Chapter III

PROCEDURE

In this Chapter, the selection of subjects, selection of variables, reliability of data, collection of data and statistical techniques used for analysing the data are described.

Selection of Subjects

One hundred and twenty male volleyball players (fourty in each group i.e. National, Inter-University & National School's level) were selected as subjects for the study. The subjects were in the age group of 16 to 30 years.

Volleyball players representing their states or departments in National Volleyball Championships held at Bhilai (M.P.) in December 1987 were considered as national level players. About twenty three (Men) teams had reported for the competition. The subjects were selected from the first six players of top 16 teams of the championships.

The players studying in various Universities of India, who had reported for West Zone Inter-University Volleyball Championships at Jaipur (Rajesthan) and in All India Inter-University Volleyball Championships at at Bhagalpur (Bihar) were selected as University level subjects. In this category the subjects were selected from the first six players of top four teams of West Zone Inter-University Tournament and rest from
the remaining six teams of All India Inter-University Volleyball Championship.

The school students who represented their respective states and Kendriya Vidyalaya Sangthan Volleyball teams in National Schools Games held at Durg (M.P.) were considered as national school's level players. In this category too, the first six players of top sixteen teams of the competition were taken as subjects of the study.

About 270 players were selected as subjects for the study in all the categories. From which only one hundred and twenty were considered for the final study as subjects as they completed all the test items. Those who could not completed all the test items were thus eliminated.

The subjects came from different parts of the country and belonged to different socio-economic strata. All the players had been participating in the game of volleyball regularly for a number of years.

Selection of Variables

A feasibility analysis as to which of the important psychomotor variables could be taken up for the investigation in keeping with the availability of equipments, acceptability to the subjects and the legitimate time that could be devoted for tests as well as to keep the entire study unitary and integrated was made in consultation with the scholars/ adviser and the experts in the field.
With the above criteria in mind the following psychomotor abilities were selected, because those are directly or indirectly related to the performance in volleyball. All these variables were classified into two categories i.e. dependent and independent variables.

**Dependent Variable**

**Volleyball Playing Ability**

The subjective judgment of "Volleyball playing ability" of each subject was based on the performance analysis of five components of play i.e. Attack, Block, Organization of Attack, Back Court Play and Serve, during the respective competition. Each component was analysed separately, on five point scale on the basis of performance analysis from (Appendix D) by five Experts. The average score of five Expert's ratings on all the five components together was considered as scores on playing ability of the subject.

**Independent Variable**

The following psychomotor abilities were selected as independent variables:

**Psychomotor Abilities**

(i) Agility;
(ii) Power (leg and shoulder);
(iii) Speed;
(iv) Reaction Time of Hand (Visual);
(v) Reaction Time of leg (Visual);
(vi) Movement time (Stepping Time);
(vii) Multilimb co-ordination;
(viii) Finger Dexterity;
(ix) Manual Dexterity;
(x) Arm-Hand Steadiness.

Reliability of Data

The research scholars established the instrument reliability, tester's competency and reliability of tests which in turn assured the reliability of data.

Instrument Reliability

All the instruments used in this study were found to be quite precise and reliable. Power (leg and shoulder), speed and agility were measured by Sarjent Jump and Reach Test, Basketball Throw. 50 metre dash and 4 x 10 metres shuttle run, respectively. These tests are well established and widely used in the field of Physical Education and Sports.

The stop watches used for measuring performance of players in 50 M. shuttle run, finger dexterity, manual dexterity & two-hand co-ordination were all calibrated. Whereas the steel tapes used to measure the performance of player in Sarjent Test and Basketball throw were of standard quality.

Reaction times and stepping time were measured by using
Electronic reaction time apparatus which was manufactured and supplied by Anand Agencies, Pune. This instrument had the transistorised chronoscope showing time up to four decimal places, and hence, it was accepted accurate enough for the purpose of study.

The arm-hand steadiness and Multilimb co-ordination were measured by the steadiness tester and two hand coordination apparatus supplied by National Psychological Corporation, Agra. Which were considered quite reliable, for measuring arm-hand steadiness and multi-limb co-ordination of the subjects.

The finger Dexterity and manual dexterity were measured by Tweezer Dexterity Tests supplied by National Psychological Corporation, Agra. These tests are widely used in research in Physical Education and Sports, in the research laboratory of Lakshmibai National College of Physical Education, Gwalior, and at N.S.N.I.S. Patiala, thus the instruments were considered quite reliable and precise enough for the purpose of this study.

**Tester's Competency and Reliability of Data**

To ensure that the investigator was well versed with the technique of conducting tests, the investigator had a number of practice sessions in testing procedures with the experts in the laboratory of Lakshmibai National College of Physical Education, Gwalior. All the measurements were taken by the investigator himself with the assistance of his colleagues.
who were all acquainted with the tests and their testing procedures.

Test-Retest Method was employed to establish the reliability of tests as well as competency of the tester. For this purpose 10 subjects from each group, were randomly selected. Testing and re-testing was administered by the same tester on the same thirty subjects with one day's gap in between under utmost similar conditions. on the tests of power (leg and shoulder), running speed, agility, reaction time (hand and leg) movement time (stepping time) finger Dexterity, manual dexterity, multilimb co-ordination (two hand co-ordination) and Arm-Hand Steadiness.

The obtained Pearson's Product Moment Correlation coefficients were found to be statistically significant at .05 level of confidence as shown in Table 1.

TABLE 1

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<th>RELIABILITY CO-EFFICIENTS OF TEST RE-TEST SCORES</th>
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Since very high correlations from .85 to .92 were obtained. Therefore, the tests selected for the purpose of this study were highly reliable and tester proved to be competent to administer these tests.

Collection of Data

Prior to the administration of tests a meeting of all the players and their coaches was called to explain the requirement of the procedure, regarding the efforts required of them in addition to the strain they had to endure alongside their participation in the respective championships. Though no special technique was used to motivate the subjects, the subjects were very enthusiastic and cooperative throughout the project.

The data were collected by administering the tests for chosen variables. All the tests were administered on Volleyball courts or in the rooms near the site of competition for respective category.

Before the administration of tests the subjects were allowed to warm up for the tests of speed, power and agility, whereas they were given a chance to practice on the apparatus for reaction time, speed of movement (stepping time), two-hand co-ordination, finger dexterity, manual dexterity and arm-hand steadiness, in order to get them familiar with the tests and to know exactly what was to be done.

To ensure uniformity in testing conditions, the tests for speed, agility were conducted after warming up during practice sessions, prior to the competition. Tests of power were administered after warming
up before the actual match and the tests for remaining psychomotor ability were conducted during evening hours i.e. from 3 p.m.to 5 p.m. on the rest day of the competition. The data for chosen psychomotor abilities was collected as per the procedure mentioned below.

**Administration of Tests**

4×10 Mts. Shuttle Run

The purpose of this test was to determine the agility of the subject.

Four wooden blocks (2"x2"x4"), stop watches, wooden clapper were required for this test. Two parallel lines were marked on the ground 10 metres apart, the subjects were made to stand behind the starting line. On the command 'ready' 'go' the subjects ran to the blocks, picked one and ran back to the starting line and placed it behind the line. Then he ran back and picked-up the second block, ran back and placed the second block behind the starting line. Two subjects ran at a time and three trials were given with some resting time between trials.

The score for each subject was the length of time that was taken by the subject to complete the distance of 4 x 10 metres, recorded to the nearest tenth of a second. The best of the three trials was taken as score for analysis.¹

¹Johnson and Nelson, *Practical Measurement for Evaluation in Physical Education*, p.218
Basketball Throw

Purpose of this test was to measure the explosive strength of arms; one Basketball, steel tape and a nail were used as equipments.

The subject was made to sit on the re-training line in such a position that it coincided with the line of frontal plane on the body. He was asked to sit in feet apart position with Basketball in hands. The subject threw the ball with a forward, upward swing of his arms. Distance was measured from the restraining line to first touch of the ball to the ground in metres. Best of the three trials was recorded as subject's score in metres.2

Sargent Jump and Reach Test

Sargent Jump Test3 was used to assess the explosive Power. The object of the test was to measure the power of legs in jumping vertically upward.

A smooth wall surface of at least 12 feet from the floor was chosen. Marking were clearly made on the wall starting from four feet, and six inches above a measuring steel tape and several chalk pieces were used to mark the recording scale.

3 Johnson and Nelson, Practical Measurement for Evaluation in Physical Education p. 120.
The subject stood with one side toward the wall with heel together and made his tips of fingers wet in water. From this position the subject stretched his arms upward as high as possible and made a mark on the wall with the tips of fingers and then jumped as high as possible and made another mark at the maximum height of his jump. Three trials were given.

The distance between the standing reach and jump, measured to the nearest centimeters was the score and the best of the three trials was recorded.

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50 Metres Run

The 50 metres run test was selected with a view that distance shorter than 50 metres are influenced by start and distance longer than 100 yards are influenced by endurance. This test also requires less space and time and measures running speed and the effect of start if any was minimized by permitting standing start only. The equipment needed were five stope watches and a clapper.

Five subjects ran together to have a competitive performance. The subjects were asked to stand on the starting line. The clapper was clapped after the caution "ready" was given to the subjects. The starter stood in such a position so that the V of the clapper (Open before clap) was visible to the time keepers. As the 'V' closed when the clap was executed, the time keepers at the finish line started the stop watches.
The subjects satiated at least 4 stimuli across the finishing line and the stop watches were stopped, as and when the concerned subject crossed the distance. The clocked time (tstart, the moving signal: tstop) until the subject crossed the Finish line was recorded to the nearest second as the running time.

Hand Reaction

The purpose was to test for reaction times using Electric Apparatus. The apparatus was a non-removable screen with an electric go-devise. The subject had to press the reaction time cord on the tester's finger. The subject had to respond as quickly as possible to any index finger stimulus in the tester's hand. The subject had to remove his index finger, press the cord pressed, as soon as the subject receives the red light stimulus, removed his index finger, press the cord pressed by the subject, so that the stimulus was recorded to the nearest second. The reaction time was given

FIGURE 1 - MEASUREMENT OF REACTION TIME OF HAND (VISUAL)

ibid. p. 251.
The subjects sprinted as fast as possible across the finishing line and the stop watches were stopped, as and when the concerned subject covered the distance. The clocked time, from the starting signal (clap) until the subject crossed the finish line was recorded to the nearest tenth of a second as the running speed score.

**Hand Reaction Time**

The purpose of this test was to measure the subjects hand reaction time using Electronic time Apparatus, supplied by Anand Agencies, Pune. The apparatus was set according to the prescribed procedure. The detachable screen was fixed in the desired holes, which divided the reaction time Apparatus into two sides - one subject's side and the other tester's side. The subject set in a chair on subject's side and the researcher stood on tester's side.

The subject was asked to press down the key with his index finger of strong hand and was also asked to remove it as he receives stimulus in the form of red light in front of the key, as fast as possible. The tester said 'ready' and then after giving some gap, stimulus key was pressed. As soon as the subject received the red light stimulus, he removed his index finger. The time taken by the subject to react to the stimulus was recorded in the Chronoscope. The reaction time was recorded to ten thousand part of a second. Five trials were given.

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4 Ibid. p. 251.
FIG. 2 - MEASUREMENT OF REACTION TIME OF LEG (VISUAL) AND STEPPING TIME
to each subject and the average of five trials was recorded as the score for hand reaction time.

**Leg Reaction Time and Stepping Time**

The leg and stepping reaction time of the subject was measured with the help of electronic reaction time apparatus, supplied by Anand Agencies, Pune. For administering the test the instrument was set as prescribed.\(^6\) Four Wooden boards (Foot Switches) marked ABCD and D were used. All the boards were arranged in a row in such a manner that starting boards A and B were in middle and stepping-boards C and D were on two sides of the starting boards so that subjects could step from board A to board C with his right leg and from board B to board D with his left leg. Out of these board A and B were starting boards and boards C and D were stepping boards. Starting Boards were connected to chronoscope number one and stepping boards were connected to chronoscope number two. The subject stood on board A and B. With his right foot on board A and left foot on board B facing the stimulus board. After the on set of the visual stimulus (yellow light) the subject lifted his preferred foot left/right from the starting board A or B and stepped on the stepping board C or D. The time taken by the subject to lift his foot from starting board after receiving the stimulus, was recorded in chronoscope number one and time taken to step from board A or B to C or D was recorded in chronoscope number two as stepping time.

FIG. 3 - MEASUREMENT OF TWO-HAND COORDINATION
Three trials were provided to each subject and the best timing to the ten thousands part of a second was recorded as foot and stepping Reaction Time of the subject.

Two Hand Co-ordination

The two hand co-ordination ability of the subjects was assessed with the help of Two Hand Co-ordination Instrument (electrical) supplied by Anand Agencies, Pune. The Chronoscope was attached to the instrument and switch was put on. The subject stood comfortably near to the apparatus while holding the side and centre handle with his left and right hand respectively. The side handle move the pin of apparatus forward and backward and centre handle moves the pin to the sides. On the command 'go' the subject started moving the pin from left side to right side as per the design of the apparatus. The score was the time taken by the subject for tracking out the pattern plus the error time recorded in the chronoscope. Three trials were given to each subject and the best was recorded as his score.\(^7\)

Finger Dexterity

The finger dexterity was measured by finger dexterity apparatus supplied by National Psychological Corporation, Agra. The apparatus was set according to the prescribed procedure. The apparatus was a wooden plate with a metal surface on the top, having 100 holes arranged in

10 x 10 rows and on top a small depression was provided to place the pins. The subject was instructed to place only one pin at a time in a hole. A practice trial was permitted.

The subject started placing the pins in the holes on the command 'go' and the stop watch was simultaneously started by the tester. The subject tried to place the pins in all the hundred holes in any pattern he pleased and in the shortest possible time. The time taken in seconds to fill in all the holes with the pins was recorded as the subjects score on finger dexterity. Three chances were given to each subject and the best timing was recorded as his score.  

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**Manual Dexterity**

The manual dexterity of the subjects was measured with the Tweezer Dexterity Tester, supplied by National Psychological Corporation, Agra. The subject was seated on a chair, facing the instrument with a clip in his hand. The apparatus was a plate with a metal surface on the top, having 100 holes arranged in 10 x 10 rows and on top a small depression was provided to place the pins. The subject was instructed to place only one pin at a time in a hole with the help of clip. A practice trial was permitted the subject started placing the pins in the holes on the command 'go' and the stop watch was simultaneously started by the tester. The subject tried to place the pins in all the holes in any

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Each subject was given five trials in the beginning to familiarize orientation with the procedure of the test. The subject sat in a chair and held in key in the hand he preferred. The hand holding the key was not allowed to touch any part of the apparatus. When the subject was

FIG. 5 - MEASUREMENT OF MANUAL DEXTERITY
pattern he pleased and in the shortest possible time. Time taken in seconds to fill in all the holes with the pins with the help of clip was recorded as the subjects score on manual dexterity. Three chances were given to each subject and the best timing was recorded as his score.\textsuperscript{9}

\textbf{Arm Hand Steadiness}

The arm hand steadiness was measured by steadiness tester, supplied by National Psychological Corporation, Agra.

This apparatus had nine holes of different diameters arranged in a sequence from big hole to small hole, four in the top row and five in the bottom row and a light indication. There was an electrical circuit key which was attached to the light indicator as well as to the different holes which when inserted in a hole and touched any side of the hole put the light indicator on and this was a signal for the error score 1 to be recorded which was written under a particular hole as all the holes had been assigned certain error score.

Each subject was given three trials at the beginning to facilitate orientation with the procedure of the test. The subject set in a chair and held in key in the hand he preferred. The hand holding the key was not allowed to touch any part of the apparatus. When the subject was ready, on the command 'Start' he inserted the key one by one in all

\textsuperscript{9}Raj Kumar Sharma, "Comparision of Psychomotor Abilities Between High and Low Physical Fitness Groups" (Unpublished Master's Thesis LNCPE, Gwalior, 1987).
the hole as fast as possible because the time was also checked to complete all the hole. The test started with the subject to insert the key in the sequence in which they were given from below to number hole. However, the light indicator would light up when the key was inserted at the correct hole. The score was recorded in this manner.

The scores were averaged for the three tests and the average of the three tests was recorded as the error score. The average error score and time score of each subject were computed and the significance was tested.

FIG. 6 - MEASUREMENT OF ARM-HAND STEADINESS

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the holes as fast as possible because the time was also clocked to complete all the hole. The test desired the subject to insert the key in the sequence in which they were given from bigger to smaller hole. Whenever the light indicator was put on, the error score of that hole in which the key was inserted at that time was noted and the total error score was recorded in this manner.

Three trials were given to each subject and the average of the three total error scores and the three time scores were recorded as the error score and time score for each subject. This error score and time score were thus converted to standard scores (Z.scores) and the average of these two constituted the arm hand steadiness score for each subject.\textsuperscript{10}

Statistical Procedure

To assess the psychomotor abilities of volleyball players at three different levels Mean and Standard Deviations\textsuperscript{11} were computed; and an analysis of variance \textsuperscript{12} (F - ratio) was applied to determine the significance


of difference among the volleyball players of different ability levels; which was followed by least significant Difference Test\textsuperscript{13} of Post-hoc comparisions to determine the significance of difference between ordered paired means.

The relationship between dependent variable (volleyball playing ability) and independent variables (psychomotor abilities) was established by computing Pearson's Product Moment Correlation\textsuperscript{14} and combined Effect of psychomotor abilities to volleyball playing ability was obtained through Wherry Doolittle Method\textsuperscript{15} of Multiple Correlation. Volleyball playing ability was predicted from psychomotor abilities by utilizing Regression Equations.\textsuperscript{16}


\textsuperscript{14}Clarke and Clarke, Research Process in Physical Education, p. 227.


\textsuperscript{16}Ibid. p. 437