Chapter – II

REVIEW OF RELATED LITERATURE

Singh\(^1\) constructed and standardized specific physical fitness test for boys volleyball players. He took 100 players of Inter College and District level. Wherry-do-Little method of multiple correlation 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.

Narain\(^2\) 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 from each factor. One test item having the highest loading was included in the test battery from each factor. The test items thus derived were applied on 500 badminton players.

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to develop the norms. The selected five factors were Trunk Strength, Flexibility, Badminton Agility, Badminton Endurance and Arm-Leg Explosive Strength and the test items selected endurance specific physical fitness test for Badminton players were Sit-ups, Court agility, Trunk flexion, Six corners endurance and Softball throw. Factor analysis technique was used to select the test items out of twenty variables.

Sharma\textsuperscript{3} 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 items 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.

Prakash\textsuperscript{4} has worked on construction and standardization of physical fitness test for High school boys. For study selected age group 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


\textsuperscript{4} S.M. Prakash, "Construction and Standardization Physical Fitness Test for High School Boys", (Unpublished Doctored Thesis, Jiwaji University, Gwalior 1995).
Head Medicine Ball Throw, Basket Ball Throw, leg Raise, Upper Body Raise, Push-ups, Burpee, Sit-ups, leg Raise (Sec. Hold), 50 Metres Hopping. The raw scores have been converted into standard T-scores, for the age groups of 13 to 15 years high school boys.

Thomas⁵ 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 Districts of Kerala State. The test items were push-up, bent knee sit-up, burpee jump, standing broad jump, vertical jump, kicking for distance (football), 12 minutes run/walk, one mile run, 800 metres run, 30 metres run, 50 metres run, 70 metres run, shuttle run, Illion's 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.

Guruvammal⁶, constructed norms in selected physical fitness test items for Secondary School Girls in Madras City. 10 girls from each ten randomly selected schools were taken as subjects and tested on the selected physical fitness test items, consisting of Sit-ups, Vertical jump, Flexed arm

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hang, 4 x 10 meter Shuttle run, 50 metre Dash and 600 metre 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 test items.

Singh⁷ prepared physical fitness norms for high school boys of Punjab State. The test items were administered on 5000 subjects from various schools. The test items were standing broad jump, sit and reach test, agility run, bent-knee sit-ups, 50 metres dash, push-up (chair), cricket ball throw, 600 metres run / walk. The percentile norms for physical fitness test were found to be valid and suitable to assess the physical fitness level of the high school boys between the ages of 12 to 15 years.

Falls et al.⁸ developed physical fitness test batteries by the factor analysis technique utilizing the Pearson Product Moment Formula of Correlation a metrix of inter-correlation among 53 variables was obtained. The data were the subjected to factor analysis utilizing the principal axis form of preliminary solution.

Two separate rotations of the axis were carried through one orthogonal and the other oblique. For the orthogonal rotation, Jaeser's varimax criterion was used. A regression equation was developed for each

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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 variable on each extracted factor were utilized as the validity correlation, utilising 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.

Thiruppathi\(^9\), computed physical fitness norms for boys of the Junior Colleges in Solapur District. 20 boys from classes XI and XII of fifteen randomly selected junior colleges were taken as subjects for this study. AAHPER Youth Fitness Test was administered on them. The two scales namely T-scale and Hill scale, were constructed for the combined samples of the Junior Colleges and separately for classes XI and XII.

One hundred junior high school boys were administered a devised physical fitness test by Huang\(^{10}\). Factor analysis here yielded five factors. Seventy percent of total variance of physical fitness was observed. The factors identified by him were speed, explosive strength of leg muscles, dynamics flexibility, dynamic strength and flexibility.

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\(^{10}\) Chen-Hsing Huang, "A Factor Analysis of Physical Fitness Components for Seventh Grade Chinese Students", Completed Research in health, Physical Education and Recreation XXIV (1982) : 25.
Watson\textsuperscript{11} prepared test items for the 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{12} evaluated the physical fitness of the 1972 Olympic Men's Team of Czechoslovakia to know the level of fitness. The test battery consisted of age, weight, height, fat percentage, reach height, 3 kg. Medicine ball put by both hands first, with right 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.

Sandhu\textsuperscript{13} constructed Motor fitness battery for females volleyball players. The subjects of her study were 300 volleyball players. The subjects representing different colleges of the State of Punjab. They were

\textsuperscript{11} Rick E. Watson, "The Establishment of Norms for the Nebraska Physical Fitness Test", Completed Research in Health, Physical Education and Recreation, 19 (1978) : 102.


from different Universities of Punjab and their age was ranged from 17 to 21 years. Factor analysis were used to construct motor fitness test. The subjects were tested on 27 different items of motor fitness test through the factor analysis technique. 10 factors were expected after an orthogonal rotation of maximum loading were selected for test battery, which consisted of seven tests namely: spike jump, W.M. Run, W.M. Agility, Push-ups, 20 metres run, the stick test and bend and reach test. The scientific authenticity of the test was established by computing reliability, objectivity, validity and specificity. For preparation of the norms 300 female volleyball players were selected. The Hull-scale and T-Scale were used to prepare the norms for different test items for college female playing volleyball.

Patrick\textsuperscript{14} 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 Lengthwise 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.

Haag and Singer\textsuperscript{15} developed a test 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 was 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-up, (v) Shuttle Run and (vi) Ball throw.

Sree Devi\textsuperscript{16} constructed motor fitness norms for Secondary School girls. For this purpose, she selected 80 students of Central School No. 1, Gwalior, from grades eight and nine as subjects for this study. AAHPER Youth Fitness Test was administered on all subjects. Based on mean and standard deviation values, T-scale, 6 sigma scale and Hull scale were prepared for each test items. Also, it was concluded that a common scale of AAHPER Youth fitness test could be used for grades eight and nine and 6 sigma scale and Hull scale were more suitable than T-scale.


Singh constructed a specific test battery of motor fitness for football players. The subjects were 50 male football players of LNIPE, Gwalior. The Pearson'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 metre run, 1 mile run and W M agility run with ball contribute much to playing ability in football among motor fitness.

Manoj Kumar developed norms on selected motor fitness components in the age group of 13 to 17 year of Gwalior District Schools. Test items to measure the motor fitness components were 50 metres dash, standing broad jump, sit-ups, one minute stock for balance and 600 metre run / walk.

Ramputty constructed norms in selected fitness test items for girls of age group 12 – 16 years in Gwalior District. She administered the test on 650 students of Kendriya Vidyalaya and public schools of Gwalior District. The test items were flexed armed hang, curl up, sit and reach shuttle-run, one minute run / walk 50 yard dash, standing broad jump. The data obtained was correlated following the product moment correlation method.

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Robson, et al.\textsuperscript{20} and his colleagues conducted a study on a simple physical fitness test battery for elementary school children. They took 152 boys and 150 girls of Kendriya Vidyalaya, Gwalior as 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 by assessing their physical fitness.

Ajmer Singh\textsuperscript{21} undertook a study to develop physical fitness norms on four thousand college students of Punjab University, Chandigarh. Fleishman's Test battery was used on 17 to 21 years old college students. In conclusion he found that physical fitness improved linearly according to age and the students belonging to the rural area were significantly superior in their performance on different items.

Andraos\textsuperscript{22} conducted a study on physical fitness to establish norms for physical fitness level of South African Boys and compared their physical fitness levels with those of Canadian boys. The AAPHER physical fitness test battery consisting of one minute speed sit-ups, standing


broad jump, shuttle run, flexed arm hanger, 50 yard dash and 300 yard dash run was administered. Test was applied to compare the mean score of the South African and Canadian students. The result was found to be significantly in favour of the South African Boys.

Barbanti\textsuperscript{23} conducted a study to establish physical fitness norms for Brazilian School children and to determine if different existed between norms for Brazilian and American boys and girls for selecting physical fitness measurements. Physical fitness test battery consisting of sit and reach test, modified sit-ups, nine minutes run, twelve minute run, two tests of athletic ability, 50 metre dash and standing broad jump were administered to 2342 boys and girls. The comparison between norms for Brazilian and American boys and girls showed that the American boys and girls in general were taller and heavier, and they scored higher in the sit and reach test, modified sit-ups, 50 metre dash and standing broad jump test. Brazilian children had higher scores on the nine minutes run test than American children.

The multiple group method of factorising was used by Cumbee\textsuperscript{24} to extract eight factors from the inter-correlation of 21 variables that had been used in the part to measure some phase of motor co-ordination. Five of the

\textsuperscript{23} Valdir Jose Barbanti, "A Comparative Study of Selected Anthropometric and Physical Fitness Measurements of Brazilian and American School Children", Dissertation Abstracts International, 3 (June, 1983) : 3840.

factors (bouncing objects, tempo, two handed agility, speed of change of direction of the arms and hands and body balances) permitted rather a clear interpretation. Some of the factors were left unnamed and needed further clarification.

A test battery of physical performance test was selected by Fleishman\textsuperscript{25} on the basis of factors isolated from much larger batteries of tests. The factors identified in two separate studies were combined into one test battery called ‘The Basic Fitness Test Battery’. The basic fitness test items which form this test battery are extent flexibility, dynamic flexibility, shuttle run, soft ball throw, hand grip, pull ups, leg lift, cable jump, balance and 600 yard run-walk.

Kowert\textsuperscript{26} constructed a badminton ability test battery for men. The judges rating scale yielded a 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 refreshion equation containing the variables of the diagonal run test. French's Long Service test and Miller's Wrist Volley test.

Burry and Curetor\textsuperscript{27} conducted factor analysis of performance in pre-pubescent boys. He used the principle of an inter-correlation-matrix of physique and performance data from 95 boys. Subjects between 7 – 11 years of age were located and rotated to an oblique simple structure in order to determine the nature of factors involved in the physique of young boys and the relationships between these factors and the performance. The influence of body size having bun virtually nullified by the rotation procedures, three type of factors of physique were observed are related to growth in transverse directions and adipose tissue and the other related to growth in vertical dimensions. Three factors related to motor performance – power, endurance and dynamic shoulder strength were isolated. The morphological and performance measurements were found to be essentially unrelated.

Cousins\textsuperscript{28} utilized Thurstone's method of multiple factor analysis to factor the correlation of 26 selected wartime fitness test items. Four factors were isolated in terms of the correlations between the individual test items and the factors.


Ismail and Cowell\textsuperscript{26} conducted a study on factor analysis of motor aptitude of preadolescent boys. The varimax orthogonal rotated was used to extract five factors from the inter-correlation of 25 items, which the authorities claim measure motor aptitude. The factors under lying the 25 items utilized in the study seemed to permit speed, growth and maturity classification, kinaesthetic memory of the arms, body balance on objects and body balance on the floor.

Fox\textsuperscript{30} had done a study on reliability and validity of selected physical fitness test for High School Girls. In this the Rogers Strength Test, The 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 two or more times in order to investigate the reliability of the tests. The results seemed to indicate that the Roger's strength test and Washington Battery were reliable that those whose scored high on the 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 the PFI.


\textsuperscript{30} Katherine Fox, "The Reliability and Validity of Selected Physical Fitness Test for High School Girls" Research Quarterly, 1959 Vol. 30 No. 3. p. 430.
Kulmna and Zhu\textsuperscript{31} 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 portfolios for 1\textsuperscript{st} – 6\textsuperscript{th} grade students using the many faceted rash model and examine advantages and disadvantages of a portfolio assessment system based on Rash calibration. Nine hundred ninety five students from 23 schools in first sixth grade, who completed three six of nine health related fitness portfolios, participated in this study. Ten physical education teachers performed the grading across various portfolios and grade levels. Students portfolios were rated using 23 pre-developed rubrics and their scores linked through several common portfolios that were used across schools. The rating scores were analysed using the many faceted Rash Model, with four defined facets: Portfolios, Rubric, Student and Rater. The model data fit 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 facets can be examined and controlled simultaneously. A large sample size and a more complex

\textsuperscript{31} Pamela Hodges Kulmna and Weino Zhu, "Fitness Portfolio Calibration for First Through Sixth Grade Children", \textit{Research Quarterly}, vol. 72, No. 4 (December 2001), 324.
process, however, are required in the calibration stage of developing such a system using the Rash Model.

Two studies were found to have been conducted by McCloy and Murphy using Thurstone factor analysis method on the analysis of inter correlation of cardiovascular respiratory variables. In both the studies the purpose was to analyse the table of inter correlations to determine the principal components describing the cardiovascular respiratory variables. When dealing with a number of variables one can assume that they were all unrelated and therefore, there are as many abilities as tests, or one could assume that they were all perfectly related and therefore, there was only one ability or characteristics. Neither of their hypothesis is correct as indicated by reported studies.

Rosenstein and Frost in their attempt to compare initial and final physical fitness scores of senior high school boys who were administered the New York state physical fitness test, were able to report significantly good performance by the pupils participating in this programme. Likewise Saunders et al. in their comparative study on high school children found a

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significant difference between the pupils opting for physical education and those who were not exposed to physical education.

Hunt\textsuperscript{36} with an extensive observation, suggested that age, height and weight could be retained as criteria for physical fitness and motor ability tests till alternatives are available through investigations. This contribution throws open the arbitrary nature of available assumptions warranting further research.

Seymour\textsuperscript{37} projected the fact that age is not a criterion in physical fitness test and the suggested the possibility of reducing test items with no substantial loss of accuracy.

Berger\textsuperscript{38} has mentioned that a decision with regard to the type of conditioning exercises to be included in a training programme based on an understanding of the primary physiological systems that undergo stress during a game, and the kind of activities which best provide this type of stress during practice. The body adopts itself to the type of stress placed

\textsuperscript{36} Stanely Hunt, "The Relationship Between height, Weight, Age and Ability to perform MANITOB\textquotesingle s Physical and Motor Fitness Performance Test for Junior High School Boys". \textit{Dissertation Abstracts International}, XXXV (March 1975) : 5904-A.

\textsuperscript{37} Emergy W. Seymour, "Follow-up Study on Simplification of the Strength and Physical Fitness Index". \textit{Research Quarterly}, XXXI (May 1960) : 208.

\textsuperscript{38} Richard A. Berger, "Physical Conditioning is Specific to Sport". \textit{The Athletic Journal}, 53:9 (May 1973) : 60.
upon it. This physiological adaptation is necessary for physical conditioning to occur. The adaptation made by playing basketball is the best conditioning for the sport. Likewise the running of cross-country athletes results in physiological adaptation which is the best way for improving condition in that sport. No matter what the component of conditioning strength, endurance, flexibility of power specificity of training applies. The best training to improve best sport performance is to practice the movements at the same rate and intensity during an actual game situation.