CHAPTER II
REVIEW OF RELATED LITERATURE

Plenty of research literature is available in the field of motor fitness and areas like curriculum development. Every day the research studies and their reports are pouring in and getting available from one corner to another of world. The present study encompasses the areas like exercise, activity habit, physical status and curriculum development.

Physical fitness related to performance has been a subject of research enquiry since more than seventy five years. The contemporary status of research on physical fitness is an outcome of the vast literature available on physical fitness. This study involves the literature on construction and standardization of specific fitness test. A sincere effort was made by investigator to collect relevant literature per training to the present study.

The review of related literature is mainly confined to the library of Lakshmibai National College of Physical Education, Gwalior, Kurukshetra University, Kurukshetra and Punjab University Chandigarh, which are considered to be the richest libraries in India as far as the literature related to physical education is concerned. The researcher has gleaned through almost every source like Research Quarterlies, Journals of various kinds, Periodicals, Encyclopedias and Relevant books to pick up the material and also has taken help from google. She has gone through it properly, carefully, critically and has then jotted down the required experts for inclusion in the thesis.

The researcher wishes to popularize selected exercises included in the study with the help of appropriate authorities to raise the fitness level
of students. She has tried to provide maximum possible administrative feasibility in conducting tests, so that they are organized without any complications. For instance the tests are prepared for the Haryana school girl’s hockey players.

She also made an attempt to bring the review of relevant research work in form of background for present study. Some of the outstanding names associated with the subject in the early thirties and forties of 20th century were Cozens, Sargent, Cureton and so on. Their work in this field is appreciated and referred even today.

STUDIES RELATED TO MOTOR FITNESS

Cozens\(^1\) (1930) in one of his work had studied the stature (height) in relation to physical performance of college man, where he observed negligible correlation between age and height and between age and weight.

Stansbury\(^2\) (1940) developed physical efficiency test for junior and senior high school boys. The test items are eight pound shot-put + standing broad jump+weight. The result showed that physical efficiency score is quotient 111, indicates reliability of the test.

Everet\(^3\) (1952) tested 30 baseball players of university of LOWA on ability to throw for distance, running speed and agility. Ability to visualize special relationship, (Thurston’s Test) ability to make decision (The Hock test) and motor capacity (general motor capacity score).

---

\(^1\) Fredrick W. Cozens, ‘A Study of Stature in relation to physical performance’ R.Q 1;1 March 1930, p-38

\(^2\) Stansbury Physical Efficiency Test’ cited in ‘Test and Measurement in health and Physical Education’ by C.H.McCOLY And N.D. Young, New York; Century-Crofts, 1940, p-161

quickly. These subjects were rated according to the playing ability of the players. Product moment correlation, Partial correlation and multiple correlation were computed and the following conclusions were made.(1)The Sergeant Jump is the best single measure for selecting baseball talent (2)The best economical combination to predict baseball ability is the sergeant jump ‘S’ test and block test. ‘T’ score is equal to 0.92, sergeant jump-0.18, ‘S’ test score-0.23, block test (sec.)+ 0.19.

Fox\(^4\) (1959) had done a study on reliability and validity of selected fitness test for High School Girls. In this the Roger’s Strength test, Kraus Weber test of minimum muscular fitness and a battery of motor fitness tests were administered to 169 freshmen, Sophomore and junior girls at Sheycline High School, Seattle, Washington. Each test was administered with two or more items in order to investigate the reliability of the test. The results seemed to indicate that the Roger’s Strength test and Washington Battery and on the PFI had much lower percentage of failure on the Kraus Weber test than did those with poor Washington Battery and PFI Scores, and that there was a moderate correlation (.59) between the Washington Battery and PFI.

Glassow & Krause\(^5\) in (1960) conducted a study on motor performance of girl’s age 6 to 14 years. Hence group achievement scores for elementary school girls for the 30 yards run, standing broad jump and the over arm throw were presented to add to the limited information, now available on children in first 3 grades,1 through 8 and for ages 6 through 14 years. Reliabilities of within day scores were reported a relation of 10 years scores and of first grade scores with those of grades.


\(^5\)Ruth B. Glassow & Krause, ‘Motor Performance of girls age 6 to 14 years’, Research quarterly 31-3 (October 1960), 426
3 through 5, showed that individual tend to remain in the same relative position within the group during elementary school years. This paper added to present knowledge of motor performance of elementary school children by reporting observation derived from achievement scores of girls.

**Ikeda** (1962) Conducted the Iowa Motor Fitness Test in order to compare the physical fitness of children in Iowa and Tokyo. The result indicated that Tokyo children scored better in all motor performance tests except in sit-ups. He also found that Tokyo children had more chances for activity through Physical Education classes than Iowa group.

**Clarke and Schope** (1962) Revealed in their study of a strength test for boys 9 through 12 years of age in grades iv, v and vi, which was based upon cable tension strength test. From 18 cable strength tests, the following 4 were selected by multiple correlation procedure: shoulder extension, trunk extension, knee extension and ankle extension. The subjects were 826 boys from ten communities located in various parts of Oregon. The total of four tests were designed the strength composite, utilize Roger’s method in the construction of strength index norms.

**Wharton Margret** (1962) Wharton conducted an investigation of the AAHPER youth fitness test as a predictive measure of the skill development in field hockey. One hundred and seven senior high school

---

6Ikeda‘A Comparison of Physical fitness of Children in Iowa and Tokyo’r.q 33:4, Dec.1962, p-5
7H.Harrison Clarke and Theodoreg Schope, ‘Construction of a Muscular Strength Test for boys in grades iv, v, vi’ Research Quartely3(December 1962):515
girl’s who had previous field hockey training experience were used as subjects. A significant relationship was found between the scores on the youth fitness test and field hockey achievement as measured by Schithals French Field Hockey achievement test.

Thirteen selected test variables were administered to one hundred and twenty high school girls by Arnett (1962) to Construct a Purdue Motor Fitness Test. Multiple regression analysis was used to construct a test battery of three items The constructed test battery had a validity coefficient of 0.7555 and a reliability coefficient of 0.848.

J.P.Thomas (1964) mentioned the important physical prerequisites of players are speed, strength, power, endurance, agility and balance. He suggested that the muscles of arms, shoulders, back and legs must be strengthened and their movements are coordinated in split second manners in ball control and in tackling the opponent. Regions of the body to be developed by a soccer player are neck, shoulder, chest, thigh and hips, lower back, gastronomes, but the choice, sequence and the dosage should be carefully worked out on the basis of particular area of the body to be developed. He suggested a battery of exercise for team conditioning. The purpose of this battery is to build strength and endurance. Items in this battery are: Spot running for endurance, pushups and squat jump for 30 seconds.

Harold V. Ritchson (1968) studied fourth grade boys and girls. Data on the following variables were collected and correlated -age, height,

---

11Harold V. Ritchson, ‘The relationship of Several Physical Fitness variables in selected Elementary School Children’ Completed Research in Health, Physical Education and Recreation 10 ( 1968) p 76-A
weight, leg strength, body movement time, 50 yards dash, shuttle run and standing broad jump. The main scores on AAHPER Test items were compared to national norms. Several significant correlations were found, with the highest scores being weight with leg strength (0.48) and leg strength with shuttle run (-0.38).

Casle\textsuperscript{12}(1972) conducted a study with thirty test items of one hundred and eighty three girls as subjects and constructed a motor fitness battery. In his motor fitness test battery items were strength, cardio-vascular endurance, flexibility, agility, balance and power. The thirty test items were not true measures of motor fitness as only sixty three percentage of the total variance were result oriented.

Patrick\textsuperscript{13} (1972) constructed a motor fitness test battery for girls in lower elementary grades. The items indicated in this test battery were Clark’s Strength composition. Well’s sit and reach test, Dodging run, base length wise, stick balance and vertical jump. It measured the essential components of motor fitness such as muscular strength, muscular endurance, cardiovascular endurance, flexibility, agility, balance and power.

In order to construct a scientifically designed evaluative instrument to assess the motor fitness of boys in primary grade, Dinucci\textsuperscript{14} in 1973 proposed thirty test items to measure muscular strength, muscular endurance, cardio-vascular endurance, power, speed, agility, flexibility and balance administered to an incidental sample of two hundred and thirty eight boys aged between six to nine years. An inter correlation matrix was constructed for the factor analysis of a data using the

---

\textsuperscript{12}Patrick Ross Casle, ‘The Construction of a Motor Fitness Test Battery for girls’.


\textsuperscript{14}James M. Dinucci, ‘The Construction of a motor fitness test battery for boys in the primary grades’, Dissertation Abstracts International 3 (1973) : 2105-A
principal Axis method. Seven factors having values above 1.0 and accounting for 67.17 percent of variance were isolated. The first of two test batteries developed included the test items which loaded highest on each factor and were as follows: Clark’s Strength composite, McCloy’s Endurance ratio. Well’s sit and reach, Bass balance on stick length wise, wrist flexion and extension flexibility, arm flexion and back flexibility and modified pushups. The second test battery developed for more administrative feasibility, included items which loaded high on each factor and eliminated composite and ratios. The items in test battery were grip strength, 300 yards run, Well’s sit and reach, Bass balance on a stick lengthwise, wrist flexion and modified pushups.

Boris Delton\textsuperscript{15} in 1975, has suggested 6 tests namely 30 meter sprints, jump and reach test, stand high jump, agility test with special foot work, 300 mts running to measure the motor abilities mainly agility of Basketball players and concluded that agility is a best component in Basketball players.

Robson\textsuperscript{16}, et al and his colleagues in 1978 conducted a study on a simple physical fitness test battery for elementary school children. They took 152 boys and 152 girls of Kendriya Vidyalia, Gwalior as their subject. The test battery was for practicable and simpler than the existing physical fitness tests and measured most of the essential motor qualities of elementary school children. The norms were in to ability group assessing their physical fitness.

\textsuperscript{15}Boris Delton, Methodisch GRUND Sa Tzedes, ‘Basketball training in Basketball’ (Berlin Sports Verleg, 1975)

\textsuperscript{16}M. Robson et.al. ‘A Simple Physical fitness test battery for elementary school children’, Journal SNIPES, 1 (April, 1978)p-28
Haag and Singer\textsuperscript{17} developed a test in 1979 to measure motor fitness for boys and girls representing school in the age groups 10 to 20 years. The study was conducted with the objective to help the children in schools and clubs to learn and develop complex motor skill by achieving basic fitness level. Students from grade five and eight were tested (n = 580) in order to calculate the major test criteria. The objectivity of the test were 0.999, the reliability of the test was 0.902, the validity obtained through comparison with standard fitness test was 0.78 - 0.87. The test included the following items: (i) Figure 8 run, (ii) Sit-up, (iii) Jumping, (iv) push-ups,(v) Shuttle run and (vi) Ball throw.

S.K.Verma, S.R.Mohindroo and D.K.Kansal\textsuperscript{18} in 1979 Conducted study on 76 Indian National Players of different games to compare the anaerobic power of different categories of sportsmen like Athletic, Basketball, Football and Hockey. The different intersportive groups of players have shown quite different values of the parameters. It was interesting to note that trend of variability in various sports categories studies agrees greatly with the demands of the various games. Basketball is a game played in small area and requires a constantly changing position which demands a special agility on the part of players, fast starting, stopping and sudden change of direction and fast acceleration. So basketball is a game which requires reaction speed, sprint speed and endurance. So, high level of anaerobic power is closely related to the requirement of the game. This Study further reveals that different groups of Football and Hockey player

\textsuperscript{17}H.Haag and R.Singer, ‘Developed of a test to measure Motor fitness’ Proceedings of the XXII World congress on Physical Education and Evaluation,Ke1(July1979)

based on their respective playing position have different mean value of above mentioned parameters, for example, goalkeepers are at the top.

**In 1982, Moorthy**\(^{19}\) Conducted a study on status of muscular fitness of Indian school children, one thousand school children from Pune were randomly selected and Kraus Weber Test was administered for their minimum muscular strength. The results revealed that 82% boys and girls failed in the test.

**ShyamLal Mazumdar**\(^{20}\) in 1986 studied the changes in motor fitness component and playing ability resulting among Soccer players at two states of Physical Education and Conditioning programme and concluded that;

1. During the first stage speed, maximum leg strength, agility and playing ability was improved.
2. During second stage only maximum leg strength and agility improved significantly.
3. The break in between the stages of training diminished the improvement of playing ability, the speed was not affected.
4. The total year’s physical education and conditioning programme was proved to be of value in improving motor fitness components and playing ability.

**A.K.Uppal**\(^{21}\) (1986) conducted a study on motor fitness components as predictors of Soccer playing ability. Thirty male Soccer players participated in this study in order to evaluate the extent to which the

---


level of motor fitness can help to predict their performance in Soccer. All subjects performed a series of five motor fitness components that tested speed, agility, maximum and explosive strength and cardio respiratory endurance. A multiple regression analysis was performed and the results indicated that reasonably accurate prediction of soccer playing ability might be made on the basis of the tests of motor fitness components.

**AAHPER (1987)** Health-related Physical Fitness test battery (Cardiorespiratory function, Body composition, modified sit-ups, sit and reach) was applied for the collection of data. The collected data was subjected to statistical treatment. 'F' test was applied to compare fitness status of 13 to 16 years age groups children, "t" test was also applied to compare the Health-related physical fitness status of the boys belonging to urban and rural schools boys. Four scales namely percentile, T, hall and sigma were also developed for future use. The following conclusions have been drawn. There has been a significant difference between one age group to other age group among rural and urban boys in the Health-related physical fitness components. In modified sit-ups, fourteen and sixteen year boys significantly performed more sit-ups than 15 year boys at rural and urban sample. Cardio-respiratory function of sixteen year rural boys was found significantly better than thirteen, fourteen and fifteen year boys at rural and urban sample. In body composition test the fat contents were minimum in thirteen year boys and maximum in sixteen year boys of urban sample. Fat contents of sixteen year boys were significantly maximum than other age groups were as fifteen year boys possessed significant minimum fat contents that other age groups of rural sample. In sit and reach test thirteen year
boys were significantly better flexible than fifteen and sixteen year boys of urban sample. In thirteen year age group the fat contents of rural boys were significantly more than urban boys. They were also found less flexible than their counter part. However, their cardio-respiratory function was significantly better than urban boys. In fourteen year age group the fat contents in rural boys were significantly more than urban boys. In fifteen year age group the cardio-respiratory function of urban boys was significantly better than the rural boys. Urban boys possessed more fat contents than rural boys but found significantly less flexible. In sixteen year boys the fat contents of rural boys were significantly more than urban boys, former also performed significantly better in modified sit-ups test but found less flexible as compare to urban boys. Four scales namely percentile, t, hull and sigma were developed for each of the test variables to measure health-related fitness of each age group for rural and urban boys.

Singh, (1993) conducted a study of physical fitness status of students of department of physical education, Punjab University, Chandigarh and Kurukshetra University, Kurukshetra. He collected data on 34 males subjects and 27 females students by using AAHPER physical fitness test. The students of Kurukshetra University were found superior on overall physical fitness status whereas girls of Punjab University were significantly better than Kurukshetra University in speed and agility components. However, no significant difference was observed in the overall physical fitness between the subjects of both universities.

Sharma, (1997) conducted a study to construct and standardize motor fitness for elementary school children of Delhi. His sample included five hundred boys and girls. The study was conducted in two phases. In the
first phase he developed motor fitness battery by using factor analysis technique. The battery consisted of five motor fitness test namely:

1. Softball throw
2. Toe touching
3. Double foot balance
4. 50 meter dash
5. 300 meter run/walk for girls and boys.

In the second phase he developed percentile scale on all.

**Bakshi, (2001)** conducted study to assess the Health related Physical fitness status of the male students studying from 9th to 12th classes in the Higher Secondary School of the Jammu Province. To achieve this objective, the whole of province was divided into six clusters comprising, 99 Higher Secondary school of boys in all. For the collection of data 34 schools were randomly selected from total 99 schools. 17 School belonged to rural area and an equal number of schools belonged to urban areas. As many as 118 subjects were randomly selected from each school for the collection of data.

**Kuhnna and Zhu** in 2001 conducted the study on fitness portfolio calibration for first through sixth grade children. The purpose of this study was to develop and calibrate health related fitness portfolio for 1st – 6th grade students using the many facet rash models and examine advantages and hundred ninety five students from 23 schools in 1st to 6th grade, who completed six of nine health related fitness portfolios,

---

22 Pamela Hodges Kuhnna and Weino Zhu, ‘Fitness Portfolio Callibration for First through Sixth Grade Children’, Research Quartely. Vol. 72, No 4 (December 2001)p-324
participated in this study. Ten physical education teachers performed the grading across various portfolio and grade levels. Student’s portfolios were rated using 23 pre-developed rubrics and their scores linked through several common portfolio that were used across the schools. The rating scores were analyzed using the many faceted Rash models, with four defined facts: Portfolios, Rubrics, Student and Rater. The model data was very good and consistent grade difference was found, that is older students scored higher in fitness knowledge than younger ones. With rash calibration, measurement problems in conventional portfolio assessments can be eliminated and a valid and reliable assessment system can be developed. In addition, several other measurement advantages were provided by Rash calibration e.g. related facts can be examined and controlled simultaneously. A large size and a more complex process, however, are required in the calibration stage of developing such a system using Rash model.

STUDIES RELATED TO CONSTRUCTION AND STANDARDIZATION OF HOCKEY GAME

Sangral\textsuperscript{23} constructed a specific fitness test in 1956 for Hockey players based on anaerobic power energy system of players. The subjects were twenty three regular course male trainees of regular courses of National Institute of Sports, Patiala. The objectives of the study were to construct and standardize a specific fitness test for Hockey players based on anaerobic power energy system. The combined reliability and objectivity of the specific fitness test for Hockey players was found as 0.70 using Pearson’s Product Moment method. The investigator has

\textsuperscript{23} M.S.Sangral, ‘Specific Physical Fitness test for Hockey’, Proceeding of the UGC All India Seminar on Selection and Training in Sports held at Chandigarh (December 1956):p-41
contributed toward the specific physical fitness measurement of Hockey players. But for smaller data, using only the anaerobic power system as basis of total physical fitness of Hockey players may not be taken as a standardized test for measuring specific physical fitness for Hockey players.

Wharton in 1962 did the investigation of the youth fitness test as a predictive measure of skill development in field hockey. AAHPER youth fitness test was studied as predictor of skill development in field hockey. 107 senior high school girls who had no previous field hockey training were used as subjects. A significant relationship was found between the scores on youth fitness test and field hockey achievement as measured by Schmittal French Field Hockey achievement test.

Julee A. Illiner, 1969 suggested the construction and validation of a skill tests for the drive in field hockey. Beginning high school players, physical education majors and association players, were tested on their ability to drive the ball to the left and to right, after five weeks of instructions and of practice. Speed was considered to be the imported aspects of the drive and was therefore included in the skill test. Scores were obtained for each component and were than combine in to a single score, by means of additive and multiplicative techniques. Statistical evidence presented included studies of objectivity, reliability, validity target adequacy and scoring the test was found to be the objective (r=.97 and higher) reliable (r=.72 and higher) invalid measure of an individual’s ability to execute the drive.


25 Julee A. illiner, ‘The Construction and Validation of a Skill Test for the Drive in Field Hockey’, Completed Research in Health, Physical Education and Recreation 3 (1969);200
Singh\textsuperscript{26} Conducted a study in 1978 using Fleishman’s basic physical fitness battery to evaluate the physical fitness of male Hockey players. Sixty seven hockey players were randomly, selected from the hockey playing population of Punjab. The Fleishman’s testing battery included the following item (1) Extent flexibility (2) Dynamic flexibility (3) Explosive Strength (4) Static strength (5) Dynamic strength (6) Trunk strength (7) Coordination (8) Equilibrium and (9) Endurance. The data was analyzed by computing mean, range, standard deviation and the following conclusions were drawn (1) The test scores indicated high level of explosive strength, static strength of arms, cardio-respiratory endurance and leg explosive strength (2) Dynamic flexibility and coordination scores indicated lowest fitness.

T.K.Chattopadhyay\textsuperscript{27} in 1980 made an attempt to compare physical fitness of the university level Soccer players and Hockey Players, The criterion measures selected for assessing the Physical fitness was resting pulse rate. Cooper’s 12 minute Run/Walk and AAHPER fitness test battery and he found that there is significant difference only in 50 yards dash favoring the Soccer team and pull ups favoring the Hockey team.

Dureha\textsuperscript{28} in 1984 compared the offensive and defensive hockey players on the basis of selected motor abilities and selected anthropometric measurements. Fifty male players studying in (1983-84) academic year were the subjects. The selected motor components included agility, speed , explosive strength, endurance and selected anthropometric variables included weight, height, leg length, arm length, thigh girth and

\textsuperscript{26}Kamaljeet Singh, ‘Physical Fitness of Hockey Players’ SNIPES Journal(January 1978):29
\textsuperscript{28}D.K.Dureha, ‘Comparison of selected Motor Components and Anthropometric variables of Offensive and Defensive College Level Hockey Players’, (Published Master’s Thesis, Jiwaji University,1984
wrist diameter. It concluded that the results in motor abilities and anthropometric variables of offensive and defensive hockey players showed no significant differences.

**Uppal and Datta**\(^29\), 1988 Studied the motor fitness components as predictors of Hockey performance. The purpose of the study was to identify those motor fitness components which could predict the performance of the game. Seventy four male Hockey players from different universities of India served as subjects for the study. The motor fitness components included speed, strength, power, agility, dynamic balance, flexibility and kinesthetic perception. Straight field Hockey rating scale served as criterion measure to evaluate the playing ability. The study included that motor fitness components mainly speed, grip strength (both right and left hand) agility, balance, kinesthetic perception contributed to Hockey playing ability. Whereas power and flexibility were not significant contributors to Hockey performance.

**STUDIES RELATED TO CONSTRUCTION AND STANDARDIZATION OF VARIOUS GAMES**

The purpose of **M.T.Waghchoure & T.K.Bera Chandrashekar**\(^30\) project was to construct and standardize a new battery of KHO-KHO skill tests. Two thousand (\(N=2000\)) school boys, age ranged from 11 to 14 years, from Pune City, India, were pooled as the sample and were tested by the 10 items of the preliminary form of the skill test. The data was processed through item analysis which assured the existence of 10 items in the test. The test items were arranged on the basis of the result of


\(^{30}\)M.T.Waghchoure& T.K.BeraChandrashekar, ‘Construction and Standardization of a battery of kho-kho skill’ Agashe College of Physical Education Pune, Maharashtra, India 2 Scientific Research Department Kaivalyadhama (Lonavala), Pune.
item difficulty. The scoring principles of each item were also established scientifically. The test-retest reliability co-efficient of this test was found statistically significant (r=0.85, p<0.01). This test battery also ensures its content validity. Both the percentile and T-scale norms were established on Likert’s five points scale. The overall results revealed that this test can assess the KHO-KHO skills and predict potential with sufficient reliability and validity.

**Kowert**\(^{31}\) in 1962 constructed a badminton ability test battery for men. The judges rating scale yielded reliability co-efficient of 0.38 when correlated with the class rankings of the subject’s playing ability. An ‘r’ of 0.97 was obtained for the reliability of the judges’ rating scale as determined by the interclass correlation between the sum of the three judges rating and the scores obtained for the diagonal run. Millar’s wrist Volley and French’s long service tests was 0.84. It was found that the badminton playing ability of the male College students (N=46) could be successfully measured by the multiple refreshing equation containing the variables of the diagonal run test.

**Childress**\(^{32}\), 1972 Administered the test items to one hundred and six school basketball players. The purpose of this study was to identify the components of high school basketball playing ability and to construct and evaluate tools for classifying identified as successful and unsuccessful. Twenty four test items were selected through review of related literature as valid measures of the components of high school


\(^{32}\) James Thomas Childress, ‘Factor and Regression Analysis to Identify and Determine the Effectiveness of selected Physical Variables in Predicting a successful Basketball Performance’, Dissertation Abstracts International 33(November,1972)2147-A
basketball ability. The result of the study indicated that the components of basketball ability could be isolated, measured and utilized to construct and evaluate tools for classifying players into two populations identified as successful and unsuccessful.

**Farror**\(^{33}\) Investigated motor/physical performance variables in 1975 for a sample population of professional baseball players. Eight motor/physical performance variables were selected as valid measure of components of professional baseball playing ability and were identified as (1) running speed (2) muscular power (3) depth perception (4) shoulder flexion strength (5) throwing speed (6) agility (7) eye-hand coordination and (8) reaction time. In addition, the athletic motivational inventory which measure 13 personality traits were administered to each subject. 103 professional baseball players who trained in Florida during the 1974 baseball season were selected as subjects. Statistical procedure used for analyzing the data were percentile rank, one way analysis of variance, Duncan’s method of comparison and correlation ratio. It was concluded that test battery of vertical jump, eye hand coordination, Illinois agility run, shoulder flexion, strength, glace and bat test, medicine ball put, 60 yard dash and throwing speed will successfully differentiate between players classified as low minor leagues and those who are either high, minor or major league players, with the significant differences in performance favoring the later two groups.

Disch\textsuperscript{34} et al in 1977 developed a test battery in 1977 to analyze the performance of Volleyball players. The battery was developed with the help of U.S.A Women Volleyball coaching staff and measurement specialized staff of Rice and Huston University. It assessed the playing of women Volleyball players. The test were selected from the various physical fitness components following the procedure of most reliable and valid information to Volleyball playing capacity and also keeping in view that the test could be administered in teaching and coaching situations and they were closely related to various phase of the game. The test were age, weight, height, reach height, percentage fat, vertical jump, triple hop, 20 m. dash, agility run, basketball throw and Queen’s college step-test to assess the maturity, structure, body size, leg power, coordination, speed, controlled speed, arm power, coordination and an aerobic condition.

Watson\textsuperscript{35}, 1978 prepared test items for physical fitness tests consisting of Long jump or Vertical jump.50 yard dash, sit-up, stick jump and 300 yard distance run. The norms were established for each test item for girls and boys according to chronological age. Percentile table were constructed based on the results of investigation. Watson further recommended that in elementary level, there should be some test items and norms to evaluate shoulder girdle strength.

Hornak\textsuperscript{36} in 1978 evaluated the physical fitness of the 1972 Olympics Men’s Team of Czechoslovakia to know the level of fitness. The test  


\textsuperscript{35} Rick E. Watson, ‘The establishment of norms for the Nebraska Physical Fitness Test’, Completed research in Health, Physical education and Recreation,19(1978)p-102

\textsuperscript{36} Jaromir Hornak, ‘Czechoslovakian (1972 Olympic Men’s Team), Physical Fitness Test, Volleyball Technical Journal’, 4 (1978)p-10-11
battery consisted of age, weight, height, fat percentage, reach height, 3 k.g medicine ball put by both hands, first with right and then left hand, 350 gram ball throw with run up and without run up, broad jump, triple jump, touching the basketball board by jumping, sprint 60 mts, 1000 mts run, step test and bicycle ergometer test. He found that these items were significantly related to their performance.

**K.H.Saratomki Devi**\(^{37}\) conducted a study on twenty four Volleyball Players in 1980 to find out the relationship of selected strength and flexibility measures to playing ability in Volleyball. She concluded in her study that arm strength, abdominal strength, leg strength and Shoulder flexibility were significantly to playing ability in Volleyball. Grip Strength did not correlate significantly to playing ability in Volleyball. Wrist flexibility and ankle flexibility had significant relationship to playing ability in Volleyball. Trunk flexibility showed negative but insignificant correlation to playing ability in Volleyball.

**In 1987, Sandhu**\(^ {38}\) constructed motor fitness battery for female Volleyball players. The subjects of her study were 300 Volleyball players. The subjects representing different colleges of Punjab state. They were isolated factor so as to make possible the estimation of a subject score on the factor. Items having low weights were dropped from the equations in order to reduce the number of variables needed for a high degree of prediction. The factor loading of variables on each extracted factor were utilized as the validity correlation, utilizing the factor


loading of a variable on each extracted factor in the orthogonal solution, as the criterion coefficients. Multiple regression techniques were utilized to develop a test battery for the isolated factors.

Sharma\textsuperscript{39} in 1987 constructed a specific physical fitness test for soccer players in which he used factor analysis on the data of soccer players of North – Zone universities of India. As many as seven factors of specific physical fitness were obtained out of which six were considered meaningful to select test items for each factor. One test item for each factor with the highest loading was included in the test battery. The derived test items were applied on 500 players to develop norms.

Narain\textsuperscript{40}, 1987 Constructed and Standardized specific physical fitness test for badminton players. He used factor analysis technique on the data of 100 inter-college/ district badminton players of Northern India. As many as 7 factors of specific physical fitness were obtained. Out of which, five were considered as meaningful to select test items for each factor. The test items thus derived were applied on 500 badminton players to develop norms. The selected five factors were trunk strength, flexibility, badminton agility, badminton endurance and arm-leg explosive strength and test items selected endurance specific physical fitness test for badminton players were sit-ups, court agility, trunk flexion, six corners endurance and softball throw. Factors analysis technique was used to select the test items out of twenty variables.

\textsuperscript{39} N.P. Sharma, ‘Construction of Specific Physical Fitness Test for Soccer players’ (Published Doctoral Thesis, Punjab University, Chandigarh, 1987)

\textsuperscript{40} Shiv Narain, ‘Construction and Standardization of Specific Fitness Test for Badminton Players’ (Published Doctoral Thesis Jiwaji University, Gwalior, 1987)
In 1989, Singh\textsuperscript{41} Construction and standardization specific physical fitness test for boys volleyball players. He took 100 players of inter college and district level. Whery-do-little method of multiple correlations was employed to extract the test items out of 26 variables. A test battery formed was administered to the volleyball players to formulate the norms. The study concluded that (i) the battery of tests developed by the researcher has the ability to predict the specific fitness of volleyball players, (ii) the five tests selected (spike jump, W.M run, Squat thrust, Basketball Throw and Wrist Flexion) showed highly significant relationship with the volleyball playing ability.

Paul\textsuperscript{42}, 1991 assessed the relationship among athletic ability parameters and specific measures of tennis performance to construct specific test battery for the Tennis players. Each player’s performance scores from USTA’s Performance test battery were correlated with the player’s age, ranking and Tennis stroke ratings. The athletic ability measurements that were assessed and correlated with age, rankings and Tennis stroke ratings were flexibility, strength, power, agility, speed, aerobics endurance and response time. Although significant correlations were found among several physical performances variables, significant correlation of these variables with age, ranking and Tennis stroke ratings were not found with all predictor variables. The Hexagon test was the only variable to account for a significant degree of variation in ranking.

Prakash\textsuperscript{43} in 1995 has worked on Construction and Standardization of physical fitness test for High school boys. For study selected age group

\textsuperscript{41} Gurbaz Singh ‘Construction of Specific Physical Fitness Test for Volleyball Players’ (Published Doctoral Thesis Jiwaji University, Gwalior, 1989

\textsuperscript{42} Roe Fort Ernst Paul, ‘Development of a performance profile to assess nationally Ranked junior Tennis Players’, Dissertation Abstracts International 52( July 1991) 110-A

\textsuperscript{43} S.M Prakash, ‘Construction and Standardization physical fitness test for High school boys’, (Published Doctoral Thesis, Jiwaji University, Gwalior, 1995 )

63
of 13 to 15 years from 180 high school boys of eleven identified institutions, Dakshina Kannada district, Karnataka, India. 32 test variables were administered on subjects. They were Age, Weight, Height, Push-ups, Reverse Sit-ups, 2 Hops by dominated leg, 2 Jumps by both legs, Medicine ball throw. Over hang, 4 x 10 meter shuttle run, 50 meter dash and 600 meter run. The percentile scales were computed for the combined samples of the girl students. It was also concluded that performance of the girl students was very poor in the selected items.

Singh\textsuperscript{44}, 1999 constructed a specific test battery of motor fitness for Football players. The subjects were 50 male football players of LNIPE Gwalior. The person’s product moment correlation was used to know the contribution of all items of football to football performance .The result of the study shown that kicking for distance, 70 meter run, 1 mile run and W M agility run with ball contribute much to playing ability in football among motor fitness.

Thomas\textsuperscript{45}, 2000 undertook construction and standardization of specific physical fitness test for Soccer players. His study was confined to district level Soccer players of the age 17 to 21 years from different district of Kerala state. The test items were push-ups, bent knee sit-up, burphy jump, standing broad jump, vertical jump, kicking for distance (Football), 12 minutes run/ walk, one mile run, 800 meters run, 30 meters run, 50 meters run, 70 meters run, shuttle run ,Illinois agility test, special agility test, bridge up test, trunk extension test, sit and reach test from raw score a significant difference in the means was found to exist between the test variables when applied to the successful and unsuccessful soccer players.

\textsuperscript{44}Kshetrimayum Ojit Kumar Singh, ‘Construction of a specific test battery of Motor fitness for Football players’, (Published Master’s Thesis, LNIPE, Gwalior, 1999)

\textsuperscript{45}Biju Thomas ‘Construction and Standardization of specific physical fitness test for Soccer players’ (Published Doctoral Thesis, Jiwaji University, Gwalior, 2000)