CHAPTER V
SUMMARY. CONCLUSIONS AND RECOMMENDATIONS

Summary

Assessments of physical fitness through physical variables have been in practice in most of the reported literature in the field of physical education. The modern day growth of the field provides ample opportunities for the overall development of an individual in the present context. Physical fitness is one of the potential characteristics of an individual. It is very difficult to accurately specify one's physical fitness on the basis of numerical data, yet through observations and studies into physical attributes and involvement of muscles it is possible to assess one's physical fitness objectively enough.

Many experts in the field have imparted their knowledge in understanding and defining physical fitness through logistics, subjective ratings and numerical data. A conventional definition of physical fitness could be of Clarke and Clarke which stands nearest to the reality. Nevertheless, physical fitness stands beyond these definitions. It is a comprehensive phenomenon. Physical fitness in its simplest form could be identified or defined as the capacity of an individual to perform the assigned task with ease and comfort.

Physical fitness tends to vary from individual to individual, and region to region and it also differs depending on the nature
of work to be performed. Other factors like environmental conditions, topography, heredity, nutritional set-up, etc., may have their influence on the physical fitness of an individual. There may be numerous inherent factors which may also have to be accounted for in deciphering individual's physical fitness.

Physical fitness has been identified by various components like muscular strength, endurance, dynamic strength, agility, speed, explosive strength etc., through performance on physical variables or test items.

In India, the institutional set-up, the student behaviour and attitudes, their food habits and living style etc. may together contribute in deciding the physical fitness standard of our school going children. Physical fitness level of our school children may differ to a large extent in comparison to that of American and European standards. The developed physical fitness tests of foreign countries may not suit our own standards. Considering these things, the construction of physical fitness test for high school boys in terms of our own standard and the setting up of norms in grading the physical fitness level of high school boys was deemed very necessary. The purpose of this study was to construct a physical fitness test battery for high school boys and to standardise the physical fitness test on high school boys.

Since, the study needed an elaborate investigation it was divided into two phases.
The I Phase of Study

Initially, 29 test items were selected in consultation with experts, on the basis of the study of reported literature as also based on the researcher's own experience. Face validity was the criterion considered in selecting the test items. Age, weight and height were considered to be general factors. In all 32 test variables were selected inorder to administer them on high school boys who had represented their institution at least in taluk levelsports or games.

Selected test items were administered to a representative sample of 180 sports boys from 11 schools having good sports reputations of six taluks of Dakshina Kannada district, Karnataka State. Proper motivational measures had been taken to ensure the best performance by the students on test items. Objectivity of test items was obtained by administering the test by two testers on the same sample, on the same day and during two different sessions. The reliability of test items was obtained by the test-retest method.

Correlation matrix was obtained for 32 variables. Two variables had been deleted for factor analysis and multiple regression analysis because of their low values in correlations as well as in objectivity and reliability. Principal components analysis method was used to extract factors, which generated seven factors. These seven factors accounted for 69.3 per cent of the
total variance in the data set. These factors individually possess 34.0, 12.1, 6.6, 5.6, 4.1, 3.7, and 3.3 per cent of the total variance.

The factors identified were muscular strength, agility, muscular endurance, the speed of limbs, body co-ordination, explosive strength and age respectively. These sub-systems are components of major system called physical fitness.

Muscular strength emerged as a dominant sub-system with 30.4 per cent of the total variance followed by agility (vide 12.1 per cent of variance) and so on. The factors were rotated by using varimax rotation (Kaiser's normalization) to get rotated factor loadings. The variables with bi-polar loadings of 0.45 and above were considered for interpretations.

Factor I was identified as muscular strength. Weight and height were principal variables with highest rotated factor loadings (0.89 and 0.85 respectively). The ball-throw with different weight and size of the balls or with different modes of throw were clear measures of muscular strength in common.

Factor II was identified as agility factor. Four of the five predicted agility variables have shown significant loadings on agility factor. Agility has shown closer association with the speed factor and a negative relationship with the muscular strength factor. Variables of speed factor have shown significant
negative loadings on this factor, whereas, variables of muscular strength have shown significant positive loadings on this agility factor.

Factor III was identified as muscular endurance which is independent in its nature. Tests that were predicted to measure muscular endurance have shown significant loading on this factor and have shown negligible loadings on the other six factors. Push-Ups (15 sec.) is also significant (0.71) in this factor.

Factor IV was identified as the speed of limbs factor. The variables predicted to measure the speed of arms and legs were significant in this factor.

Factor V was identified as body co-ordination which appears to be a specific factor with the Cross-Step Sideward Running variable. This variable shows a close association with the agility factor and a significant negative relationship with the muscular strength factor.

Factor VI was identified as explosive strength. Standing Broad Jump alone has been identified as a unique variable to measure the explosive strength of the whole body. An opposing significant loading on abdomen muscles's explosive strength [Sit-Ups (Bent Knee-15 sec.)] was observed in this factor.
Factor VII was identified as age factor. As age factor does not show any significant relationship with the five physical fitness components that have isolated it needs further investigation.

Multiple regression analysis results were obtained by using the Step method. To consider a test as dependent variable, the face validity, highest rotated factor loadings and reliability of test items were taken as criteria for regression analysis. Six components of physical fitness identified in factor analysis were included for multiple regression analysis. Age factor was not considered because of the unreliable results in factor analysis.

Multiple regression analysis yielded significant results on muscular strength (Multiple R 0.914), agility (Multiple R 0.655), muscular endurance (Multiple R 0.824), the speed of limbs (Multiple R 0.449), body co-ordination (Multiple R 0.588) and explosive strength (Multiple R 0.456). Analysis of variance indicated that there is a significant effect due to the regression of different variables on six different components of physical fitness at 0.05 level of significance and the six regression models were a good fit (P value 0.000)

Four of the six regression models strongly supported the factor analytic findings, whereas in the other two models the speed of limbs (vide 20 per cent of the total variance) and explosive strength (vide 21 per cent of the total variance) did
not yield satisfactory results. This may be due to the specificity of dependent variables (Tapping by Hand and Standing Broad Jump respectively) selected for the analysis.

Out of the 32 variables subjected to statistical analysis 14 variables were finally considered for the construction of physical fitness test for high school boys. Considering administrative feasibility, logistics and educational application, the following physical fitness test with six test items was constructed for high school boys to assess their physical fitness.

1. Weight
2. Height
3. Tapping by Hand
4. Agility Test II
5. Standing Broad Jump
6. Leg Raise (Sec. Held)

The II Phase of Study

Subjective ratings by the experts in the field of physical education was obtained to assess the face validity of the constructed test. By analysing the contents of the test, content validity of the physical fitness test was assessed. Construct validity of the physical fitness test was assessed by considering the factor analytic findings and also by comparing the test with the established test namely AAPHER youth fitness test. A validity correlation co-efficient of 0.868 was established between AAPHER Youth fitness test and the constructed physical fitness test.
Standardisation of constructed physical fitness test of high school boys was carried out during July '94 to September '94. Initially, the required details of test administration were mailed to 300 high schools of Dakshina Kannada district, along with request letters by the researcher. The concerned physical education teachers were requested to administer the test to their 30 high school boys of the age group of 13 to 15 years. As a result, physical fitness test assessment of 2636 boys were received from 66 institutions of the district. Then the investigator personally administered the test to 1905 high school students from 30 institutions. Physical fitness assessment of 125 boys collected during first phase of study was also included for standardisation.

In all, the constructed physical fitness test was administered to a fairly large representative sample of N=4666 high school boys of the age group of 13 to 15 years, belonging to 96 different high schools of Dakshina Kannada district from eight taluks for assessing the physical fitness standard of high school boys.

Raw scores were converted into standard scores represented by T-scores. T-scale norms have been developed for the high school boys of the age group of 13 to 15 years. Norms for all the six test items included in the test battery were developed.
Conclusions

With in the constraints of this study following conclusions were deduced.

1. Factor analysis of 30 variables generated seven factors, which accounted for 69.3 per cent of the total variance in the data set. Muscular strength emerged as a principal component (vide 30.4 per cent of the total variance) of physical fitness. Factors identified were muscular strength, agility, muscular endurance, the speed of limbs, body co-ordination, explosive strength and age.

2. Multiple regression analysis supported factor analytic findings in four of the six components identified. These four components are muscular strength, agility, muscular endurance and body co-ordination. However the other two factors, the speed of limbs and explosive strength, have fairly supported the factor analytic findings. All the six components included in the regression analysis confirmed their significance at 0.05 level of significance with the variables included in the regression.

3. The test constructed measured five different components of physical fitness namely muscular strength, agility, muscular endurance, the speed of limbs and explosive strength. Six test items of the physical fitness test battery showed significant rotated factor loadings and significant 't' values with respect to physical fitness.
4. Weight and height could be clear measures of muscular strength.
5. Age need not be the criterion to assess one's agility. Age need not be considered for assessing physical fitness level of high school boys.
6. Vertical Jump has greater affinity towards muscular strength whereas, Standing Broad Jump is a clear measure of the explosive strength of the whole body.
7. 40 mts. and 50 mts. runs have a combination of factors, not exactly the predicted speed factor.
8. Agility factor has close association with speed factor and an opposing relationship with muscular strength factor.
9. Arm muscles reach a state of exhaustion with in a short period. Hence, muscular endurance of arm muscles could be measured in a short duration (15-30 sec.).
10. The test constructed stood the criteria of scientific authenticity, administrative feasibility and educational application in the field of physical education and will help in assessing the high school boys's physical fitness.

Recommendations

1. The test constructed will serve as a valid tool for assessing high school boys's physical fitness in India and therefore the physical education teachers can make use of the test to evaluate student performance and also instruction.
2. The test can be used by the coaches/selectors to know the physical capacity of the player while selecting potential competitors.

3. Rating of five components of physical fitness will be possible and accordingly the training programmes could be rescheduled.

4. Similar type of studies can be done on elementary school children, high school girls, college men and women.

5. Many factor analytic studies could be conducted in India pertinent to specific components of physical fitness, so that a generalised conclusion can be drawn with respect to physical fitness. Furthermore, these type of studies will lead to plan for experimental designs in measurement area.

6. Other multivariate analyses like cluster analysis, discriminant analysis etc. could be used to decipher the behaviour of numerical data with respect to physical fitness.

7. As the age factor did not yield significant results it warrants a detailed study. Other areas like speed, body co-ordination, flexibility etc. should also be thought of for further studies.

8. Normative studies can be done on the constructed physical fitness test throughout India.

9. Regional importance should be given to identify and understand better the physical capacity of Indian Youth and such studies should lead to improve the physical fitness standard of our Indian Youth.