Chapter - II
Review of Related Literature

The superlative state of research on physical fitness is an outcome of the immense literature available on physical fitness: comparison of physical fitness with other aspects, factor analysis of indeterminate representing physical fitness, multiple correlation and regression analysis with the developed criteria and so on. This study involves the literature relevant to the developing, standardization of physical fitness, yet, pertinent literature, and though peripheral to physical fitness deemed to be relevant and ingredient.

In a comparative study of physical and mental abilities and achievement, Ray\(^1\) (1940), found that physical ability is a more reliable predictor of academic esteem (standing), and was of the opinion that athletes were superior in mental abilities. However, sharma\(^2\) (1982), found no significant differences of
physical fitness between high and low academic groups.

Scott et al., 3 (1945) gave account of their investigation that no significant relationship was observed between physical fitness and work capacity. But Brogdon 4 (1973), found that Anglo-American males with large gross body size were superior to Mexican-American in performing physical fitness tests.

Day 5 (1984), Sharma 6 (1986), Quraishi 7 (1987), in their respective studies observed the significant correlation between physical fitness and motor ability, specifying the laws and significance and the ineffectual predictors with respect to speed, strength, endurance as well as cardiovascular endurance and agility. Joseph 8 (1984) found in his study that strength, endurance and speed oddly correlated to extraversion.

Nelson and Fahrney 9 (1965) have found significant correlations between strength and speed of elbow flexon movement of three different groups. Eckert and Day 10 (1967), have obtained significant correlation between maximal pushing strength and work load in push-ups.
Wedemeyer\textsuperscript{11} (1946) observed that no significant relationship exists among strength, 2 minutes Sit-ups and Body weight, but when endurance factor compared to strength factor, observed an important in endurance factor in his experimental study.

Colgate\textsuperscript{12} (1966) has found no positive relationship between arm-strength and arm-speed. Where-as Gray\textsuperscript{13} (1967) was of the opinion that strength was more specific than was expected, and also found that shoulder extension strength had highest principal axis loadings for all his three school level of examination.

A significant correlation of 0.76 was obtained by Berger and Blaschke\textsuperscript{14} (1967) between strength and motor ability.

Seymour\textsuperscript{15} (1960) protruded the fact that the age is not a criteria in physical fitness test and evokes the possibility of subduing test items with no substantial loss of precision.

Cozens and Cubberley\textsuperscript{16} (1935) found significant correlation between basketball throw and factor of weight and height, and also concluded that factors of
age, weight and height have almost a trivial effect upon performance while setting up achievement scales for college women. Bookwatter et al.17 (1950) found that age and weight have influencing factors for grip strength.

An extensive observation by Hunt18 (1975), suggested that age, height and weight could be retained as criteria for physical fitness and motor ability tests till alternatives are available through investigations. These contributions throw open the arbitrary nature of available assumptions warranting further research.

Sperling19 (1940) was of the opinion that one test cannot be substituted by another test and that each test has its own validity for the purposes of classification.

Kraus and Hirschland22 (1954) have observed the differences in physical fitness between American and European children. While comparing the datas, 57.9% of American children have failed to successfully complete the six minimum muscular fitness test, and only 8.7% of European children failed to do the same test. This
indicates that European children excelled in their fitness.

Knuttgen (1961), has observed that Physical fitness differed significantly from place to place and varied from time to time. His comparative study emphasized an trans-continental standards, where AAHPER Youth Fitness Test on Danish School Children responded with scores that exceeded the American measures.

In another similar study, when comparing the physical fitness records of 15 to 20 years, Miyashita and Sadamoto (1987) obtained differences in physical fitness of Japanese children to European and North American children.

In 1913, The Playground and Recreation Association of America (North National Recreation Association) realized the inadequate facilities for promoting athletic sports in rural schools and communities, and feel the need of standard test, which could be put into operation anywhere constructed the athletic badge tests with India of raising the standard of physical efficiency of boys and girls. The standards originally
established have to be revised from time to time, to confirm with results indicated by statistical computations.

Espenchade and Melency\(^{24}\) (1961) checked and compared the fitness records of school boys and girls of the same age level, and concluded that 24 years ago boys and girls were superior in dash and broad jump where as in all other factors the modern boys and girls were superior.

Robson et al\(^{25}\) (1978) constructed a simple physical fitness test battery for elementary school children. The test battery is practicable and simpler than the existing physical fitness tests and measures most of the essential motor qualities of elementary school children. The norms were prepared for the selected items and can be used for classifying the children into ability group by assessing their physical fitness.

An International Research Programme for the standardization of physical fitness test was undertaken by International Council on Health, Physical Education
and Recreation. A committee for the standardization of physical fitness test (ICHPER) was appointed at Tokyo in 1964 to set-up standards and to construct instruments for the measurement of physical fitness. A survey was conducted and a report on the tentative standards was distributed to all the members of the committee for review. The comments and recommendations received were discussed at the meeting held in Nagglingen, Switzerland, in August, 1967, and the performance Test, were developed.

Mookerjee (1978) in his study, concluded that physical fitness of rural boys was superior to that of urban boys. But Tuteja's (1978) observation in his comparative study did not yield any significant difference of physical fitness of rural and urban boys.

The studies pertinent to the present investigation that have subscribed to Factor Analysis, Multiple Correlation, Multiple Regression Analysis are reviewed as follows.

Some classic studies have used factor analysis, (McCloy (1937), Barry and Cureton (1961), Larson (1937),
Ismail and Cowell\textsuperscript{32} (1961), and Klovah\textsuperscript{33} (1966) have examined to know the theory and interpretation of factor analysis in depth.

Philips\textsuperscript{34} (1949) inferred that power have significant correlation with strength and speed. 200 college women were put into testing on 27 test items selecting from different tests. The data then were subjected to thurstone method of factor analysis, which yielded 4 factors, (speed, general strength and abdominal strength) as major components of physical fitness tests; and the fourth factor was left unidentified.

Disch\textsuperscript{35} (1973) in an effect to draw the dimensionality of speed of body movement administered 23 tests to 73 males. By subjecting the data to factor analysis four factors of speed, viz., sprinting, controlled, leg and arm speed, were extracted.

Manning \textit{et al.}\textsuperscript{36} (1988) administered eight different power tests predicted to measure anaerobic power to 31 college men subjected to factor analysis, extracted five
factors, but, none of the five factors agreed with the hypothesized criterion of anaerobic power. Results also revealed that unrelated aspects exist among the variables and that they were not measuring similar qualities, thus emphasizing ambiguity.

McCrow\textsuperscript{37} (1949), made an effort to identify motor learning factor, relationship between motor learning and physical ability. Hundred junior school girls were tested with 30 variable were subjected to factor analysis, but yielded no significant differences among factors. Hence concluded that factor of motor learning cannot be evaluated through physical ability.

Mckinny and Dean\textsuperscript{38} (1972) using Principal components factor analysis with varimax rotation to 128 undergraduate physical education major administered to 49 test variables, which yielded five factors. Consisting the five test variables they have constructed two motor fitness test batteries for male physical education majors.

Measure of flexibility by factor analysis was attempted by Harris\textsuperscript{39} (1969), where in 53 variables of
flexibility were administered to 147 college women. She concluded that any of the joint action or a composite test would hardly give the satisfactory index of flexibility because of its high specificity in an individual.

Power has close relationship with speed factor rather than strength factor. This thought was depicted by Start et al (1966), when they subjected their data to varimax analysis and the results were confirmed by promax analysis, which also enabled them to obtain two second orders factors.

Jackson and Frankiewiez (1975) administered sixteen test items on 50 male college students in effort to determine the factors of the human muscular strength. Multiple factor analysis modes confirmed four factors of muscular strength (Static-force-arms, Explosive-power-arms, Dynamic-work-arms and static-power-legs). The other two factors dynamic-work-legs and Explosive-power-legs did not support the robust factor.

Twenty six test items on 76 male college students
have been administered by Jackson (1974) in an effort to clarify the factors of strength, but the study does not support factors of strength (Dynamic, Static and Explosive). However dynamic strength appeared to be more dependent upon individual differences in body weight than on the types of movement.

Bissonnette (1974) has identified, static strength, hip flexibility, recovery pulse and muscular endurance, factors as components of physical fitness.

Twenty one variable administered to 200 college fresh entrant women by Cumbee (1954), using multiple group method of factoring extract yielded eight factors of motor co-ordination, of which only five were identified. A comparison of centroid and multiple group method of factoring was also attempted where in the results showed similar solutions by both methods of analysis.

Huang (1982), had administered a device physical fitness test on 100 Chinese junior high school boys. Factor analysis yielded seven factors, 70% (percent) of total variance of physical fitness were observed. The
factors identified by him were speed-explosive strength, size of the body, endurance, co-ordination, strength of leg muscles, dynamic flexibility, dynamic strength and flexibility.

Barrow\textsuperscript{46} (1952) administered 29 test items on 222 college men to construct a motor ability test. Doolittle Technique of multiple correlations and regression technique were employed to compute the data. Results revealed multiple 'R's of 0.950 and 0.925 for two test batteries constructed. Six factors named by him were power, arm and shoulder co-ordination, agility, hand and eye co-ordination, strength and speed.

McHone \textit{et al}\textsuperscript{47} (1952), administered nineteen test on 123 college men to construct a short test battery for high school boys. The test battery so constructed provided multiple correlation co-efficient of 0.9159, 0.8964, 0.8770, 0.9085, and 0.8942 with the test items.

Wellman\textsuperscript{48} (1935), had found a multiple correlation of 0.56 between the variables of a test battery and criterion. She also found correlation of 0.72 between
physical fitness index and Brance test; and, a correlation of 0.73 between speed and agility tests.

Cozens (1940) administered 22 test variables to 250 college men. Through multiple correlations and regression analysis a strength test battery of five items was constructed, strength as a dependent variables was supported by Multiple ‘R’ of 0.982 with the selected 10 test items.

Arnett (1962) had administered thirteen selected test variables to 120 senior high school girls to construct a 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 0.755 and a reliability coefficient of 0.848.

Eighteen cable tension strength test was administered by Clarke and Schoff (1962), to 826 boys (9-12 years of age) for the construction of a muscular strength test for boys. Multiple correlation analysis yielded four test items for the battery.

Falls, et al. (1965), analysed 53 variables to
developed a physical fitness test battery, wherein, he subjected the data to factor analysis and regression analysis. Factor loadings were used as validity correlations to reduce the number of variable. Then the data was subjected to Multiple regression analysis to develop a test battery for the isolated factors.

Fifteen test variables were administered to 128 high school girls by carpenter\(^{53}\) (1943). Factor analysis, here, yielded four factors namely strength, body coordination, motor educability and a fourth which was left unnammed. The data which also was subjected to multiple correlations analysis by using the test items with highest factor loadings, to predict identified factors. A test battery of nine items was constructed and T-score norms have been incorporated.

Glasgow\(^{54}\) (1973) in an attempt to construct a gross muscular strength test battery, administered 21 cable strength tests to 234 physically disabled boys. Factor analytic solutions yielded 3 factors. These items of a constructed test battery were adduction, hip outward
rotation and trunk extension.

Eleven test variables of strength were administered to 100 college men by Coleman\(^5\) (1937). Factor analysis extracted 3 factors namely strength, speed and weight. He also found that weight highly correlated with strength factor. The data was further analysed for Multiple and Partial correlations. While so analysing, factor loadings and other possible combinations of variables were considered. The results revealed that Roger’s strength index was a very adequate measure of strength as a distinct factor in individual athletic performance. A Multiple 'R' of 0.880 was established among 4 pounds and 16 pounds shot-putting and weight.

One hundred and sixty college students were administered two different groups of physical variables (8 and 15 items each) by Larson\(^6\) (1940) to predict components of strength to construct a test combination of strength variables. Zero-order correlation, factor analysis and multiple correlation analysis were used to compute the data. Two significant factors of strength were identified and they were named as dynamic strength,
and static dynomometrical strength. A strength test battery of 3 variables (Chinning, dips, and vertical jumps) was constructed.

Since the construction of a test is itself basic in nature, this work envisages fresh inputs to existing methodologics that would have bearing in the constantly evolving techniques in the construction and development of physical fitness tests.


38. S.R. McGinney and Donald Dean, "The Construction of a Motor Fitness Test Battery for Undergraduate Male Physical Education Majors", *Dissertation*


