CHAPTER - III
PLAN AND PROCEDURE

In the previous chapter a brief review of the available literature on motor fitness has been given. The motor fitness programme is not a usual feature in Indian educational institutions. It is not a common feeling that the physical fitness is for players only, general student body has to do nothing with it. Therefore, a few physical fitness and motor fitness programmes runs in educational institutions. The specific fitness test batteries usually require vast play field, costly equipment and lots of time to organize them.

The purpose of this study was to find a solution for several difficult problems stated above. An attempt has been made to provide specific fitness test items for easy assessment of performances.

In this chapter the procedures adopted for selection of test items, selection of subjects, demonstration and practice of tests, administration of tests and collection of data, training of researcher’s assistance, tools used in the study and reliability of data have been explained in detail. The descriptions of test items and statistical design have also been described.

The First Phase of The Study (Pilot study)

Initially 35 specific fitness tests, predicted to measure seven components of motor fitness of school girl’s hockey players, were selected by the investigator. This process of selection of test items was done by the researcher through consulting the experts, study of related literature and also researcher’s own experience in the field. The criterion used while
selecting the different test variables was the face validity of the respective test.

**Pilot Study**

In order to know the theme of study, to acquaint well with the procedure, to understand better the processing of data, to identify the administration difficulties of the selected test variables etc. A pilot study was conducted by the investigator.

**TOOLS TO BE USED FOR PILOT STUDY WORK**

**SPEED TEST**

- 30 Meter Run
- 40 Meter Run
- 50 Meter Run
- 60 Meter Run
- Tapping By Leg

**STRENGTH TEST**

- Push Up
- Sit Ups Bent Knee
- Two Hand Basketball Throw
- Two Hops By Dominant Leg
- Shot- Put

**ENDURANCE TEST**

- 50 Meter Hopping
- 800 Meter Run
- One Leg Raise
- 2.4 Kilo Meter Run
- 600 Meter Run/Walk
AGILITY TEST

- Shuttle Run
- Agility Test I
- Agility Test II
- Agility Cycle
- Illinois Agility

FLEXIBILITY TEST

- Bend Twist Touch
- Trunk Extension
- Shoulder Lift/Extension
- Sit And Reach
- Groin Flexibility

POWER TEST

- Two Hand Medicine Ball put
- Standing Broad Jump
- Vertical Jump
- Over Head Medicine Ball Throw Sitting (2 kg)
- Two Hops By Both Legs

CO-ORDINATION TEST

- Burpee Squat Thurst
- Alternative Hand Wall Toss
- Sideward Jump
- Reaction speed
- Tapping By Hand
RELIABILITY OF DATA

The reliability of data was ensured by the instrument reliability and tester competency.

INSTRUMENT RELIABILITY

The stop watch, measuring tape, medicine ball, basket ball, whistle and the like used in this study were calibrated. The material used of fine quality. Thus the instruments were considered reliable for the purpose of the study.

Pilot study helped the researcher to know and infer the following for the main study:

1. The student’s behavior and their limitations while performing test items.
2. Enabled the researcher to modify test items to the required standard for the present study.
3. To plan well in advance the mode of administration of 19 test items at different identified Haryana district schools.
4. To organize smoothly the administration of different tests as per the capacity of the students.
5. Enabled the investigator to acquaint well with the advanced statistical procedures and interpretations such as co-efficient correlation method.
6. To motivate the students to get their maximum performance on the test items.
Selected 35 test items were administered to 30 girls, of schools having good reputation, at Haryana state. The tests were administered on two consecutive days, two sessions per day and by giving sufficient rest between the tests. Proper measure had been taken to motivate the girl’s players to perform their best on test items. This select-band of players will be, then, made to try all the variations so that the valid-most test form(s) could be retained for finalization of the whole battery.

**THE OBJECTIVITY AND RELIABILITY OF TEST ITEMS**

The collected data in the pilot study of 30 girls hockey players between the age of 13 to 15 years of Haryana. The co-efficient co-relation between all 35 tests of seven components was made by the statistical technique. Similarly reliability of all 35 factors also searched through the reliability statistical technique. Reliability is usually measured in terms of correlation co-efficient between the first and second measure. The higher the correlation, the more similar the measurements are and therefore the greater is the test-retest reliability. When ‘r’ is closer to 1 it indicates a strong positive relationship. A value of ‘0’ indicates that there is no relationship. Values close to ‘-1’ signal a strong negative relationship between two variables.

Objectivity of the test was obtained by administering the tests by two testers, who gave their independent judgment of the same sample. In addition to this the researcher also concentrated his mind towards general physical fitness factor. Age, height and weight were also considered in the present study.

**Objectivity and Reliability**

Zuidema¹ found trial stability to be an important factor in assessing an
unbiased estimate of test reliability. She also argues that “the choice of a stable measurement schedule in research and measurement involving the investigated physical fitness test requires more trials. Pre-test administrations are recommended in test and measurement books.” Keeping this in view, sufficient pre-test practice and greater number of trials were given for the students while estimating the objectivity and reliability of test variables. Best of 2-4 trials, was considered in calculating the objectivity and reliability of test variables. Co-relation co-efficient were obtained by using product-moment method.

Objectivity and Reliability co-efficient of 35 tests are presented in Table 4.13. 30 meter Run, Two Hops by Dominant Leg, 50 meter Hopping, One Leg Race, Shuttle Run, Illinois Agility Run, Trunk Extension, Shoulder Lift/Extension, Groin Flexibility Test, Two Hand M. Ball Put, Two Hops by Both Legs, Burpee Squat Thrust, Sideward Jump and Tapping by Hand, show very low correlation as far objectivity and reliability concerned. Tapping by Leg and Sit Ups Bent Knee tests shows an almost negligible correlation in objectivity and reliability.

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1Marvin Albert Zuidema, ‘An analysis of the influence of various measurement factors upon the Reliability and Efficacy of selected physical efficiency tests.’ Dissertation Abstracts International, XXXII(August, 1971), 778-A
### TABLE-3.1
OBJECTIVITY AND RELIABILITY CO-EFFICIENT OF TEST VARIABLES

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Test Variables</th>
<th>No. of Samples</th>
<th>Objectivity</th>
<th>Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>30 Meter Run</td>
<td>30</td>
<td>0.44</td>
<td>0.48</td>
</tr>
<tr>
<td>2.</td>
<td>40 Meter Run</td>
<td>30</td>
<td><strong>0.98</strong></td>
<td><strong>0.97</strong></td>
</tr>
<tr>
<td>3.</td>
<td>50 Meter Run</td>
<td>30</td>
<td><strong>0.95</strong></td>
<td><strong>0.96</strong></td>
</tr>
<tr>
<td>4.</td>
<td>60 Meter Run</td>
<td>30</td>
<td><strong>0.73</strong></td>
<td><strong>0.89</strong></td>
</tr>
<tr>
<td>5.</td>
<td>Tapping By Leg</td>
<td>30</td>
<td>0.22</td>
<td>0.31</td>
</tr>
<tr>
<td>6.</td>
<td>Push Up (15 sec.)</td>
<td>30</td>
<td><strong>0.90</strong></td>
<td><strong>0.91</strong></td>
</tr>
<tr>
<td>7.</td>
<td>Sit Up Bent Knee</td>
<td>30</td>
<td>0.43</td>
<td>0.39</td>
</tr>
<tr>
<td>8.</td>
<td>Two Hand Basket Ball throw</td>
<td>30</td>
<td><strong>0.96</strong></td>
<td><strong>0.98</strong></td>
</tr>
<tr>
<td>9.</td>
<td>Two Hops By Dominant Leg</td>
<td>30</td>
<td>0.47</td>
<td>0.49</td>
</tr>
<tr>
<td>10.</td>
<td>Shot- Put</td>
<td>30</td>
<td><strong>0.94</strong></td>
<td><strong>0.98</strong></td>
</tr>
<tr>
<td>11.</td>
<td>50 Meter Hopping</td>
<td>30</td>
<td>0.48</td>
<td>0.46</td>
</tr>
<tr>
<td>12.</td>
<td>800 Meter Run</td>
<td>30</td>
<td><strong>0.97</strong></td>
<td><strong>0.96</strong></td>
</tr>
<tr>
<td>13.</td>
<td>One Leg Race</td>
<td>30</td>
<td>0.44</td>
<td>0.42</td>
</tr>
<tr>
<td>14.</td>
<td>2.4 Kilo Meter Run</td>
<td>30</td>
<td><strong>0.88</strong></td>
<td><strong>0.96</strong></td>
</tr>
<tr>
<td>15.</td>
<td>600 Meter Run/Walk</td>
<td>30</td>
<td><strong>0.96</strong></td>
<td><strong>0.94</strong></td>
</tr>
<tr>
<td>16.</td>
<td>Shuttle Run</td>
<td>30</td>
<td>0.49</td>
<td>0.49</td>
</tr>
<tr>
<td></td>
<td>Test Description</td>
<td>Qty</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>---</td>
<td>------------------------------------------</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>17.</td>
<td>Agility Test –I</td>
<td>30</td>
<td>0.82</td>
<td>0.77</td>
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<tr>
<td>18.</td>
<td>Agility Test- II</td>
<td>30</td>
<td>0.96</td>
<td>0.94</td>
</tr>
<tr>
<td>19.</td>
<td>Agility Cycle</td>
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<td>0.92</td>
<td>0.85</td>
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<td>20.</td>
<td>Illinois Agility Run</td>
<td>30</td>
<td>0.49</td>
<td>0.46</td>
</tr>
<tr>
<td>21.</td>
<td>Bend Twist Touch (20 sec.)</td>
<td>30</td>
<td>0.99</td>
<td>0.98</td>
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<tr>
<td>22.</td>
<td>Trunk Extension</td>
<td>30</td>
<td>0.41</td>
<td>0.47</td>
</tr>
<tr>
<td>23.</td>
<td>Shoulder Lift/ Extension</td>
<td>30</td>
<td>0.47</td>
<td>0.41</td>
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<tr>
<td>24.</td>
<td>Sit And Reach</td>
<td>30</td>
<td>0.98</td>
<td>0.97</td>
</tr>
<tr>
<td>25.</td>
<td>Groin Flexibility</td>
<td>30</td>
<td>0.43</td>
<td>0.47</td>
</tr>
<tr>
<td>26.</td>
<td>Two Hand M. Ball Put</td>
<td>30</td>
<td>0.49</td>
<td>0.44</td>
</tr>
<tr>
<td>27.</td>
<td>Standing Broad Jump</td>
<td>30</td>
<td>0.88</td>
<td>0.85</td>
</tr>
<tr>
<td>28.</td>
<td>Vertical Jump</td>
<td>30</td>
<td>0.90</td>
<td>0.89</td>
</tr>
<tr>
<td>29.</td>
<td>Over Head Medicine Ball Throw</td>
<td>30</td>
<td>0.99</td>
<td>0.98</td>
</tr>
<tr>
<td>30.</td>
<td>Two Hops By Both Legs</td>
<td>30</td>
<td>0.48</td>
<td>0.45</td>
</tr>
<tr>
<td>31.</td>
<td>Burpee Squat Thrust</td>
<td>30</td>
<td>0.48</td>
<td>0.47</td>
</tr>
<tr>
<td>32.</td>
<td>Alternative Hand Wall Toss (30 sec.)</td>
<td>30</td>
<td>0.93</td>
<td>0.92</td>
</tr>
<tr>
<td>33.</td>
<td>Sideward Jump</td>
<td>30</td>
<td>0.41</td>
<td>0.44</td>
</tr>
<tr>
<td>34.</td>
<td>Reaction Speed</td>
<td>30</td>
<td>0.88</td>
<td>0.86</td>
</tr>
<tr>
<td>35.</td>
<td>Tapping By Hand</td>
<td>30</td>
<td>0.46</td>
<td>0.41</td>
</tr>
</tbody>
</table>
Prediction Factor: The following factors of the sample were considered in the study

1. **Age:** The age of the student was taken from their sports participation performa’s. Subject’s chronological age in completed years was recorded.

2. **Weight:** Subject’s weight without foot wears was recorded to the nearest kilograms. Standard portable weighing machine was used to weight the student’s weight.

3. **Height:** Subject’s standing height without footwear was taken. The height of the student to the nearest centimeter was recorded in centimeters. In most of the places stadiometer was used and in some places, wall markings were used to measure the height.

**Prediction factor: Speed**

1) **30 Meters Run**

**Objective:** To measure the speed of the gross body of an individual.

**Marking:** Two lanes of 30 meters in length and 1.22 meters in width were marked on an outdoor area. Starting and finish line were also marked.

**Equipment:** A stop-watch, and a flag to indicate the finish line.

**Procedure:** Two subjects stood behind the starting line. On signal ‘go’ by the starter, they ran the distance of 30 meters as fast as possible and completed the race. Starter gave hand signal to the time keeper to indicate the start of the race. (as shown in illustration 1)

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Illustration -1
(30 Meter Run)

Scoring: One trial was given. The time taken by the subject to complete 30 meters was recorded in seconds and rounded off to the nearest 1/10 of a second.

2) 40 Meters Run³

Objective: To measure the speed of the gross body of an individual.

Marking: Two lanes of 40 meters in length and 1.22 meters in width were marked on an outdoor area. Starting and finish line were also marked.

Equipment: A stop-watch.

Procedure: Two subjects stood behind the starting line. On signal ‘go’ by the starter, they ran the distance of 40 meters as fast as possible and completed the race. Starter gave hand signal to the time keeper to indicate the start of the race. (as shown in illustration 2)

³ www.topendsports.com/testing/tests/sprint-40meters.htm
Illustration -2  
(40 Meter Run)

**Scoring:** One trial was given. The time taken by the subject to complete 40 meters was recorded in seconds and rounded off to the nearest 1/10 of a second.

3) **50 Meters Run**

Similar to that of 40 meters run, but here the subject ran the distance of 50 meters at a stretch. As shown in the figure 3.1.

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Figure 3.1

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4[www.topendsports.com/testing/tests/sprint-50meters.htm](http://www.topendsports.com/testing/tests/sprint-50meters.htm)
4) **60 Meters Run**\(^5\)

Similar to that of 30 meters, 40 meters and 50 meters run, but here the subject ran the distance of 60 meters at a stretch.

5) **Tapping by Leg**\(^6\)

**Objective:** To measure the speed of the limbs.

**Marking:** A 60 centimeter line was marked on the ground. Two small circles drawn on each point and named as ‘A’ and ‘B’. A 30 centimeter line parallel to the line at center point, 20 centimeter away was also marked in the figure 3.2.

![Figure 3.2: Marking of Tapping by Leg](image_url)

**Equipment:** A stop-watch.

**Procedure:** The subject stood on the 30 centimeter marked line and kept her convenient leg on circle ‘A’. On signal ‘go’ she tapped the circles ‘A’ to ‘B’, ‘B’ to ‘A’ and continued the same for five seconds,

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\(^5\) [www.topendsports.com/testing/tests/sprint-60meters.htm](http://www.topendsports.com/testing/tests/sprint-60meters.htm)

\(^6\) 'Construction and Standardization of motor fitness test for high school boys’ by S.M.Prakash, Laxmi bai national institute of physical education,Gwalior,1995.
as fast as possible as shown in illustration 3.

Illustration -3  
(Tapping by Leg)  

**Instructions:** Tapping both the circles was to be counted as one. If one didn’t tap on the circle, score was not to be counted.

**Scoring:** Number of completed scores in five seconds was recorded. A scorer stood near point ‘B’ to count the scores.

**Prediction Factor:** Muscular Strength

6) **Push-Up** (15 seconds)

**Objective:** To measure the strength of arms and shoulder girdle.

**Equipment:** A stop-watch, and a mat on the floor.

---

**Illustration -4**

*(Push-Up)*

**Procedure:** The subject assumed prone support position on the mat. On being signaled, she flexed her body horizontally, so that her chest almost touched the ground. She returned back to the starting position by pushing up the body and by extending the elbows straight. She repeated this activity as fast as possible for a period of 15 seconds (as shown in illustration 4).

**Instruction:** The body was not to slag or poke, but the straight line of the body was to be maintained throughout the testing period. Incomplete push-ups were not counted.

**Scoring:** Correct numbers of completed push-ups in 15 seconds were recorded. Assistance of a partner for the subject in counting was used.
7) Sit-Ups Bent Knee\(^8\) (15 Sec.)

**Objective:** To measure the strength and endurance of the abdominal muscles.

**Equipment:** A mat on the floor and Stopwatch.

**Procedure:** From a lying position on the back, the performer flexed her knees while sliding her heels as close to body as possible. The performer interlocked the fingers behind the neck and performed sit-ups alternating a left elbow touch of the inside right knee and a right elbow touch of the inside left knee (as shown in illustration 5).

**Scoring:** The total number of repetitions was recorded for score. However, repetitions should not be counted when fingertips do not maintain contact behind the head, when the knees were not touched, or when the pupil pushes off the floor with the elbow. The subject did the sit-ups for 15 seconds.

![Illustration -5](Sit-Ups Bent Knee)

\(^{8}\)ibid,p-120-124
**Additional pointers:** (a) The feet should rest flat on the floor and may be separated a few inches. (b) The back of the hands should touch the mat each time before curling the sit-up position.

8) **Two hand Basketball Throw**

**Objective:** To measure the strength of arm and shoulder girdle muscles.

**Marking:** Five meter line on out-door area.

**Equipment:** A measuring tape and Basketball.

**Procedure:** The subject stood behind the marked line. She threw the basketball in standing position with two hands as far as she could in one maximum effort.

**Instructions:** She was to throw the ball in any manner she wished; she was to throw the ball only in standing position.

**Scoring:** Two trials were given. Best of the two trials was considered. Nearest ball impact perpendicular to the marked line was recorded in meters and part of the meter was rounded off to the nearest 10 centimeters.

9) **Two hops by dominant leg**

**Objective:** To measure the muscular strength of leg muscles.

**Equipment:** A measuring tape.

**Marking:** A meter line was marked on the out-door area of a smooth surface.

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9http://www.topendsports.com/testing/tests/ball-throw.htm

10http://shodhganga.inflibnet.ac.in/bitstream/10603/3167/13/13_chapter%203.pdf
**Procedure:** The subject stood behind the line marked on her dominant leg. She took two consecutive hops in front by her dominant leg. She tried to reach as far as possible (as shown in illustration 6)

**Instructions:** The subject was not allowed to make any initial movements of the dominant foot; she was permitted to bend her knee and to swing her arms before and during the hops. She should not stop or take pause after a hop. Both the hops should be performed at a stretch.

**Scoring:** Two trials were given. Best of the two trials was recorded in meters. The measurement was taken as in the case of standing broad jump. Part of the meter was rounded off to nearest 5 centimeter.

**Illustration -6**

2 Hops by Dominant Leg
10) Shot Put

**Objective:** To measure the muscular strength of arm and shoulder girdle strength primarily, power, agility, arm and shoulder girdle coordination speed and balance secondly.

**Equipment:** A measuring tape, A Shot put.

**Marking:** A shot put circle with diameter of 2.135 cm. And the thrower has to throw the shot put within the specified sector angle.

**Procedure:** The event was explained and demonstrated since the try was to be a part and not a throw. The subject stood within the circle and put the shot within the sector angle. Three trials were given and the best throw was counted. (as shown in illustration 7)

![Illustration -7 (Shot Put)]()

**Instructions:** One must take up a position in the throwing area with the side opposite arm towards the throwing sector. One must put the shot and not throw it. One must not step on or over the restraining circle during the throw.
Scoring: Three trials were given. The final score is the distance of the best put measurement.

Prediction factor: Muscular endurance

11) 50 Meter Hopping

Objective: To measure the muscular endurance of leg muscles.

Marking: Two lanes of 50 meters in length and 1.22 meters in width were marked on an out-door area. Starting and finishing lines were also marked. (Same markings were used for 40 mts and 50 mts runs.)

Equipment: A stop-watch and flag to indicate the finish near finish line.

Procedure: The subject stood behind the starting line. On signal go by the starter, she hopped on her convenient leg (either left or right leg) and completed the distance. This test was administered on two students at a time. (as shown in illustration 8)

Illustration -8 (50 Meter Hopping)

11 ‘Construction and Standardization of motor fitness test for high school boys’ by S.M.Prakash, Laxmi bai national institute of physical education, Gwalior, 1995.
**Instructions:** The subject was not to change her hopping leg during the race.

**Scoring:** For incorrect hopping re-race was conducted. Time taken to hop the distance in seconds was recorded and rounded off the 1/10 of a second. A hand signal was given by the starter to the time keeper at the time of starting the race.

**12) 800 Meter Run**

**Objective:** To measure aerobic fitness in the players.

**Equipment:** A stop watch and a running track.

**Procedure:** The aim of the test was to complete the required distance in the fastest possible time. On the signal “ready” all participant line up behind the starting line, and they began running on the track after the signal “go”.

**Instructions:** The participant will not start the running before signal “go”.

**Scoring:** Total time taken to complete the distance was recorded in minutes and seconds.

![Illustration -9 (800 Meter Run)](http://www.topendsports.com/testing/tests/800m-run.htm)
13) Leg Raise$^{13}$ (10 seconds)

**Objective:** To measure the strength and endurance of abdomen muscles

**Equipment:** One stop-watch, a mat on the floor and rectangular wooden frame open on one side with measurements as shown in the figure 3.3.

**Procedure:** The subject lay on the mat in supine position with her hands locked and placed behind the neck; elbows flexed and feet together; knees locked and wooden frame was kept near the knees, so that both legs were inside the frame. The subject would lift the leg together on signal go and touch the upper part of knees to the lower surface of the wooden frame. She then repeats this process of leg lifts as many times as possible in ten seconds. The frame was held by the partner firmly.

![Figure 3.3](image)

$^{13}$‘Construction and Standardization of motor fitness test for high school boys’ by S.M.Prakash, Laxmi bai national institute of physical education, Gwalior, 1995.
Instructions: The subject was not to bend her knees till the completion of the test. For all leg lifts, heels were to touch the ground and when lifted, upper part of the knees should touch the inner part of the frame. Incomplete lifts were not counted. Lifting of elbows from the ground was not permitted.

Scoring: Lifting legs up and returning to the starting position was counted as one. Total number of correct, completed leg lifts in ten seconds were counted by the scorer and recorded in numbers.

14) 2.4 Kilometer Run\textsuperscript{14}

Objective: To measure aerobic fitness and endurance of leg muscles.

Equipment: 400 meter track and stop-watch.

Procedure: The aim of this test was to complete 2.4 kilometer in the shortest possible time. At the start all players were line up behind the starting line. On the command “go” the stop watch started, and players start running although walking was authorized, it was strongly discouraged. (as shown in illustration 10)

\textbf{Illustration -10} (2.4 Kilometer Run)

Instructions: The subject has to complete 2.4 kilometer distance.

Scoring: Total time to complete the race was recorded.

15) 600 Meter Run/ Walk

Objective: To measure the endurance.

Equipment: 400 meter track, stop watch.

Procedure: On the signal, “ready”, the subjects stand behind the starting line. After the command “go” they were encouraged to run the distance in the fastest possible time. Walk was permitted. Five runners tested at one time with accuracy and efficiency. Each runner completed the required distance. (as shown in illustration 11)

Illustration -11
(600 Meter Run/ Walk)

Scoring: The total time in minutes and seconds was recorded.
Prediction Factor: Agility

16) Shuttle Run\textsuperscript{15}

**Objective:** To measure the agility and flexibility of an individual.

**Marking:** Two 3 meter parallel lines were drawn 30 feet apart as shown in the figure 3.4.

**Equipment:** A stop watch and old class room duster.

\textbf{Figure- 3.4}

**Procedure:** The performer starts behind the starting line on the signal go and runs to the blocks, picks up one, returns to the starting line, and places block behind the line; she then repeats the process with the second block. (as shown in illustration 12). Allow some rest between the two trials.

\textsuperscript{15}Johnson and Nelson, op, cit, p-217
Illustration -12
(Shuttle Run)

**Scoring:** The score for each performer is the length of time required (to the nearest tenth of a second) to complete the course. Only the best trial was recorded.

**Additional Pointers:** (a) Stress the importance of running as hard as possible across the finish line with second block. (b) Marking tape should be used to designate the starting and finishing line. (chalk mark was used in this study instead of marking tape) (c) A person may touch behind the line and not use blocks since blocks may be tumbled, dropped, kicked or thrown and thus require an additional testing or problem in standardization.

17) Agility¹⁶ Test I

**Objective:** To measure the agility of an individual.

**Marking:** Two parallel lines of 30’ each and 40’ apart were marked on the outdoor area. Four points of two lines were named as ‘A’, ‘B’, ‘C’ and ‘D’. A diagonal line of 50’ was joined from ‘B’ to ‘C’. Start and finish lines were also marked as shown in the figure 3.5.

¹⁶‘Construction and Standardization of motor fitness test for high school boys’ by S.M.Prakash, Laxmi bai national institute of physical education,Gwalior,1995.
Equipment: A stop-watch and cones.

Figure- 3.5

Procedure: The subject stood behind the starting line. On signal ‘go’ she ran in zig-zag from ‘A’ to ‘B’, ‘B’ to ‘C’, ‘C’ to ‘D’ and ran in a straight line after touching the circle marked at ‘D’ to finish line extended from point ‘B’. As shown in illustration 13.

Illustration -13

(Agility Test- I)
**Instructions:** The subject was to go in a zig-zag manner as demonstrated; she was not to jump or run over the cones fixed on the ground; if she did not take the proper turns, she was re-administered the test.

**Scoring:** Two trials were given. The best time taken to complete the race was taken and recorded in seconds and rounded off to the nearest 1/10 of a second.

**18) Agility**¹⁷ **Test- II**

**Objective:** To measure the agility of an individual.

**Marking:** Two 3 meter lines were marked in an indoor hall. One line was marked on the wall, 1 meter above and parallel to the ground. Another line was marked on the ground 3 meters away and parallel to the wall. A mat on the floor behind the marked line was preferred as shown in the figure 3.6.

![Figure 3.6](image-url)

*Figure- 3.6*

¹⁷‘Construction and Standardization of motor fitness test for high school boys’ by S.M.Prakash, Laxmi bai national institute of physical education,Gwalior,1995
**Equipment:** A stop-watch and mat.

**Procedure:** The subject lay in supine position and the head was to be positioned behind the marked line with arms stretched sideways. Feet were to be comfortably apart. On signal ‘go’ she was to get up from the starting position as fast as possible and was to run towards the wall and was to touch the wall below the one meter mark and was to return back to assume the starting position. As shown in illustration 14.

![Illustration -14](Agility test - II) (Starting position)

**Instructions:** The subject was to get up from the starting position on either side and in any manner she wished; bending the knees before signal ‘go’ was not allowed. She was allowed to slide over the floor at the time of re-assuming the starting position.

**Scoring:** Two trials were given. The best time taken by the subject to perform the test was recorded in seconds and rounded off to the nearest 1/10 of a second.
19) Agility Cycle\(^{18}\)

**Objective:** To measure the agility of an individual.

**Marking:** Two lines 8 meters in length were marked on an outdoor area. Midpoint ‘O’ forming a ‘+’ shape. Small circles of 30 centimeters in diameter were marked on points ‘B’, ‘C’, and ‘D’. A circle of one meter in diameter was marked at point ‘O’. A starting line, two meters in length was marked at point ‘A’ as shown in the figure 3.7.

![Figure- 3.7](image.png)

**Equipment:** A stop-watch.

**Procedure:** The subject stood behind the starting line. On signal ‘go’, she ran forward from ‘A’, to ‘O’, then did a cross-step sideward running from ‘O’ to ‘B’, and ‘B’ to ‘O’; then run forward from ‘O’ to ‘C’ and backward from ‘C’ to ‘O’; then did a cross-step sideward running from ‘O’ to ‘D’ and ‘D’ to ‘O’ and at the end run backward from ‘O’ to ‘A’ to complete the agility cycle.

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\(^{18}\)‘Construction and Standardization of motor fitness test for high school boys’ by S.M.Prakash, Laxmi bai national institute of physical education, Gwalior, 1995
**Instructions:** The body was to face forward till the completion of test, she was to touch the center circle each time during the course of her run, she was to do cross-step sideward running when she was running sideways.

**Scoring:** Two trials were given. The best time taken to complete the agility cycle was recorded in seconds and rounded off to the nearest 1/10 of a second.

20) **Illinois Agility Run**

**Objective:** To monitor the development of athlete’s agility.

**Marking:** The length of the course is 9.14 meter, and the width (distance between start and finish point) is 5 mts, 4 cones are used to mark, finish and the two turning points. As shown in figure 3.8

**Equipment:** A stop-watch, cones.

**Procedure:** The subject stood behind the starting line. On signal ‘go’, the stop watch was started and the athlete gets up as quickly as possible and runs around the course in the direction indicated without knocking the cone over, to the finish line, at which the timing was stopped.

**Scoring:** Two trials were given. The best time taken to complete the agility test was recorded.

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Prediction factor- Flexibility

21) Bend Twist Touch

Objective: To test the ability to repeat rapid flexing and twisting movements of the upper body.

Marking: An ‘X’ mark on the wall and floor with chalk.

Equipment: A stopwatch.

Procedure: The subject stands with feet shoulder-width apart and back close to the wall, allowing sufficient space to bend down without touching it. An “X” was put on the wall (chalk) at shoulder height on the body mid-line; another “X” was on the floor on the body mid-line just in front of the feet. After command “Go,” the subject’s bends down to touch the floor “X” with both hands and immediately rises, twisting to the left, to touch the wall “X” with both hands. This constituted one
cycle, and the next cycle was performed by twisting to the right. As shown in illustration 15.

Illustration -15 (a)
(Bend Twist Touch) (Starting position)

Illustration -15 (b)
(Bend Twist Touch Execution)
Scoring: The score was the number of cycles to alternate side completed in 20 seconds.

22) Trunk Extension

Objective: The purpose of the test was to determine the range of motion when the back was arched from the prone position.

Equipment: A mat on the floor, stop watch and a scale.

Procedure: Lie down on the mat, with the partner applying pressure on the back of the thighs. Fingers were interlocked behind her neck, gently raise her head and shoulders as far as possible from the floor. This position was held for 3 seconds. As shown in illustration 16.
**Scoring:** The distance from the floor to the chin was measured to the nearest ½ inches.

**23) Shoulder Lift/ Flexion**

**Objective:** The purpose of this test was to measure flexion at the shoulder joint.

**Equipment:** A ruler and pen.

**Procedure:** The subject lies down with her chin on the floor and her arms were fully extended and parallel. Hold a stick or ruler horizontally with both hands and the subject kept her elbow and wrist straight. She raised her arms upward as far as possible with her chin remaining in contact with the floor. As shown in illustration 17.

**Instructions:** Athlete chin was remaining in contact with the floor and that she was not allowed to extend her wrist to increase the score.

![Illustration -17](http://www.topendsports.com/testing/tests/trunk-lift.htm)
**Scoring:** The distance was measured from the bottom of the ruler to the floor in inches.

**24) Sit and Reach**\(^{21}\)

**Objective:** To measure the trunk flexion of an individual. This was determined by their ability to stretch the lower back and hamstring muscles.

**Equipment:** A platform.

**Procedure:** Subject removed her shoes and sat with her knees fully extended and the bottom of the feet flat against the surface of the platform. Her feet’s were extended forward with one hand placed on the top of the other. Steadily reach as far forward as possible and maintain that position for 3 seconds. As shown in illustration 18.

![Illustration -18](Sit and Reach)

Instructions: No bounding or jerking movements were allowed and it was important that the knees remain absolutely straight, slight flexion at the knee joints greatly influence the results.

Scoring: The distance in front of or beyond the edge of the platform that can be sustained was measured and recorded. Measurements in front of the platform were negative whereas those beyond were positive.

25) Groin Flexibility

Objective: This flexibility test measures flexibility in the adductors.

Equipment: A ruler or measuring tape.

Illustration -19

(Groin Flexibility)

Procedure: The athlete sat on the floor with her knees bent, feet flat on the floor and legs together. Let her knees drop sideways as far as possible keeping her feet together. The soles of her feet should be together. Then the athlete clasp her feet with both hands and pulled her ankles as close to her body as possible. As shown in illustration 19.

Scoring: The distance from heels to her groin was counted.

Prediction Factor: Power

26) Two Hand Medicine Ball Put

Objective: To measure the explosive strength of arms.

Equipment: Medicine ball, tape, straight chair, rope and lime powder.

Procedure: A line about five feet long was marked and straight chair was placed in the center of the line. The subject was told to sit on the chair by holding the medicine ball in both hands with the ball drawn back against the chest and just under the chin from the action, She was to put the ball for maximum distance. As shown in illustration 20.

Illustration -20 (a)
(Two Hand Medicine Ball Put) (Starting position)

http://shodhganga.inflibnet.ac.in/bitstream/10603/3167/13/13_chapter%203.pdf
Illustration -20(b)
(Two Hand Medicine Ball Put) (Throwing action)

Scoring: The best throw was recorded in meters and centimeters.

27) Standing Broad Jump\(^\text{24}\)

Objective: To measure the Power and explosive strength of the body.

Marking: A meter line was marked in an outdoor or indoor area.

Equipment: A measuring tape.

Procedure: The subject stood behind the marked line with her feet slightly apart and parallel. She took a crouch position by bending her knees. She jumped outward as far as she could at a stretch with one maximum effort and landed in front. As shown in illustration 21.

Instructions: Initial movement of the toes was not to be allowed. Leaning backward after a jump was not to be permitted. If the jump was not executed correctly another chance was to be given.

ILLUSTRATION -21(a)
(Standing Broad Jump) (Starting position)

Illustration -21(b)
(Standing Broad Jump) (Jumping action)
Scoring: Nearest heel mark right angle to the starting line was considered. Two trials were given. The better of two trials was recorded in meters. Part of the meter was rounded off to the nearest five centimeters.

28) Vertical Jump\(^{25}\)

Objective: To measure the explosive power and strength of leg muscles. (The test was modified in marking and scoring)

Marking: Parallel lines of two centimeters drawn on white sheets were pasted on the wall above 160 centimeters. The markings ranged from 160 centimeters to 280 centimeters. Bold Arabic numerals were written on both edges of the papers at every two centimeters and in the center of pages at every 10 centimeters interval.

Equipment: White sheets, sketch pens, two different colored powders and a measuring tape.

Procedure: (a) The subject took colored marking powder by the tip of the middle finger of her convenient hand and stood in front of the wall markings. She touched both the toes to the wall and then extended the hand over the wall marking and tried to reach as high as possible without rising her heals and marked the standing reach height. This height was noted.

(b) Subject stood on one side with her finger having marking powder towards the wall markings; she jumped as high as possible and marked the height of her jump.

Instructions: Jumping twice or ‘crow hop’ was not to be permitted. She

\(^{25}\)http://www.topendsports.com/testing/tests/vertjump.htm
was to be allowed to crouch and swing her arms before she took a jump. She was not to touch the wall other than with the marking hand.

**Scoring:** The number of centimeters between the standing reach and jumped mark measured to the nearest centimeter was to be recorded. Best of two trials was recorded in centimeters.

**29) Over Head Medicine Ball Throw**

**Objective:** To Measure the strength and power of arm muscles and upper back muscles.

**Marking:** Two meter line in an indoor area.

**Equipment:** One measuring tape.

**Procedure:** The subject stood on the marked line. The subject held the ball above the head in both hands with elbows extended. She then threw the ball forward outward as far as she could in one maximum effort (as shown in illustration 22).

![Over Head Medicine Ball Put](http://www.topendsports.com/testing/tests/medicine-ball-throw-overhead.htm)
Illustration -22 (b)
(Over Head Medicine Ball Put) (Throwing action)

Instructions: She was allowed to make initial movements of hands, holding the ball by swinging backwards and by flexing the elbows; she was permitted to bend her upper body backward before throw.

Scoring: Two trials were given. Best of the two trials was considered. Nearest ball impact perpendicular to the line marked was recorded in meters. Fraction of a meter was rounded off to the nearest five centimeters.

30) Two Hops by Both Legs

Objective: To measure the explosive strength of leg muscles.

Marking: One meter line was marked on the out-door area preferably near the jumping pit. However, proper care was taken to avoid the possibilities of injuries.

Equipment: One measuring tape.

Procedure: The subject stood behind the line marked with her feet kept parallel and in a comfortable position. She took two consecutive jumps-

27www.topendsports.com/testing/tests/2-hop-jump.htm
as in standing broad jump—by both legs as far as possible (as shown in the illustration 23).

Illustration -23
(Two Hops by Both Legs)

Instructions: The subject was not to make any initial movements of her toes; she was permitted to crouch before taking her jump; she was allowed to swing her arms backward and forward during the jump. She was not allowed to stop or take a pause after first jump. Both the jumps were to be performed at a stretch.

Scoring: Two trials were given. Best of the two trials was recorded in meters. Part of the meter was rounded off to nearest 5 centimeter.

Prediction Factor: Co-ordination

31) Burpee\(^{28}\) (Squat Thrust)

Objective: To measure the Coordination and general muscular endurance of the body.

\(^{28}\)Johnson and Nelson, op.cit, p-133
**Equipment:** A mat on floor.

**Procedure:** From a standing position (a) bend at the knees and waist and place the hands on the floor in front of the feet, (b) thrust the legs backward to a front leaning rest position, (c) return to the squat position as in the first count, and (d) stand erect. From the signal go repeat this exercise at a constant rate of movement for as long as possible (as shown in the illustration 24).

![Illustration -24](image)

(Burpee (Squat thrust))

**Scoring:** The score was the number of correct repetitions executed. The score was recorded to the nearest whole number. The subject was given an upper limit of 125 numbers not withstanding her ability to perform more than, She was asked.

**Additional Pointers:** (a) The score was terminated if the performer stops to rest. (b) Repetition which was incorrect was not counted toward the score.
32) Alternate Hand Wall Toss

Objective: To measure hand-eye coordination.

Equipment: Tennis ball, smooth and solid wall, marking tape, stopwatch.

Procedure: A mark was placed a certain distance from the wall 3 feet (Instead of 2 meters). The subject stand behind the line and facing the wall. The ball was thrown from one hand in an under arm action against the wall, and attempted to be caught with the opposite hand. The ball was then thrown back against the wall and caught with the initial hand. The test was continued for a nominated period of 30 seconds. (as shown in the illustration 25).

Scoring: The number of successful catches in 30 second period was counted.

Illustration -25 (Alternate Hand Wall Toss)

33) Sideward Jump

**Objective:** To measure the coordination and balance of the body.

**Marking:** A rope of one centimeter in thickness was tied firmly to two poles. The rope was tied 10” above and parallel to the ground.

**Equipment:** 2 poles, rope and a stop-watch.

**Procedure:** The subject stood sideward with her feet parallel near the rope. On signal ‘go’ she jumped over the rope to the other side of the rope on both legs and returned back to initial position with a jump is shown in illustration 26. This process of sideward jumps was repeated by the subject for 10 seconds.

![Illustration -26 (Sideward Jump)](image)

**Instructions:** The jump was always to be on her toes, she was to jump on both legs. She was not to touch the rope while performing the sideward jumps.

**Scoring:** Jumping both sides, once was counted as one cycle. Total number of cycles completed in 10 seconds was recorded. The tester was
assisted by a scorer to count the cycles.

34) Reaction Speed\textsuperscript{30}

Objective: To measure the reaction speed of an individual. Reaction time is the interval between the presentation of a stimulus and the muscular response

Equipment: A table and a foot scale.

Procedure: The Subject was asked to place her hand on the edge of the table. She formed ‘U’ shape with thumb and other fingers. There was a gap of at least a foot scale width. The tester held a 30 centimeter scale with ‘0’ of the scale on the outer edge of the thumb as shown in illustration. On signal ‘ready’ the subject responded with ‘yes’. Then the tester dropped the scale any moment she wished. The subject caught the scale as soon as she could. (as shown in the illustration 27).

\textbf{Illustration -27 } (Reaction Speed)

\textsuperscript{30}www.topendsports.com/testing/tests/reaction-stick.htm
Instructions: when the subject is ready to react, then only she was to say ‘yes’. After she said ‘yes’ the scale will be dropped at any moment. She was to concentrate on the scale as it enables her to catch it as soon as it is dropped.

Scoring: As many trials as possible were given, till subject held the scale twice (almost in the same position). The difference in marking, in level with the outer edge of the thumb recorded in cms.

35) Tapping by Hand^{31}

Objective: To measure the neuro-muscular coordination.

Marking: A 90 centimeter line and another line 45 centimeter in length was marked perpendicular to the first line and intercepting at mid-point was marked on the table. Small circles were drawn on each point and named ‘A’, ‘B’, ‘C’ as shown in the figure 3.9.

Equipment: A Stop-watch and a table.

Procedure: The subject stood comfortably in front of the table marked with her convenient hand on circle ‘A’ as shown in illustration. On the signal ‘go’, she would tap the point ‘A’, ‘B’ and ‘C’ in a clock wise direction as many times as possible in five seconds.

^{31}www.India.com/→ Tapping+by+hand-5+seconds++fitness+test
Instructions: Tapping was to be done by tips of the fingers. As shown in figure. Tapping the circles was to be only in clock wise direction. Tapping all the three circles once was to be counted as one cycle. Half completed cycles were not counted. Support of the table was not to be taken while tapping.
**Scoring:** Number of completed cycles in five seconds was recorded. Tester took the assistance of one person to count the cycles. The assistant stood near the circle ‘C’, for counting. As shown in illustration 28.

**STATISTICAL TREATMENT**

Out of 35 variables only 19 test variables have shown a positive correlation in objectivity and reliability and other 16 variables shown results below 0.5, so researcher took only 19 variables for the further study. The validity coefficient of these test items will be calculated with the help of validation equation, the most reliable and valid test will be included as a test item to measure the included variables of motor fitness.

A test battery will be constructed after selecting one most reliable and valid test for each physical fitness variable such as Speed, Strength, Endurance, Agility, Flexibility, Power and Co-ordination.

It is pertaining to mention here the Pilot study is taken in this study is only to evaluate the reliability, validity, authenticity and objectivity of all 35 disciplines in various Physical fitness variables which will help the researcher and indicate the further research programme. It is also clear that this adopted process of pilot study will make more and more scientific clearance in the mind of the researcher to complete the perfect and efficient process for the complexion of the present study.

As has already mention in the first chapter about all the limitation and delimitation of the study. But the researcher had also kept in the mind that caste, creeds, religion, rural and urban area factors for the selected
samples were not considered while selecting the sample for the present study.

**Selection of Specific Motor Fitness Components**

In order to select a specific motor fitness test, first of all tests were listed keeping in mind the relevancy for measuring the Physical fitness of the hockey players. Finally a systematized test of nineteen test items was chalked out by the researcher with the help of pilot study and is presented below:-

**LIST OF SELECTED TEST ITEMS:**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Variables</th>
<th>Test Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>SPEED</td>
<td>i) 40 Meter Run</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ii) 50 Meter Run</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iii) 60 Meter Run</td>
</tr>
<tr>
<td>2.</td>
<td>STRENGTH</td>
<td>i) Push Up</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ii) Two Hand Basket Ball Throw</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iii) Shot- Put</td>
</tr>
<tr>
<td>3.</td>
<td>ENDURANCE</td>
<td>i) 800 Meter Run</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ii) 2.4 Kilo Meter Run</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iii) 600 Meter Run/Walk</td>
</tr>
<tr>
<td>4.</td>
<td>FLEXIBILITY</td>
<td>i) Bend Twist Touch</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ii) Sit and Reach</td>
</tr>
<tr>
<td>5.</td>
<td>AGILITY</td>
<td>i) Agility Test I</td>
</tr>
</tbody>
</table>
ii) Agility Test II

iii) Agility Cycle

6. **POWER**

i) Standing Broad Jump

ii) Vertical Jump

iii) Over Head Medicine Ball Throw

7. **CO-ORDINATION**

i) Alternative Hand Wall Toss

ii) Reaction Speed

The selected 19 tests were administered to a representative sample of 180 Haryana school girls hockey players between the period of 2010-2013. Proper motivational measures had been taken to ensure the best performance by the players on test items. All the girls players were selected randomly under the age of 13-15 years and represented their districts at state level tournament. The D.O.B data was collected from their participation Performa which was duly tested by the concerned principles of their respective schools. The selected players were from districts- Panchkula, Sirsa, Panipat, Rai-Sonipat, Rewari, Gurgaon, Yamunanagar, Jind, Faridabad, Bhiwani, Kaithal, Ambala, Narwana, Jhajjar, Rohtak, Karnal, Hisar, Shahabad(M.), Fatehabad etc.