carolina Fitness Test Battery 1961): To measure speed endurance while performing lateral movements.

**Sit Ups Test** (AAHPER Youth Fitness Test Battery 1976): To measure abdominal muscle strength and endurance.

**Tools used to measure the overall table tennis playing ability**

Average of cumulative points scored by each players in the Panjab University Inter-college table tennis competition for both men and women in year 2003.

**Administration of tests and collection of data**

The required data were collected through administration of tests for the selected motor fitness variables. All the tests were administrated ten days before and during the Panjab University inter college table – tennis tournament for both male and female. This period was considered to be the best time for the collection of data for the main reason that the players had entered the competition period after having acquired optimum fitness. The impact of their training and conditioning had reached the peak level during that period. They were in position to respond to the load of tests without undue fatigue. The subjects appeared in the test in their full playing kit.

Before the administration of the tests the scholar gave the subjects brief introduction about all the test items. Doubt if any, was cleared. The tester herself given the proper demonstration about each and every test
items and also given a chance to practice the prescribed test so that they become familiar with the tests and knew exactly what was required to be done. To ensure uniform testing conditions the subjects were tested only during the evening sessions.

**Reaction Time** (Nelson Hand Reaction Test)

The purpose of this test was to measure the hand reaction time of the subjects.

**Equipment**

50-centimeter scale with a concentration zone was marked at 20cm of the scale, chair and table.

**Description**

The subject was asked to sit on a chair with his/her forearm and hand resting on table. The tips of his/her thumb, index figure and forefinger were held in a ready position about 10 centimeters beyond the edge of the table. The upper edge of thumbs and index finger was kept in a horizontal position. The scale was held near the top, keeping it in between the subject thumb and index finger with the base line ('0' cm mark) even with the upper surface of the thumb. The subject was directed to look at the concentration zone (which was black shaded zone about 20cm above the base of the scale) and was told to catch the scale by pinching the thumb and index finger when it was released. Figure 3.01, 3.02 and 3.03 illustrated the methodology for speed of reaction test.

**Scoring**

When the subject caught the scale, the score was readied just above the upper edge of the thumb in centimeters. The score of the test was the average of the five trials.
Speed of Reaction Test

Fig. 3.01: Position of the hand

Fig. 3.02: Position of the scale

Fig. 3.03: Holding of the scale
**Speed of Movement** (Nelson Speed of Movement Test)

The purpose of this test was to measure the subjects combined reaction and speed of movement of the hands.

**Equipment**

50-centimeter scale with a concentration zone was marked at 20cm of the scale, chair, table and marker.

**Description**

The subject sits on a chair with his/ her hands resting on the edge of the table. Palms of the hands facing to each other with the inside borders of the little fingers along the two parallel lines which were marked on the edge of the table which was 12 inches apart.

The scale was held near the top, keeping it in between the subject both hands and the base of the scale ('O' cm mark) was parallel to the upper edge of the palm. The subject was directed to look at the concentration zone (which was black shaded zone about 20cm above the base of the scale) and was told to catch the scale in between the palms, when it was released. Figure 3.04 and 3.05 illustrated the methodology for speed of movement test.

**Scoring**

When the subject caught the scale the score was readied just above the upper edge of the hands in centimeters. The score of the test was the average of the five trials.
Speed of Movement Test

Fig. 3.04: Position of the hand on the table

Fig. 3.05: Holding of the scale
Choice-Response-Movement Ability: (Nelson Choice-Response-Movement Test)

The purpose of this test was to measure the subject’s ability to react and move quickly and accurately in accordance to the given stimulus.

**Equipments**

Stop watch, measuring tape and marking tape or Lime Powder.

**Description**

The subject faces the tester while in standing crouch guard position at a marked spot exactly between the two side lines (parallel lines) which were 14 yards apart from each other as shown in figure 3.06 the tester hold the stop watch in her upraised hand. The tester then abruptly waves her arm to either the left or right and simultaneously start the stopwatch. The subject responds to the hand signal and ran as quickly as possible towards the indicated direction to cross the side boundary line mark tester stopped the watch as the subject crosses the correct line. If the subject ran towards the wrong side even then the watch will run as its. Until, the subject reverses the direction and reach to the correct sideline.

**Scoring**

The score in each trail was elapsed time required to complete each trial. Score was recorded to the nearest hundredth of a second for each trial. The final score was the average of ten given trials, five to each side, but in random sequence.
Nelson Choice-Response-Movement Test

Fig. 3.06: Marking for Nelson Choice-Response-Movement Test
**Acceleration Speed (30m Fly start)**

The purpose of this test was to measure the acceleration speed ability of the subjects.

**Equipment**

Clapper, marking tape, measuring tape and stopwatch.

**Description**

On the track, a 30m distance was marked with starting and finishing lines. After a short warm up, the subject took their position, behind the starting line. On the sound of the clapper the subject started their race ran as fast as possible up to the finishing line only two players were made to ran at one time. This is illustrated in figure 3.07.

**Scoring**

The time was recorded to the nearest one hundredth of a second.

**Flexibility**

**Wrist Flexion**

The purpose of this test was to measure the wrist planter flexion of the subject’s playing hand.

**Equipment**

Double armed Goniometer, bench and table.
30 Meter Fly Start

Fig. 3.07: Marking for 30 Meter Fly Start
Description

The subject was asked to sit on a bench putting his/her forearm forward on the table with thumb closed together. The elbow was kept flexed. The fixed arm of the Goniometer was placed on the radial bone and moving arm in line with the thumb so that axis of the Goniometer fell on the wrist joint.

The subject was asked to complete flex his/her wrist to the maximum, so that the thumb arm of the Goniometer moved on the protector along with the thumb.

Scoring

The degrees indicated by the moving arm on the protector were recorded as scores.

Wrist Extension

The purpose of this test was to measure the wrist dorsiflexion of the subjects playing hand.

Equipment

Double-armed Goniometer, bench and table.

Description

The subject was asked to sit on a bench putting his/her arm forward on the table with thumb closed together the elbow was kept flexed. The fixed arm of the Goniometer was placed on the radial bone and moving arm in line with thumb so that axis of the Goniometer fell on the wrist joint, the subject was asked to dorsi flex or gave extension to his/her wrist to maximum, so that the arm of the Goniometer moved along with the thumb on the protector.
**Scoring**

The degrees indicated by the moving arm on the protector were recorded as score.

**Trunk flexibility** (Bend and Reach Test)

The purpose of this test was to measure the subject's trunk flexibility.

**Description**

A 40 inches scale, marked in half inch units, was fixed on the front side of the bench, so that half the scale was above the bench and half, below it in a vertical position, then subject was asked to stand erect on bench with toes even with the front edge of the bench and against the backside of the scale. He/she bent the trunk forward, with fingers in the front of the scale. The subject then slowly reached downwards as much as possible, the fingers tips of both hands moved parallel to and equally downward on the scale. He/she was not permitted to flex their knees. Figure 3.08 illustrated the methodology for bend and reach test.

**Scoring**

The best scores of three trials was recorded to the nearest of half of an inch, as indicated by the middle fingers whenever completely rested on the scale.
Bend and Reach Test
Power

Explosive Leg Power Vertically Upward (Sargent Jump)

The purpose of this test was to measure the subject legs explosive power vertically upward.

Equipment

Measuring tape, several pieces of chalk and a smooth wall surface of at least '12' feet from the floor were required.

Description

The subject stood with one side towards a wall, heels together and hold a piece a chalk in hand nearest to the wall, keeping the heels on the floor, he/ she reached upward as high as possible and made a mark on the wall. The subject then jumped as high as possible and made another mark on the wall. This is illustrated in fig. 3.09.

Scoring

The number of inches between the reach and jump mark measured to the nearest half of an inch as the score. Three successive trials were given and the best trial was recorded as the score.
Sargent Jump

Fig. 3.09

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Explosive Leg Power Horizontally (Standing Broad Jump)

The purpose of this test was to measure the subject's leg explosive power horizontally.

Equipment

Marking tape, chalk, mats or an outdoor jumping pit.

Description

Subject was asked to stand behind the take off line with his/ her feet comfortably apart. Before jumping the subject was allowed dipping at the knees and swinging the arms backward. He/she then jumped forward by simultaneously extending the knees and swinging the arms forwards to cover maximum possible horizontal distance while, landing on both the feet. This is illustrated in Fig. 3.10.

Scoring

The score was distance between take-off line and the nearest point where any part of the subject body touched. The score measure to nearest of inch. Three successive trials were given and best of three was recorded as a subject score.
Standing Broad Jump

Fig. 3.10
Agility

Shuttle Run

The purpose of this test was to measure the agility of the subjects in running and changing direction

Equipment

Marking tape, clapper, stopwatch and two wooden block (2”X2”X4”)

Description

Two parallel lines were marked, five centimeters thick and 30 feet’s apart on smooth play field. The subject was asked to take any position behind the starting line. The research scholar gave command ‘ready’ and then clapper sounded. At this, the subject started running and at the same time the time keeper started the watch, as the runner crossed the line, he/she picked one wooden block and come back to the starting line, placed the block behind the starting line and ran back to pick the second block and this time he was permitted to carry it across the starting line. The timekeeper stopped the watch when he/ she crossed the starting line second time. Each subject was given two trials. Fig.3.11 has illustrated the marking area for shuttle run test.

Score

The time was recorded to nearest one hundredth of a second. The best time, out of two trials was recorded as the subject scores.
Shuttle Run

Fig. 3.11: Marking for Shuttle Run Test
**Lateral Movement** (Side Step Test)

The purpose of this test was to measure the lateral movement and quick change of direction moving ability of the subject’s.

**Equipments**

Marking tape, measuring tape and stop watch.

**Description**

Two parallel lines was marked on the floor which was 12 feet apart named ‘X’ and ‘Y’ and three more line was marked of one feet from ‘X’ to ‘Y’ with a distance of 3 feet’s as illustrated in fig.3.12. Subject stood at the outside line ‘X’ and on the command of ‘Go’ ran towards the centre mark i.e. ‘B’ and after reaching their, change his/her body stance and start doing side step movement towards right until his/her feets crossed the out side line ‘X’ and then again side steps to the left until his/her foot touched or crossed the outside line to the left i.e. ‘Y’. He/she performed these movements as rapidly as possible for only 10 seconds.

**Scoring**

A one-foot tick mark placed (‘A’ & ‘C’) between the centre line (B) and each outside line (‘X’ & ‘Y’) to facilitate the scoring process. Each trip from the centre line (‘X’ & ‘Y’) to facilitate the scoring process. Each trip from the centre line across and marked line counts as one. Score was number of mark crossed by the subject within 10 seconds. Two trials were given and best of two recorded as subject score.
Lateral Movement for 10 Sec.

Fig. 3.12: Marking for side step test (Lateral Movement for 10 Sec.)
**Endurance**

**Agility and Speed Endurance** (Side Stepping Test)

The purpose of this test was to measure the subject speed endurance while performing lateral movements.

**Equipments**

Marking tape, measuring tapes, and stop watch.

**Description**

Two parallel lines were marked on a smooth play field, which were 10 feet's apart. Subject stood with one foot touching a sideline. On the command ‘Go’ he/she moved sideward with a side-stepping or lateral movements up to another sideline and crossed the line. He/she then again moved back with lateral movements to the other sideline. Subject performed these movements up to 30 seconds. One point was given each time subject touched the sideline. Two trials were given. Figure 3.13 has illustrated the marking area for side stepping test.

**Scoring**

Score was number of one-way trips performed by the subject within 30 seconds. Best of the two trials was recorded as subject's score.
Side Stepping Test

Fig. 3.13: Marking for side stepping for 30 Sec. test
**Abdominal Muscle Strength and Endurance** (Sit-ups Test)

The purpose of this test was to measure the subject's abdominal muscle strength and endurance.

**Equipment:**

Mats and Stopwatch

**Description**

Subject lies in supine position on the mat with his/her knees flexed, made an angle of 90° approximately between the thighs and the lower legs. His/Her hands were behind the neck with fingers interlocked. One person held the feet's of the subject. From this position, the subject raised his/her upper body till chest touched the thighs of the subject. This whole movement constituted one-sit up. The upper body was lowered again to the starting position in which shoulders touched the mat or floor. In this manner the subject did as many repetitions as possible within one minute Fig 3.14. Illustrated the methodology for sit up.

**Scoring**

Total number of sit-ups performed in one minute was the scores of the subject.
Sit-ups

Fig. 3.14
Overall Table Tennis Playing Ability (Points Scored in the Panjab University Inter-college Table Tennis Competition for Men and Women)

The purpose of this procedure was to evaluate the subjects overall table tennis playing ability.

Equipment

Score sheet, Match fixtures, Pen, Table and Chair.

Description

The overall table tennis playing ability was evaluated during Panjab University inter-college table tennis tournament for men and women in the month of September 2003. The record of cumulative scores of each player were prepared. The scores of each match taken together were considered as cumulative scores.

Scoring

Average of cumulative point scored were considered as final scores for the analysis purposes.

Statistical Analysis

The relationship between dependent variable i.e. overall table tennis playing ability and independent variables i.e. Motor fitness variables was established by computing Pearson’s Product Moment Coefficient of Correlation (Zero order). The combined contribution of all the motor fitness variables to overall table tennis playing ability was obtained through multiple correlations. Most versatile motor fitness variables as predictors to the overall table tennis playing for male and female were obtained through multiple step-wise regression. Regression equation for both male and female were also drawn on the basis of predicted motor fitness variables.