Chapter III

PROCEDURE

The procedure adopted by the investigator in the identification of physical fitness components, identification of specific physical fitness tests, selection of the subjects, criterion measures, reliability of the data, instrument reliability, testers competency, subjects reliability, criterion (composite scores), collection of the data (First Phase), test administration procedure, procedure for analysis of data, identification of test battery, collection of data (Second Phase), and statistical technique for norms have been explained in this chapter.

Identification of Physical Fitness Components for Volleyball Players

It is an admitted fact that physical fitness plays a pivotal role in the achievement of top-level performance in volleyball. Many of the sports scientists like Toyoda¹

Normand\textsuperscript{2} and Nichols\textsuperscript{3} also laid stress on different physical attributes which are the essential requirements for a top-level volleyball player. Many of the other experts in the game of volleyball have also explained various physical fitness components which are considered to be most important for excellent performance in this game. Therefore, on the basis of overall empirical views of experts, the following physical fitness components were considered for this study:


On the basis of these fitness components a questionnaire was developed (Appendix A) and was sent to 50 volleyball experts. The experts included physical education teachers of schools, coaches, physical education lecturers, selectors, officials and the coaches of the National Institute of Sports, Patiala. The experts were required to give priority rating to the listed physical fitness components in relation to their contribution to the game.


of volleyball (Appendix B). The experts were given a free hand to include any other physical fitness component, which they felt was necessary to be included in the list. As many as 30 copies of the questionnaire duly filled in by the experts were received back. The results of these have been given in Table 1.

**TABLE 1**

**PHYSICAL FITNESS COMPONENTS IN ORDER OF PRIORITY (PERCENTAGE RESPONSE)**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Name of the Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Muscular Power</td>
<td>88.89</td>
</tr>
<tr>
<td>2.</td>
<td>Endurance</td>
<td>83.33</td>
</tr>
<tr>
<td>3.</td>
<td>Muscular Endurance</td>
<td>72.59</td>
</tr>
<tr>
<td>4.</td>
<td>Agility</td>
<td>72.22</td>
</tr>
<tr>
<td>5.</td>
<td>Flexibility</td>
<td>52.22</td>
</tr>
<tr>
<td>6.</td>
<td>Speed</td>
<td>51.85</td>
</tr>
<tr>
<td>7.</td>
<td>Growth Factor</td>
<td>45.19</td>
</tr>
<tr>
<td>8.</td>
<td>Body Balance</td>
<td>18.15</td>
</tr>
<tr>
<td>9.</td>
<td>Hand-eye-coordination</td>
<td>15.56</td>
</tr>
</tbody>
</table>

The results of Table 1 indicate that only fitness components from S.No. 1 to 6 have the ratings of more than
50% of the experts, hence these components have been retained and considered suitable for the development of tentative physical fitness components which could approximately measure the specific fitness of volleyball players.

Only 45.19% of experts responded in favour of the growth factor which is considered to be a low rating to retain it as one of the fitness factors. But keeping in view the consideration and importance of tall players and the players with their reach height by most of the coaches and volleyball experts, it was considered advisable to retain the growth factor for the development of specific fitness test battery. Further, age and weight, which are also components of the growth factor, were later utilized for the development of norms.

**Identification of Specific Physical Fitness Tests**

On the basis of retained fitness factors, as many as 30 functional tests were ascertained after carefully examining the related literature and consulting the experts in the field, which could measure each factor independently. The final test of these functional items has been explained in Table 2.
<table>
<thead>
<tr>
<th>S.No.</th>
<th>Component</th>
<th>Body Part</th>
<th>S.No.</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
<td>Speed</td>
<td>Running</td>
<td>1</td>
<td>20 Metre Run</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Arm Movement</td>
<td>2</td>
<td>50 Metre Run</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>Speed of Movement</td>
</tr>
<tr>
<td>II.</td>
<td>Muscular</td>
<td>Leg</td>
<td>4</td>
<td>Spike Jump</td>
</tr>
<tr>
<td></td>
<td>Power</td>
<td></td>
<td>5</td>
<td>Block Jump</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6</td>
<td>Vertical Jump</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Arm</td>
<td>7</td>
<td>Softball Throw</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>8</td>
<td>Basketball Throw</td>
</tr>
<tr>
<td>III.</td>
<td>Muscular</td>
<td>Arm</td>
<td>9</td>
<td>Push up</td>
</tr>
<tr>
<td></td>
<td>Endurance</td>
<td>Arm</td>
<td>10</td>
<td>Pull up</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Abdominal</td>
<td>11</td>
<td>Sit up</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Abdominal</td>
<td>12</td>
<td>Leg Lift</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Whole Body</td>
<td>13</td>
<td>Burpee</td>
</tr>
<tr>
<td>IV.</td>
<td>Flexibility</td>
<td>Wrist</td>
<td>14</td>
<td>Flexion</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>15</td>
<td>Hyper Extension</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trunk</td>
<td>16</td>
<td>Flexion</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>17</td>
<td>Hyper Extension</td>
</tr>
<tr>
<td>S.No.</td>
<td>Component</td>
<td>Body Part</td>
<td>S.No.</td>
<td>Test</td>
</tr>
<tr>
<td>-------</td>
<td>--------------</td>
<td>-------------------</td>
<td>-----------</td>
<td>------------------------------------</td>
</tr>
<tr>
<td>V.</td>
<td>Agility</td>
<td>Body Position</td>
<td>18</td>
<td>Squat Thrust (10 sec.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Body Movement</td>
<td>19</td>
<td>Up and Down Run</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>20</td>
<td>Court Agility</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>21</td>
<td>W. M. Agility</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>22</td>
<td>Semo Agility</td>
</tr>
<tr>
<td>VI.</td>
<td>Endurance</td>
<td>General (Whole Body)</td>
<td>23</td>
<td>W. M. Run</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>24</td>
<td>One Minute Lateral Jump</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>25</td>
<td>600 Yard Run/Walk Test</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>26</td>
<td>Six-Point Run in Volleyball Court</td>
</tr>
<tr>
<td>VII.</td>
<td>Growth Factor</td>
<td>Chronological</td>
<td>27</td>
<td>Age</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Structure</td>
<td>28</td>
<td>Weight</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>29</td>
<td>Height</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>30</td>
<td>Reach Height</td>
</tr>
</tbody>
</table>

The test items listed in Table 2 were again sent to 50 experts to evaluate the perceived relationship of each test with the game of volleyball. A specimen copy of the letter sent to the experts is given in Appendix C. The experts were requested to evaluate each test item on a
five-point rating scale (Appendix D). Each set of tests from each component was to be evaluated separately on a five-point rating scale. The scoring was to be made on the basis of functional characteristics and importance of the test. If one or more tests appeared equal in importance, the experts could allocate scores in the same way. The scoring pattern suggested to the experts was based on the recommendations of Placheta\textsuperscript{4}, Stanesue\textsuperscript{5}, Grubich et al.\textsuperscript{6} and Zelenka et al.\textsuperscript{7}

The evaluators of these test items were also requested to add any new item in the list of rating if they felt it necessary to do so. However, none of them added any new item. The rating responses were received back from 30 evaluators (Appendix E) which were subsequently tabulated


\textsuperscript{5}I. Stanesue, "L'epreuve Physiologique Complexe de Control Specifique Pour Less Footballers," Med. Sports Trino, 2, 6, 393-396.


to obtain percentage rating the results of which have been given in Table 3.

**TABLE 3**

RESULTS OF NEW DEVELOPED TESTS RATED BY THE EXPERTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Name of the Test</th>
<th>Scores Obtained</th>
<th>Total Scores</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>20 Mts Dash</td>
<td>115</td>
<td>150</td>
<td>76.67</td>
</tr>
<tr>
<td>2.</td>
<td>50 Mts Dash</td>
<td>94</td>
<td>150</td>
<td>62.67</td>
</tr>
<tr>
<td>3.</td>
<td>Speed of Movement Test</td>
<td>122</td>
<td>150</td>
<td>80.67</td>
</tr>
<tr>
<td>4.</td>
<td>Spike Jump</td>
<td>121</td>
<td>150</td>
<td>95.33</td>
</tr>
<tr>
<td>5.</td>
<td>Block Jump</td>
<td>120</td>
<td>150</td>
<td>92.00</td>
</tr>
<tr>
<td>6.</td>
<td>Vertical Jump</td>
<td>118</td>
<td>150</td>
<td>88.00</td>
</tr>
<tr>
<td>7.</td>
<td>Softball Throw</td>
<td>105</td>
<td>150</td>
<td>70.00</td>
</tr>
<tr>
<td>8.</td>
<td>Basketball Throw</td>
<td>125</td>
<td>150</td>
<td>83.33</td>
</tr>
<tr>
<td>9.</td>
<td>Push Up</td>
<td>103</td>
<td>150</td>
<td>68.66</td>
</tr>
<tr>
<td>10.</td>
<td>Sit up</td>
<td>132</td>
<td>150</td>
<td>72.00</td>
</tr>
<tr>
<td>11.</td>
<td>Burpee</td>
<td>120</td>
<td>150</td>
<td>80.00</td>
</tr>
<tr>
<td>12.</td>
<td>Wrist Flexion</td>
<td>132</td>
<td>150</td>
<td>74.67</td>
</tr>
<tr>
<td>13.</td>
<td>Wrist Hyper Extension</td>
<td>117</td>
<td>150</td>
<td>78.00</td>
</tr>
<tr>
<td>14.</td>
<td>Trunk Flexion</td>
<td>103</td>
<td>150</td>
<td>68.67</td>
</tr>
<tr>
<td>15.</td>
<td>Trunk Hyper Extension</td>
<td>120</td>
<td>150</td>
<td>80.00</td>
</tr>
<tr>
<td>16.</td>
<td>Squat Thrust</td>
<td>129</td>
<td>150</td>
<td>88.67</td>
</tr>
<tr>
<td>17.</td>
<td>Up and Down Run</td>
<td>134</td>
<td>150</td>
<td>82.67</td>
</tr>
</tbody>
</table>
TABLE 3 (Contd.)

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Name of the Test</th>
<th>Scores Obtained</th>
<th>Total Scores</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>18.</td>
<td>Court Agility</td>
<td>108</td>
<td>150</td>
<td>72.00</td>
</tr>
<tr>
<td>19.</td>
<td>W.M. Agility</td>
<td>109</td>
<td>150</td>
<td>72.67</td>
</tr>
<tr>
<td>20.</td>
<td>W.M. Run</td>
<td>129</td>
<td>150</td>
<td>86.00</td>
</tr>
<tr>
<td>21.</td>
<td>One Minute Lateral Jump</td>
<td>115</td>
<td>150</td>
<td>76.67</td>
</tr>
<tr>
<td>22.</td>
<td>Six Point Run</td>
<td>121</td>
<td>150</td>
<td>81.33</td>
</tr>
<tr>
<td>23.</td>
<td>Age</td>
<td>115</td>
<td>150</td>
<td>76.67</td>
</tr>
<tr>
<td>24.</td>
<td>Weight</td>
<td>91</td>
<td>150</td>
<td>60.67</td>
</tr>
<tr>
<td>25.</td>
<td>Height</td>
<td>122</td>
<td>150</td>
<td>81.33</td>
</tr>
<tr>
<td>26.</td>
<td>Standing Reach Height</td>
<td>133</td>
<td>150</td>
<td>88.67</td>
</tr>
</tbody>
</table>

The test items which had 50 per cent and above weightage were retained for further investigation for the development of a specific fitness test for volleyball players. The test items at S.No. 10, 12, 22 and 25 of Table 2 of the final selection were dropped from the list as their weightage was below 50 per cent. The final selected test items were administered to a sample of 214 volleyball players.
Selection of Subjects

The sample consisted of players between 14 and 18 years of age. The minimum participation level of chosen volleyball players was the district level. The data were collected in two phases with different samples. The first phase related to the construction of the test and the second phase to the development of norms. The principle of randomization was used with regard to the sample at both stages.

The subjects were picked up from the State school games competitions of Panjab, Haryana, Delhi, Chandigarh and Himachal Pradesh. Apart from the above players, the following school/sport wing/training centres were also selected State-wise, keeping in view their high proficiency in volleyball. The break-up of the subjects on which data were collected have been given in Table 4. A total of 214 subjects took part in all the test items.
TABLE 4

THE DETAILS OF THE STATE, CITY AND SCHOOL/SPORTS CENTRE OF THE SUBJECTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>State</th>
<th>City/Town</th>
<th>S.No. School/Centre</th>
<th>No. of Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
<td>Punjab</td>
<td>Jallundur</td>
<td>1 Sports School</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Patiala</td>
<td>2 Multi purpose Hr. Sec. School</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Faridkot</td>
<td>3 Balbir Hr. Sec. School</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Amargarh</td>
<td>4 Govt. Hr. Sec. School</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Sangrur)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ludhiana</td>
<td>5 Guru Nanak Stadium</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gurdaspur</td>
<td>6 Govt. Hr. Sec. School</td>
<td>12</td>
</tr>
<tr>
<td>II.</td>
<td>Haryana</td>
<td>Amin</td>
<td>7 Govt. High School</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bhiwani</td>
<td>8 Sports Hostel</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kosli</td>
<td>9 Govt. High School</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mohinder-garh</td>
<td>10 Govt. Hr. Sec. School</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Karnal</td>
<td>11 Nehru Stadium</td>
<td>12</td>
</tr>
<tr>
<td>III.</td>
<td>Delhi</td>
<td>New Delhi</td>
<td>12 National Stadium</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot;</td>
<td>13 Nehru Stadium</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot;</td>
<td>14 Indira Gandhi Stadium</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ramesh Nagar</td>
<td>15 Govt. Hr. Sec. School</td>
<td>10</td>
</tr>
</tbody>
</table>
TABLE 4 (Contd.)

<table>
<thead>
<tr>
<th>S.No.</th>
<th>State</th>
<th>City</th>
<th>S.No.</th>
<th>School/Centre</th>
<th>No. of Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV.</td>
<td>Chandigarh</td>
<td>Chandigarh</td>
<td>16.</td>
<td>DAV Hr. Sec. School Sector 8</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>17.</td>
<td>Sports Centre Sector 7</td>
<td>10</td>
</tr>
<tr>
<td>V.</td>
<td>Himachal Pradesh</td>
<td>Matiana</td>
<td>18.</td>
<td>Govt. High School</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Majra</td>
<td>19.</td>
<td>Govt. School</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td><strong>214</strong></td>
</tr>
</tbody>
</table>

**Criterion Measures**

The following criterion measures were chosen for the administration of physical fitness test on volleyball players:

1. 20 meter and 50 meter run was recorded nearest to one-tenth of a second and speed of movement was recorded in distance (centimetres).

2. Spike jump, block jump and vertical jump test height were recorded in the nearest centimetres and softball and basketball throw distance was recorded in metres (nearest to 20 cms and 10 cms respectively).
3. Push-up, Sit up and Burpee tests were recorded in number for 30 seconds.

4. The wrist flexion, wrist hyper extension, trunk flexion and hyper extension were recorded in degree and centimetre respectively and considered as score.

5. The up and down run, court agility and W.M. agility was recorded to one-tenth of a second and squat thrust was recorded in number.

6. The W.M. run and six-point run was recorded to one-tenth of a second and one-minute lateral jump was recorded in number.

7. The age was recorded in calendar months, weight was recorded in kilograms and height and reach height were recorded in centimetres.

Reliability of the Data

The reliability of the data was ensured by establishing the instrument reliability, testers competency and reliability of the tests and subjects reliability.

Instrument Reliability

The stop watches and steel tapes, softballs, basketball, flexomeasure, goniometer, weighing machine, flexomeasure with yardstick and tape and ruler guide
inserted, used in this study were calibrated and supplied by the leading firms and their reliability was ensured by the manufacturers. The height measuring apparatus was checked every day, measuring height with a steel tape. Thus the instruments were considered reliable for the purpose of this study.

Testers' Competency

The investigator was well versed with the technique of conducting tests since he has been working as a lecturer in the Department of Physical Education, Panjab University, for several years. He is qualified athletic coach and athletic official also. He had a number of practice sessions in the testing procedure under the guidance of Dr. G.S. Brar to acquire proficiency in testing. All the measurements were taken by the investigator himself with the assistance of qualified personnel. To ensure testers' competency all the test items were administered on 30 subjects by the investigator and the results were correlated with the tests conducted by Dr. G.S. Brar under similar conditions. The co-efficient of correlation of the measurements was calculated by the investigator and the results have been presented in Table 5. Since very high correlations ranging from .78 to .95 were obtained, the investigator's competence to administer the tests was established.
<table>
<thead>
<tr>
<th>S.No.</th>
<th>Tests</th>
<th>Co-efficient of Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>20 Mts. Dash</td>
<td>.86*</td>
</tr>
<tr>
<td>2.</td>
<td>50 Mts. Dash</td>
<td>.85*</td>
</tr>
<tr>
<td>3.</td>
<td>Speed of Movement Test</td>
<td>.79*</td>
</tr>
<tr>
<td>4.</td>
<td>Spike Jump</td>
<td>.86*</td>
</tr>
<tr>
<td>5.</td>
<td>Block Jump</td>
<td>.90*</td>
</tr>
<tr>
<td>6.</td>
<td>Vertical Jump</td>
<td>.89*</td>
</tr>
<tr>
<td>7.</td>
<td>Softball Throw</td>
<td>.90*</td>
</tr>
<tr>
<td>8.</td>
<td>Basketball Throw</td>
<td>.87*</td>
</tr>
<tr>
<td>9.</td>
<td>Push Up</td>
<td>.92*</td>
</tr>
<tr>
<td>10.</td>
<td>Sit Up</td>
<td>.94*</td>
</tr>
<tr>
<td>11.</td>
<td>Burpee</td>
<td>.83*</td>
</tr>
<tr>
<td>12.</td>
<td>Wrist Flexion</td>
<td>.95*</td>
</tr>
<tr>
<td>13.</td>
<td>Wrist Hyperextension</td>
<td>.94*</td>
</tr>
<tr>
<td>14.</td>
<td>Trunk Flexion</td>
<td>.89*</td>
</tr>
<tr>
<td>15.</td>
<td>Trunk Hyperextension</td>
<td>.84*</td>
</tr>
<tr>
<td>16.</td>
<td>Squat Thrust</td>
<td>.92*</td>
</tr>
<tr>
<td>17.</td>
<td>Up and Down Run</td>
<td>.87*</td>
</tr>
</tbody>
</table>
TABLE 5 (Contd.)

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Tests</th>
<th>Co-efficient of Correlation</th>
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<tbody>
<tr>
<td>18.</td>
<td>Court Agility</td>
<td>.88*</td>
</tr>
<tr>
<td>19.</td>
<td>W.M. Agility</td>
<td>.82*</td>
</tr>
<tr>
<td>20.</td>
<td>W.M. Run</td>
<td>.78*</td>
</tr>
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<td>21.</td>
<td>One-Minute Lateral Jump</td>
<td>.93*</td>
</tr>
<tr>
<td>22.</td>
<td>Six-Point Run</td>
<td>.80*</td>
</tr>
</tbody>
</table>

\[ r = 30 \]

\*Significant at 1% Level of Confidence.

\[ r = .463 \text{ (df = 28)} \]

Subjects Reliability

The above test retest co-efficients of correlation method also established that subjects reliability was significant at 0.05 level of confidence, as the same subjects were used under similar conditions by the tester and no motivational techniques were used nor were the subjects given any training.
**Criterion: Composite Scores**

Composite scores of all the test items were considered as the criterion measure: Johnson and Nelson⁸ and Clarke⁹ also suggested that composite scores could be used as a criterion measure to establish the validity of the test items. The raw scores of all the basic test items were converted into standard scores and added up to serve as composite scores.

**Collection of Data**

After observing each State and Inter-District Volleyball tournament, the various district teams, sports school/wings/centre teams (subjects) were selected for administration of the test items. The coaches, managers and school teachers of selected teams were consulted at the personal level to conduct the tests on volleyball players, and a rapport was established with them, for the next programme. All those in charge of physical education, teachers and coaches, were made fully conversant with the study. Tentative dates were finalised with them. The researcher approached each school/wing after giving proper

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and timely information before the tests were conducted. The details of schedule for conducting the tests as
given in Appendix F.

Before administering the tests, the subjects were
briefed about the purpose of the study and details of all
the tests were explained to them. They were also given a
sufficient number of trials to enable them to become
familiar with the tests. To ensure uniform testing condi-
tions, the subjects were tested in the morning and evening
sessions. The duration of the test administration was set
in a manner so that fatigue may not occur. Sufficient time
was given in between the tests, so that the subjects could
show their best performance.

The subjects were directed to come in proper playing
kit during the performance of the tests. No special
motivational technique was used to enhance their perfor-
mance. But the nature of the tests was such that each
subject was so enthusiastic that he performed each test
in the spirit of competition to surpass his counterparts
and know his status of physical fitness. The subjects
gave the maximum cooperation throughout the test adminis-
tration.
Test Administration Procedure

20 Metre and 50 Metre Run\textsuperscript{10}

Objective:

To measure the speed.

Equipment:

Two stop watches, suitable area to allow 50 metre and 20 metre runs, plus extension for follow through after the race, lime, 50 metre steel tape.

Direction:

The starting and finish lines were marked and measurement was made with steel tape. A minimum of two subjects ran at a time. The subjects were permitted to take the standing or crouch start. The word of command for start was 'Ready and 'Go'. On the command 'Go' (Fig. 3.1) the subject ran to cover the distance in the shortest time and simultaneously the starter dropped his hand down as a signal to record the time. The subject ran as fast as possible across the finish line. If the

Fig. 3.1 20METRE AND 50METRE RUN TEST
subject took a foul start, he was allowed to take another chance.

**Scoring:**

The elapsed time from the starting signal until the runner crossed the finish line was recorded nearest to one tenth of a second.

**Speed of Movement Test**

**Objective:**

To measure the speed of movement of hands.

**Equipment:**

Chair, Table, Chalk, One-foot scale, reaction-time scale and paper and pen for recording.

**Direction:**

The subject was told to sit on the chair with his hands resting on the edge on the table. Two lines one feet apart on the table were marked. The hands were placed in such a way that palms faced each other on the two lines marked on the table (Fig. 3.2A). As the

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Fig. 3.2  SPEED OF MOVEMENT TEST
subject's hands were on the ready position, it was made sure that the hands did not move before the fall of the timer. The hands were kept at the correct distance. The tester held the timer scale near its top so that it hung midway between the subject's hands. After the preparatory command 'Ready' was given, the timer was released and the subject attempted to stop it as quickly as possible by clapping of the hands (Fig. 3.2B). Twenty trials were given.

Scoring:

The scoring of the subject was at the point just above the upper edge of the hands after the catch. The average of the middle 10 trials after discarding the five fast and lowest trials, was recorded as the score. The timer was used by marking in distance (in centimetres) to facilitate judging of the player's status by the coaches.

Spike Jump

Objective:

To measure the spike jumping ability (leg muscle power) of volleyball players.

Equipment and Material:

Volleyball court, volleyball net, vertical jump
measuring apparatus, 40 x 75 cm board marked in centi-metres fitted with a hollow iron pipe or 5 x 5 centimetre wooden piece similar to a marker, height more than volleyball net, a stool (to stand on so as to read the mark on the board).

**Direction:**

The vertical jump measuring apparatus was tied with upper and lower parts of the net, so that the apparatus was adjusted in a vertical position, extending the scale above the top of the net. The scale was fixed in the centre of the net. The lower part of the apparatus rested on the ground, giving a firm base which provided the exact measurement. After fitting the apparatus, it was ensured that there was no variation in the height marked on the board. It was again checked with the standard steel tape.

The hand raised height of the performer was recorded from the top of the middle finger, from the standing position, feet flat on the ground without shoes.

The performer was supposed to take the jump as he was going to spike the ball. So the performer assumed his position three strides away (Fig. 3.3A) from the jumping spot. As the performer reached the peak of his jumping height, he would touch the scale board with open hand
Fig. 3.3  SPIKE JUMP TEST

3.3 A

3.3 B
while extending his spiking arm (Fig. 3.3B). The achieved height with jump was recorded; it was later subtracted from the reach height to find out the jumping height of the subject. The performer could take three trials consecutively with his own time. The best height achieved by the performer was considered his performance. The player could use the approach of only three strides. He could use even fewer strides as convenient to him. He could make use of his whole body parts to achieve the maximum height.

Scoring:

The best of three jumps was recorded in centimetres to calculate the jumping height.

Block Jump

Objective:

To measure the vertical jumping ability (Leg Muscle Power) of Volleyball players.

Equipment and Material:

Volleyball court, volleyball net, vertical jump measuring apparatus (a 40 x 75 centimetre marked board in centimetres fitted with a 5 centimetre hollow iron pipe or 5 x 5 cm wood piece similar to a marker, length more than net height), a stool and a stick.
**Direction:**

The vertical jump measuring apparatus was fitted with upper and lower parts of the net, so that the apparatus might remain in a vertical position, extending the scale board above the upper part of the net. The apparatus was fixed in the centre of the net. The lower part of the apparatus rested on the ground, giving a firm base. After fitting the apparatus, it was ensured that there was no variation in the height marked on the board. It was checked with a standard steel tape.

The hand raised height of the performer was recorded from the top of the middle finger in a standing position, keeping the feet flat on the ground. The performer assumed his position in front of the jump-measuring apparatus (Fig. 3.4A) similar to the blocking stance. He took his own time for jumping. For the jump, he slightly flexed his legs from the knees and jumped only with the power of legs and stretched both hands on the board (Fig. 3.4B) similar to blocking of ball. The tester stood on a small bench in front of the board with a stick in his hand to point out the maximum reach of the performer's hand on the scale board. The height achieved by the performer was considered.
Fig. 3.4  BLOCK JUMP TEST

3.4 A

3.4 B
Scoring:

The best of three jumps was recorded in centimetres for calculation of the jumping height.

Vertical Jump

Objective:

To measure the vertical jumping ability (leg muscle power) of a volleyball player.

Equipment and Material:

Volleyball court and net, vertical jump measuring apparatus (40 x 75 cm board marked in centimetres, fitted with a hollow pipe or 5 x 5 cm wood piece (similar to marker), length more than the volleyball net). A stool for the tester to stand on to read the mark on the board.

Direction:

The vertical jump measuring apparatus was fixed with upper and lower parts of the net, so that the apparatus would remain in vertical position, extending the board above the upper part of the net. The scale

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board was adjusted in the centre of the net. The lower part of the apparatus must rest on the ground, giving a firm base, which would provide the exact measurement. After fitting the apparatus, it was ensured that there was no variation in the height marked on the board by measuring with a standard steel tape.

The standing reach height of the performer was recorded from the tip of the middle finger, from the standing position, with the feet flat on the ground, without shoes.

The performer assumed his position along the board (Fig. 3.5A) facing any direction as he felt convenient. The performer jumped upward by adopting a crouch position with swing of both arms. The performer marked the board with chalk or finger (Fig. 3.5B) as he reached the peak height. The height achieved by the performer was recorded. He was allowed to take three trials continuously. The best height achieved by the performer was recorded as the result. The performer was not allowed to take a double jump nor a step forward. He was directed not to make any movement of the feet before jumping.
Fig. 3.5  VERTICAL JUMP TEST

3.5 A

3.5 B
Scoring:

The best of the three jumps was recorded to calculate the jumping height in centimetres.

Softball Throw$^{13}$

Objective:

To measure the power of the arm.

Equipment and Material:

Six standard softballs, steel tape, lime, three number plates and open ground or football ground.

Direction:

A straight restraining line about 5 feet long was marked and a point was also marked in the centre of the line from where the subject to throw the softball as far as possible. The subject was instructed to place his front foot just behind that point (Fig. 3.6) on the restraining line. He was allowed to place his feet at his convenience. The performer was not allowed to use approach run for the purpose of throw. He was only allowed to move the rear foot as the throw was made for follow through.

Fig. 3.6 **SOFT BALL THROWN TEST**
The performer was allowed to take three trials in succession with his preferred hand. He was allowed to take his own time for the throw. The throw was performed over the shoulder. The assistant stood the restraining line and the tester pegged the number plates on the point made by the ball. The best throw was measured in metres to the nearest of 20 centimetres. If the performer committed a foul, he was allowed another trial.

Scoring:

The best of three throws in terms of distance was recorded nearest to 20 centimetres.

Basketball Throw

Objective:

To measure the power of the arm.

Equipment and Material:

Three Cosco rubber basketballs, lime, steel tape, three number plates and an open ground.
Direction:

A restraining line about 5 feet long was marked and a point was also marked in the centre of the line from where the subject was supposed to throw the basketball. The subject was told to place his front foot just behind that point (Fig. 3.7) on the restraining line. The throw was made from the standing position, without using approach run. The subject was only allowed to move the rear foot while throwing. He was allowed to take his own time for throw which was made over the shoulder. The assistant stood near the restraining line to check any foul and the tester placed the number plates on the point of the throw. The best throw was recorded in metres to the nearest 10 centimetres.

Scoring:

The best of three throws was recorded in terms of distance to the nearest of 10 centimetres.

Push Up

Objective:

To measure the muscular endurance of the arms and shoulder girdle.

---

Fig. 3.7 BASKET BALL THROW TEST

Tester

DISTANCE TO BE MEASURE

Subject

Assistant
Equipment and Material:

A mat and a stop watch.

Direction:

A straight arm from leaning rest position was placed by the (Fig. 3.8A) performer who lowered the body until the chest touched the mat (Fig. 3.8B) and then pushed upward to straight arm support. During this exercise, the body was lowered and raised, keeping the body and legs in a straight line. The tester kept the time with a stop watch. To start the exercise, the word of command was "Ready" and "Start" and to end the exercise, the command was "Stop". The tester pressed the stop watch on the command "Start" and to stop the watch after 30 seconds with a word of command "Stop". The performer performed the exercise continuously for 30 seconds according to the instructions. He was not to snag or pike hips upward. He maintained a straight line through out the exercise.

Scoring:

The score was the number of correct push ups executed in 30 seconds.
Fig. 3.8 PUSH UP TEST

A - Dound Position

B - Lowered Position
Additional Points:

The score was terminated (A) if the performer stopped for rest, (B) if the chest did not touch the mat, (C) if the arms were not fully extended on each execution, the trial does not count, (D) to ensure that the performer touched the chest with the mat, the tester put his hand under the chest for better position.

Sit Up (Bent Knee)\textsuperscript{16}

Objective:

To measure the strength endurance of the abdominal muscles.

Equipment and Material:

A mat, a yardstick and a stop watch.

Direction:

The performer adopted a lying position on the back, flexed his knees over the yardstick, while he slid his heels as close to his seat as possible. The yardstick was held tightly under the knees until the performer was

\textsuperscript{16}Barry L. Johnson, "The Effect of Motivational Testing Situations on an Endurance Test," (Laboratory Experiment, North-East Louisiana University, 1963).
instructed to slide his feet slowly forward. At the point where the yardstick dropped on the mat, the tester marked the heel line and seat line to indicate how far the feet were kept from the seat during the bent knee position. The performer interlaced the fingers behind his neck and performed sit up; alternatively the left elbow touched the inside right knee and the right elbow touched the inside left knee. The performer was helped by the other subject who held his ankles and feet during the exercise to keep the body in a stable position (Fig. 3.9).

The exercise was started on the word of command 'Ready' and 'Go' by the tester, and to stop the exercise the command was 'Stop'. The performer continued the exercise, as fast as possible, according to the instructions, for a period of 30 seconds. The tester kept the time with a 1/10th of a second stop watch. As soon as 30 seconds were over, the tester ordered the performer to stop the exercise. The assistant counted the number of sit ups during the 30 seconds.

**Scoring:**

The total number of repetitions performed during 30 seconds was the score of the performer.
Fig. 3.9 SIT-UP TEST
However, the repetition was not counted when finger tips did not maintain contact behind the head, when the knee was not touched or when the performer touched the ground with his elbows.

Additional Points:

The performer kept the feet flat on the ground and was allowed to keep them as he felt convenient. The back of the hands touched the mat each time before curling to the sit-up position.

Burpee Test\textsuperscript{17}

Objective:

To measure the general muscular endurance of the body.

Equipment and Material:

Stop watch.

Direction:

The subject adopted a standing (erect) position. To start the exercise the command was given 'Ready' and

\textsuperscript{17}Johnson and Nelson, Practical Measurements for Evaluation in Physical Education, p.133.
'Go', and for discontinuing the exercise the command was 'Stop'. The exercise was performed for a duration of 30 seconds as many times as possible by adopting a correct position changed in 30 seconds. The exercise was performed in parts, starting from the standing position (Fig. 3.10), a) bent at the knees and waist and place the hand on the ground in front of the feet, b) thrust the legs backward to a front leaning rest position, c) return to the squat position, and d) stand erect. The exercise was repeated at a constant rate of movement for a duration of 30 seconds. The tester recorded the time on the command 'Go' and stopped the watch after 30 seconds. The assistant counted the number of exercises performed by the subject during the period between the commands 'Go' and 'Stop'.

**Scoring:**

The score was the number of correct positions executed during 30 seconds. The score was recorded to the nearest whole number.

**Additional Points:**

The score was terminated if the performer stopped to rest. The repetition which was not correct was not counted toward the score.
Fig. 3.10 BURPEE TEST

A

B

C

D

110
Wrist Flexion

Objective:

To measure the flexion of the wrist of preferred hand.

Equipment and Material:

Goniometre.

Direction:

The subject assumed the standing position by extending his preferred arm in front of the body. The hand was in a vertical position, fingers straight in line with the forearm. The tester placed the fixed arm of the Goniometer on the forearm (on radial bone) in such a way that the moving point of the moving arm was placed on the wrist joint. The moving arm of the Goniometer was over the index finger making one line by the fixed arm. The subject was ordered to flex his wrist by contracting his muscles and allow the moving arm of the Goniometer to move along the hand. The subject stopped his wrist flexion action at the maximum. The tester recorded the degree of his wrist flexion. The recording was made to the nearest five-degree unit.
Scoring:

The recorded degree of the subject's wrist flexion was the score of the subject.

Additional points:

The subject flexed his wrist slowly and gradually. He was to stop for a moment at his peak flexion. The flexion was not made in a jerky movement.

Wrist Hyper Extension

Objective:

To measure the hyper extension of the wrist of preferred hand.

Equipment:

Goniometer.

Direction:

The subject assumed a standing position by extending his preferred arm in front of his body. The hand was in a vertical position with the fingers straight in line with the forearm. The tester placed the fixed arm of the Goniometer on the forearm (Radial bone) in such a way that the moving point of the moving arm was placed
on the wrist joint. The moving arm of the Goniometer was over the index finger making one line with the fixed arm. The subject was ordered to extend the wrist and allow the moving arm of the Goniometer to move along the hand. The subject stopped for a while the wrist hyper extension action. The tester recorded the degree of the subject's wrist hyper extension. The recording was made to the nearest five-degree unit.

**Scoring:**

The recorded degree of wrist hyper extension was the score of the subject.

**Additional Points:**

The action of wrist hyper extension was performed gradually and slowly. The subject was to stop for a moment at the peak of the wrist hyper extension. The extension was not made in a jerky movement.

**Trunk Flexion**

**Objective:**

To measure the forward bending ability of the body.

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18Fleishman, The Structure and Measurement of Physical Fitness, p.78.
Equipment and Material:

Bench, measuring scale.

Directions:

The trunk flexion was measured in a standing position. A 60 cm. scale, marked in cms, was fixed on one side of the bench so that half of the scale was above the bench and half below it in a vertical position.

The subject was asked to stand erect with toes even with the front edge of the bench and against the side of the scale. He bent the trunk forward, with fingers in front of the scale. The subject then slowly reached as far as possible. The finger tips of both hands moved parallel to and equally down the scale. He was not allowed to flex the knees. The test was conducted after warming up. The score was taken when the fingers rested completely on the scale (Fig. 3.11).

Score:

The score was taken to the nearest cm. as indicated by the middle finger on the scale.
3.11 TRUNK FLEXION TEST
Trunk Hyper Extension

Objective:

To measure the trunk hyper extension.

Equipment and Material:

The flexomeasure case with yardstick and ruler guide inserted and a mat.

Direction:

The subject was sitting on the mat, upper body in erect position (Fig. 3.12A). The length of the trunk and the neck was measured in centimètres with the help of an assistant. The measurement was made from the ground to the tip of the nose, putting the zero end at the ground (seat level) in between the legs. The flexomeasure case was raised until the bottom of the ruler guide touched the tip of the subject's nose. The assistant recorded the reading at the bottom of the case. After that the subject assumed a prone position (facing down) on the mat and hands resting on the small of the back. The partner was to hold

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from the hips by placing his hands on the back of the thighs. He raised the trunk upward as high as possible from the ground. The assistant placed the zero end of the yardstick on the mat and slid the flexomeasure case vertically upward until the upper edge of the ruler guide touched the tip of the subject's nose (Fig. 3.12B). The reading was done to the nearest centimetre.

Scoring:

The subject's best of three lifts from trunk and neck length would be the score, i.e., trunk and neck length minus trunk lift would be the score of the subject.

Squat Thrust

Objective:

To measure the rapidity (agility) by which body position can be changed.

Equipment and Material:

Stop watch.

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Fig. 3.12  TRUNK HYPER EXTENSION TEST

(A)  Sitting Position

(B) Lying Prone Position
Direction:

The performer adopted the standing (erect) position for starting the exercise. To start, the word of command was given 'Ready and 'Go' and to suspend the exercise the command 'Stop' was given. The exercise was performed for 10 seconds as many times as possible by adopting correct positions. The assistant counted the number of positions changed during 10 seconds. The exercise was performed in parts, starting from the standing position (Fig. 3.13). a) Bend at the knees and waist and place the hands on the ground in front of the feet. b) Thrust the legs backward, to a front leaning rest position (push up position), c) Return to the squat thrust position (sitting on the toes) and hands on the ground, d) and rise to the standing (starting) position. The tester recorded the correct positions in 10 seconds from the command 'Go' to 'Stop'. The assistant also counted the correct positions changed during 10 seconds.

Scoring:

The tester recorded the scores in terms of the number of parts executed in 10 seconds. Part one was squatting and placing the hands on the ground; part two was thrusting the legs to the rear; part three was again
Fig. 3.13 SQUAT THRUST TEST

A

B

C

D

A

D
adopted squat position, and part four was returning to the starting position.

**Penalty:**

There was one point penalty (1) if the feet move to the rear before the hands touch the ground, (2) if there was excessive sway or pike of hips in the rearward position, (3) if the hands leave the ground before the feet were drawn up in position number three, and (4) if the stand was not erect (head up). If any performer tried to commit foul, the exercise was suspended and the performer allowed to restart the exercise after some rest.

**Up and Down Run**

**Objective:**

To measure the agility of the performer in running and changing direction.

**Equipment and Material:**

Steel tape, stop watch, and volleyball court.

**Direction:**

This test is similar to shuttle run but the test was conducted on the volleyball court. The service line was the starting line and the centre line (net line) was
the other end line. Two volleyballs were placed, one each on the starting point and on the centre line. On the command 'Ready' and 'Go', the performer ran from the starting line and touched the volleyball lying on the centre line and runs back to touch the volleyball lying on the starting point (Fig. 3.14). In this way the performer runs two rounds to finish the test at the starting point in the shortest possible time. The time was taken from the command 'Go' and to the torso touch on the starting line (Finish line). The performer was allowed to take two trials. The better time among the two trials was considered as the score. The time was recorded nearest to 1/10th of a second. A short recovery period was provided in between the two trials.

**Scoring:**

The time taken by each subject to complete the test was considered as his raw score.

**Court Agility**

**Objective:**

To measure the agility.

**Equipment and Material:**

Stop watch, volleyball court.
Fig. 3.14  UP AND DOWN RUN TEST

- Subject/Tester/Assistant
- Volley Ball
Direction:

The volleyball court was marked properly. The test was started from the service line. On the command 'Ready' and 'Go' the subject started running to touch the centre line. After that, he touched the attack line at a distance of 3 metres on the same side of the court; thereafter he touched the attack line of the other court, then the centre line, and finished the test by crossing the end line (service line) of the other court (opposite to the starting point) (Fig.3.15). In this way the subject completed the distance of 9 metres, + 3 metres + 6 metres + 3 metres + 9 metres (9-3-6-3-9). If a subject committed any mistake (foul), he was allowed to take another chance. He was to touch the line by leaning forward with any hand, even side to side. The time was recorded to the nearest 1/10th of a second.

Scoring:

The time elapsed between the word of command 'Go' to the finish of the test was considered as raw score of the subject.

W.M. Agility

Objective:

To measure the agility.
Fig. 3.15  COURT AGILITY TEST

Tester

Finish Point

Attack Line

Net Line

Attack Line

Subject

Starting Point

Assistant

9 m

9 m

6 m

3 m
Equipment and Material:

Stop watch, six volleyballs and volleyball court.

Direction:

Six flags/volleyballs were placed on six stations - A, B, C, D, E and F as shown in Figure 3.16. The subject took his starting position at station A on command 'Ready' and 'Go'. The subject ran to touch the ball at stations B, C, D, E and F. Then he turned back to touch the balls in reverse order, i.e., F, E, D, C, B, and finished to cross station A. Touching the ball in proper sequence was compulsory. For any breach of this rule, another chance was given to the subject.

Score:

Time taken from start to finish was recorded to serve as the raw score of the subject.

Six Point Run

Objective:

To measure the speed endurance.

Equipment and Material:

Stop watch, six volleyballs and a marked volleyball court.
Fig. 3.16  W. M. AGILITY TEST

Volley Ball Court

Subject
Assistant
Tester
Volley Ball/Flag
Direction:

A volleyball court was marked. The test was conducted on one side of the court. Seven balls were placed, one on each station, i.e., A, B, C, D, E, F and 'S' (Fig. 3.17). The subject took his starting position at station 'S'. On command ready 'Go' the subject ran to and fro to touch each ball at stations A, B, C, D, E and F respectively one by one. Any missed touch was considered as an invalid attempt. Therefore, another chance was given to the subject. The time was recorded to 1/10th of a second.

Scoring:

The time elapsed between start and finish of the test was recorded to serve as raw score for the subject.

W.M. Run

Objective:

To measure the endurance of the subject.

Equipment:

Marked volleyball court, net at proper height, stop watch, three flags of 4' height.
Fig. 3.17  SIX POINT RUN TEST

VOLLEY BALL COURT

Finish/Start
Tester ▲ Assistant

 Subject
Directions:

Three flags were fixed on attack line 30 cm. inside the side lines one each at stations A, B and C (Fig. 3.18). Point 'S' was marked for start and finish. On command 'Ready', 'Go', the subject moved fast to have a block jump at point D and ran over flag B to have block jump at point E. Again he ran over flag C to have block jump at point F, thereafter ran over flag B to have block jump on point E, then ran over flag A to have block jump at point D. In this way he completed 10 rounds and after the last block jump at point D finished his test at point 'S'. The time was recorded to 1/10th of a second.

Additional Point:

The subject was required to touch the wrist of both hands to the top of the net on each block jump. Anyhow, for two such mistakes a simple warning was given, but on the third mistake, he was asked to retire from the test. After complete recovery he was allowed another chance.

Scoring:

The time taken to complete the test from start to finish was recorded to serve as raw score of the subject.
Fig. 3.18  W. M. RUN TEST

A

Net

3m

6m

4.5m

4.5m

9m

Start
Finish
Subject
Tester
Assistant
Fig. 3.18
One Minute Lateral Jump\textsuperscript{21}

Objective:

To measure the endurance.

Equipment and Material:

Stop watch, lime and volleyball ground.

Direction:

A five feet straight line was marked on the volleyball ground. The subject stood on one side of the line, keeping the line on his right side. The subject started jumping over the line in hop action. On the command 'Ready' and 'Go' the subject started jumping first on the right side of the line and then on the left side and so on in continuous action. The jumping and landing were on both feet. The subject kept his hands anywhere on his body and could use them for balancing himself. This jumping action was continued for one minute and the time was recorded from the command 'Go'. The tester counted the total number of jumps made in one minute.

Scoring:

The total number of jumps performed during one minute was recorded as the score of the subjects.

Age

Objective:

To know the chronological age of the subject.

Equipment:

School/College record.

Direction:

The age was recorded from the school record in calendar months and years, i.e., complete 14 years of age to 18 years plus, from the date of the test administration.

Scoring:

The number of months was the raw score of the subject.

Weight

Objective:

To measure the weight of the subject.
Equipment:

Weighing machine.

Direction:

The weight was taken with a portable weighing machine with an accuracy of 0.5 kg. The subject was supposed to be in sports kit without shoes. The subject stood on the weighing machine properly. The weight was recorded in the volleyball playing kit to the nearest kilogram.

Scoring:

The body weight in kilograms of the subject was the score of the subject.

Height

Objective:

To measure the standing height of the subject.

Equipment and Material:

Steel tape and scale or a marker with marked height in centimetres on the wall.

Direction:

The scale in centimetres was drawn on a plain
cemented wall using "Freeman's Standard measuring tape."
The height was measured in socks. The subject was asked to stand with his back to the wall, in erect and attention position. The tester stood facing the wall, in front of the subject, with a wooden scale in his hand. The scale was put on the vertex of the subject so that the end of the scale touched the wall. Due care was taken so that the scale was placed in a proper manner and it was parallel to the ground. The height was recorded to the nearest centimetre.

**Scoring:**

The net height in centimetres of the subject was his raw score.

*Standing Reach Height*

**Objective:**

To measure the reach height of the subject.

**Equipment and Material:**

Steel tape, a small bench and properly marked adjustable pipe or wood piece 5 x 5 cm of spike jump support or marker.
Direction:

The spike jump scale (board) was marked with steel tape in centimetres and it was tied with the top and bottom parts of the net. The subject stood close to the net and facing it, raising his preferred hand. Both feet were flat on the ground. The subject extended his playing arm fully upward for maximum reach. The tester stood close to the subject on a small bench so that he was able to see the point just parallel to the top of the middle finger. The subject was directed not to raise his heels, nor to bend his knees and arm. The height was recorded to the nearest centimetre. This procedure could also be adopted by using the wall.

Scoring:

The height achieved by raising his preferred hand was the score of the subject.

The Second Phase of the Study and Collection of Data

In the second phase of the study, a fresh data on 400 volleyball players was collected from June to September, 1987. During the administration of newly developed specific physical fitness test variables (Table 6) for the collection of data, the same procedure was followed as mentioned in the first phase of this chapter.
# Table 6

**Administration of Specific Physical Fitness Test for the Development of Norms**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Test</th>
<th>Component</th>
<th>Body Part</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Spike Jump</td>
<td>Power</td>
<td>Leg</td>
</tr>
<tr>
<td>2.</td>
<td>W.M. Run</td>
<td>Endurance</td>
<td>General</td>
</tr>
<tr>
<td>3.</td>
<td>Squat Thrust</td>
<td>Agility</td>
<td>Whole Body</td>
</tr>
<tr>
<td>4.</td>
<td>Basketball Throw</td>
<td>Power</td>
<td>Arm and Shoulder</td>
</tr>
<tr>
<td>5.</td>
<td>Wrist Flexion</td>
<td>Flexibility</td>
<td>Wrist</td>
</tr>
</tbody>
</table>
In the normative survey of physical fitness of 14 to 18 years (Table 7) of volleyball players of different schools/clubs/sports wings from different states formed the total population. In order to make the sample fully representative of the population for this phase, the school located in the area (Appendix G) which feed the top school teams were also considered as the sample of the population from each district where the volleyball game was played regularly. All the tests were administered to 550 students out of which 500 students belonging to both rural and urban areas completed the tests.

**TABLE 7**

**STATEWISE AND AGE-WISE CATEGORIZATION OF TOTAL POPULATION**

<table>
<thead>
<tr>
<th>State</th>
<th>Age</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>Punjab</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Haryana</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Delhi</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Himachal Pradesh</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Chandigarh</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>90</td>
<td>90</td>
</tr>
</tbody>
</table>
Statistical Procedure

Wherry-do-little method of multiple correlation was used as a statistical tool to select test items out of 26 variables, which best suited to measure the specific physical fitness of volleyball players. For this purpose, composite score of 26 items was used as the dependant variable and test items as independant variables. The test items which yielded the significant and meaningful 'R' values were retained for further statistical treatment whereas the other items with low 'R' values were dropped.

Regression Equation

The derived test items through the application of Wherry-do-little method were further put to regression equation to find out the relative contribution of the test items.

The Product moment correlation was employed for assessing scientific authenticity of the test items.

The design of the study was to construct specific physical fitness test and develop norms for district level volleyball players of 14 to 18 years of age group.
'F' Test was applied to five (14, 15, 16, 17 and 18 years) age groups on each test item to ascertain the mean difference between the scores of each age group. Hull's and Percentile scale were used for the development of the norms.