CONSTRUCTION AND STANDARDIZATION OF SPECIFIC PHYSICAL FITNESS TEST FOR CRICKETERS

ABSTRACT
OF THE
THESIS
SUBMITTED FOR THE AWARD OF THE DEGREE OF

Doctor of Philosophy
IN
PHYSICAL EDUCATION

By
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UNDER THE SUPERVISION OF
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ALIGARH MUSLIM UNIVERSITY
ALIGARH, (U.P.) INDIA
2014
THESIS
ABSTRACT

Sports and games unite individuals, societies and Nations. A competitive sport is a universal passion and usually seen as an alternative to the smile which removes barriers. Sports have now achieved a significant position in the culture of the society and this culture is measured through its achievement in sports. Sport is as old as man himself and it is ingrained in the instinct of mankind. Today’s sports have different forms in the sense that earlier more emphasis was laid on creative aspects, competition has become the defining feature of sports in modern society. Sport is an ideal medium to build the character for the youth in school. By its very nature, sports are enjoyable, challenging and they require a certain amount of skill as well as physical fitness. At the international level, winning the medal enhances the prestige of the nation. Nowadays, large numbers of youths are motivated to take sports more seriously and dedicatedly.

Physical fitness is a composite, versatile observable fact, collection of aerobic, anaerobic capacity of muscular strength, flexibility, joint mobility and Speed. For effective and specific fitness development, it is the responsibility of a coach and performer to identify the fitness components, which contribute to the performance in their sport, then select and administer an appropriate method to develop it. Due to the said domain complexity; this may require a detailed analysis of the sport. So we can say that an individual who is "naturally gifted" will need proper care and specific training to make the most of their talent.

Sodhi and Sidhu (1984), define specific fitness of a sportsman as “The fitness that serves as a pre-condition required for a particular sport. Fitness involves focusing the fitness goals of an athlete to meet the specific need of an activity. The term is most common when referring to athletes who play a particular sport; the athletes identify the specific physical requirements of that sport and then target exercises that will increase their fitness in those areas. An awareness of specific fitness can help athletes excel in their chosen sports because it directly connects their workouts to the performance in their sport. It also can have some drawbacks when athletes become too focused on specific fitness at the expense of overall fitness. The first step an athlete must take before undertaking specific fitness training is to identify the needs
of his/her sport or activity. Tewarson (1983) remarked that “This era has become an age of specialization but of super specialization as well as micro specialization”.

For sports you must be specific. “Specificity” means adaptation to imposed demands. The body responds to the way demands are placed on it. If one functions in certain way your body begins to take that shape. The fitness of a cricketer which is specific to the game has no utility for the fitness of other game. Here the concern of researcher is specific fitness, particularly for the game of cricket. Henry (1958), is an important educationist in the field of specificity, says that there is a degree of generality and specificity in the performance of motor tasks. In connection with the development of general motor abilities, tests were supposed to measure the degree of generality in the performance of physical task and vice-versa. A number of well known sports scientists, researchers, coaches, trainers and physical educationists had advocated the doctrine of specificity in sports training that is training for fitness related to those sports. Loarance (1977) stated that “if your main objective is sports, it is better to play that sport”. This phenomenon in physiology is called “specificity”.

Therefore, the discussion of fitness focuses on the question, fit for what purpose? The requirements of fitness are highly specific to sports. A Football player needs different type of fitness than hockey or cricket player. It generally suggests an ability to perform a dynamic or specific task and to recover quickly. The fitness required for one sports is different from that of another. A number of researcher, sports scientist and coaches have advocated the doctrine of “specificity” in sports training, that is, training for fitness must related to a specific fitness /sports. The development of specific fitness requires the appropriate level or amount of motor abilities in relation to requirements of the concerned game.

Cricket fitness training is a form of sport-specific training designed for cricket players. The top cricket players in the world use fitness plans to developed and customized for their needs by their coaches. And other people can consult with personal trainers and cricket coaches to get advice on creating a cricket fitness training program, provide information and assistance with fitness training, including recommended workout schedules that people can use as a basis for the program. Cricket is a physically demanding sport. Players need to be capable of high intensity bursts of energy, but they also need the endurance to make it all the way through a
match. Coordination, flexibility, and agility are also important as cricket players move around all over the ground during fielding. People who play cricket professionally and who want to develop their amateur games need fitness training to be able to take their performance to the next level.

The above mentioned literature emphasized the growing need of specific physical fitness in different domain. As the investigator interested in developing a specific physical fitness for cricketers, it become mandatory to explore the existing knowledge regarding the cricketer’s specific physical fitness. The investigator contacted the various sources to build the frame work of the existing knowledge on the said topic.

The history of test and measurement in physical education is a distinct and has occupied an important place in total education system. It has a unique area to measure and an equally rich heritage in measurement and evaluation.

Test may be categorized in many different ways. For the purpose of this discussion, although not necessarily in order of importance, the reasons for testing have been divided into nine reasonably categories,

(i) Classification of student, (ii) Diagnosis of student needs and weakness,

(iii) Evaluation of instructions,( iv) Evaluation of program,( v) Marking,

(vi) Motivation, ( vii) Instruction, viii) Prediction, and Research.

Statement of the Problem

During the last three decades, the whole field of education has been making an increasingly extensive use of objective measurements. This has not been only an indication of the growing trend of education toward a more scientific basis, but one of the causes of that trend as well. From the review of literature, i could find, no test is available in present educational scenario to measure the optimum specific fitness abilities for north-zone level cricket players.

The present study has been designed as “Construction and Standardization of Specific Physical Fitness Test for Cricketers”.
Objectives of the Study

The main objectives of the study are given below

- Construction of specific physical fitness test for cricketers.
- Standardization of proposed test determining validity, reliability and objectivity.
- Development of norms for the proposed test.

Delimitation of the Study

Every research study is delimited in several ways. It has to be delimited in terms of population covered, sample selected, and scope of available studies. The following have been out-lined as delimitations.

- The study was delimited to University Level Cricket (Male) Players.
- The study was delimited to North-Zone cricket players.
- The player falling between 18 to 25 years of chronological age considered for the study.
- The study considered batsman, bowlers (fast and spinners) and fielders, from the cricket arena.

Limitations of the Study

- Different training schedules in the university was considered as limitation of the study.
- Time schedule for data collection had differed from place to place and the change of environment and the climate considered as limitation.
- The efforts of individual players exert during the each test was considered as the limitation.

Significance of the Study

- The findings of the study would be helpful in the evaluation of the cricketers.
The findings of the study would be helpful in the selection of the cricketers.

The findings of the study would be an asset to the cricketers of higher level to determine their fitness level at any point of time.

The findings of the study would be an asset to any specialization in cricket of higher level to determine their fitness level.

The conclusion of the study will contribute to determine the level of specific fitness by the cricketers.

The findings of the study will enable the cricketers to determine their fitness level before, during and after the training session.

The result of the study will contribute one to determine and compare his level of specific fitness as cricketer and his specialty as bowler or batsman or fielder.

Review of studies is an integral part of the research. It gives valuable insight to the investigator regarding the problem to be solved. The important objective of the reviewing literature is that it helps us in the formulation of the research topic. There are ninety seven literature including, research paper, articles, unpublished thesis etc. Maximum literatures are critical literature related to this study rest of them supports to design and complete to this study. In order to get a thorough knowledge about the proposed area of study, while going through various sources of literature, it has been observed that no work has been done on specific physical fitness related to the game of cricket. This area is a leading step towards specific fitness. Therefore, Researcher to undertake the problem about the specific physical fitness test of cricket players, and to construct specific physical fitness test battery for them by utilizing conventional techniques of factor analysis.

In design and methodology identification and defining the nature of population techniques used to select the representative sample and efficiency of the techniques used in data interpretation are the important processes of the investigation. The basic thrust is the construction and standardization of specific physical fitness test battery and development of norms for north-zone level cricket players. The study was executed in two phases. The first phase was related to construction and
standardization of the preliminary specific physical fitness test battery. Second phase was to develop norms by using appropriate statistical techniques. The subjects for the study were 350 cricket players of age between 18 to 25 years. The samples were recruited for the construction of the test and to develop a standardized specific physical fitness test for cricketers. The researcher had conducted a pilot study on 50 players on 48 test items from where 24 test items were extracted and final study was conducted. The researcher applied twenty four experimental test items, which aim to measure physical component of fitness were administered on 120 north-zone cricket players who participated in north-zone intervarsity cricket tournament held in Aligarh Muslim University, Aligarh. In order to select the broad component of test, the available literature of physical fitness were critically reviewed and opinions of experts regarding these tests were obtained. Also existing literature on the appropriate component of physical fitness in Indian geographical condition situation were considered. All the components of the physical fitness were considered. On the basis of these the following components for the specific physical fitness test for cricketer are considered. The physical fitness components are: 1) Cardio-vascular Endurance 2) Muscular Endurance 3) Speed 4) Flexibility 5) Power 6) Agility 7) Balance and coordination 8) Strength. The results have been obtained through the Statistical Package for Social Sciences (SPSS) Version 17.0. The Pearson Product Moment formula has been utilized for correlation of variables and then Matrix of inter-correlation among the 24 variables was obtained. The data was then subjected to Factor Analysis. The principal component analysis was used to extract factors. Varimax Rotation (Kaiser’s Normalization) was used to generate rotated factor matrix. The rotated factor matrix was used to the selected for interpretation. Considering the Eigen value, rotated factor loadings, communality, a Specific Physical Fitness Test Battery of five test items for intervarsity level cricket players was developed. The five test item test battery was further administered to 230 players. These data of 300 players for five items were subjected to percentile statistics. The percentile norm was developed from total data. The drawn selected test items by factorial analysis they were administered on 350 cricketers to develop norms. The five item test battery was further administered to 230 players.

The result of the study revealed that the factor analysis yielded five factors with Eigen values above 1.022. Through face validity, five test variables were considered as
dependent variables with the cumulative percentage of 84.084. Information from the
data sheets was entered into Microsoft Excel, analyzed and descriptive statistics
computed using an SPSS statistical package (version 17.0) to factor analyze the
physical test items and to determine the mean and standard deviation for each
variables which ranges from 57.17±6.94 to 1.40 ± 0.07 respectively. The validity co-
efficient ranging from 0.95 to 0.58 with the mean of 0.77. Content validity was
established by expert judgment. The objectivity co-efficient ranging from 0.72 to 0.63
with the mean of 0.78. Multiple correlations of 24 variables were obtained. The
positive correlation value range from 0.001 to 0.983 and negative correlation value
range from -0.988 to -0.003 was established. Factor analysis for the raw data set of 24
variables suggested five factors to be generated that account of the total variables in
the data set. Kaiser’s criteria were used to generate the factors. The considered factors
individually posses 61.832, 7.879, 5.695, 4.421 and 4.258 of variance. Thus factors
represent the sub systems of components of a major system called specific physical
fitness test.

The test items were selected to be included in the test on the basis of the results
obtained from the factor analysis to serve as the criteria to measure the Specific
Physical Fitness for cricketers of north zone interversity level players. The selected
test items were Side Stepping, Criss-Cross Test, Squat Thrust, Sit-ups and Full- squat
with factor loading of 0.975, 0.812, 0.915, 0.865 and 0.785 respectively.

The norms had been developed for Male Cricketers of north-zone Interversity Level
Players of the age group between 18 to 25 years. The norms have been developed
through percentile rank only as it is found easier for all teachers, coaches, trainers,
researchers and testers to compare the results.

Conclusion

Physical fitness abilities are perhaps one of the most controversial aspects of one's
personality. It is the most elusive quality and has been frequently defined in rather
abstract terms.

The concept and importance of physical fitness is one of the facts of a person's all
round harmonious development. Physical fitness is the cultural phenomenon of great
complexity and magnitude, which is historically, preconditioned level of health and
comprehensive development of a person. Physical fitness adds grace to the young, wealth to the poor, and ornament to rich and acts as a consoling factor to the old. The place of physical fitness in any society reflects something of that society’s characteristics. Today almost every country in the world gives importance to development of sports in order to improve the nation's health and for the well being of the future generation.

The importance of Specific fitness involves focusing the fitness goals of an athlete to meet the specific needs of an activity. Specific physical requirements of that sport and then target exercises that will increase their fitness in those areas. An awareness of specific fitness can help athletes excel in their chosen sports because it directly connects their workouts to their performance in their sport. The primary benefit of this sport-specific fitness technique is that the athlete wastes little energy building fitness levels in areas that are not directly beneficial to his or her sport.

The data and information collected for the study was rich, both in content and magnitude. The findings presented in the preceding chapters, therefore, cover only those crucial aspects which were in accordance with the scope and objectives of the study.

Due consideration has been given to the diverse characteristics of the sports undertaken, batting, bowling, fielding, wicket keeping, (fast and spinners) etc. in order to select the subject as true representative of north-zone cricket intervarsity players only. The players up to 18 to 25 years of chronological age have been taken in the study. The study is delimited to 80 percent of university level player’s for the development of norms. To justify, every member of the team was considered as subject for the study from the randomly selected north-zone level cricket players. The universities give serious consideration to all the sections, batting, bowling, etc. in formulating a team to represent them. Thus the subjects selected were justified for the study.

The final sample for construction of specific physical test battery and protocol for each test items was developed. Sample population of 120 players was exposed to 24 different motor skills for construction of test battery, and then the researcher brings out the objectivity, reliability and validity of the test items. The data collected was subjected to factor analysis in (SPSS), version 17.0. Since factor analysis starts with
the correlation matrix was initially obtained. Then Principal Components Analysis method was used to extract factors, which generated five factors. Then the factor matrix was extracted to have rotated factor loadings. By considering the administrative feasibility, logistic interpretation with respect to the pertinent field of application, rotated factor loadings and communality a test battery of five items was developed to measure the specific physical fitness for North-Zone intervarsity level cricket players. The test items for the Specific Physical Fitness Batteries are as follows:

i) Side-stepping ii) Criss-cross test iii) Squat thrust iv) Sit-ups v) Full Squat

Based on the findings of the statistical analysis, critiques and experts deliberations in the light of critical literature and scientific information on specific fitness of cricketers. Existing knowledge could be complemented by obtaining the considered opinions and insights of coaches and players. This information would also provide a framework for the development of design of batting, bowling, wicket keeping and fielding a specific assessment, focused on training, conditioning and coaching protocols. This should enhance all types' performance and contribute to the ultimate goal of winning matches. Every sports explicitly differs the demand of the physical fitness ability and the specific physical fitness ability varies from one to another. The test variables showed a significant realness to on ground pragmatics.

A cricketer, batsman, bowler, fielder, and wicket-keeper differs in quality and quantity of fitness components, like, balance, co-ordination, reaction ability (sharp movement/ability to change hands or foot), etc. The test items derived indisputably represent the specific physical fitness components of cricketers as a whole.

The first test items obtained by constructed and validated design test battery is side stepping (also known as side step dodging, spot dodging, ground dodging or simply one step sequence). This test items aims to measure the sprinting speed as well as endurance of the cricketers.

The second test item obtained by constructed and validated design test battery is Criss-Cross. This test items aims to measure the whole body co-ordination and foot work ability of the cricketers.
The third test item obtained by constructed and validated design test battery is Squat Thrust. This test item describes the quality and has a great importance for improving fitness level of cricket players. It is a true full body workout. Holding yourself in the right body position will engage your arms, chest and core muscles.

The fourth test item obtained by constructed and validated design test battery is Sit-up (60 second). Sit-ups test primarily measures the abdominal and hip-flexor muscles, strength and endurance.

The fifth and last physical test item obtained by design test battery of specific physical fitness is Full Squat. Full squat is one of the best tests which measure the maximum strength in the cricket players.

In the light of above mentioned discussion researcher reached the conclusion that these test items are highly specific in measuring the specific physical fitness for cricketers which is very demanding now-a days for cricket players.
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Dedicated to My Family
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I, Ahsan Ahmad, Department of Physical Education, certify that the work embodied in this Ph.D. thesis is my own bonafide work carried out by me under the supervision of Prof. Ikrar Hussain at Aligarh Muslim University, Aligarh. The matter embodied in this Ph.D. thesis has not been submitted for the award of any other degree.

I declare that I have faithfully acknowledged, given credit to and referred to the research workers wherever their works have been cited in the text and the body of the thesis. I further certify that I have not willfully lifted up some other's work, para, text, data, result, etc., reported in the journals, books, magazines, reports, dissertations, thesis, etc., or available at web-sites and included them in this Ph.D. thesis and cited as my own work.

(Ahsan Ahmad)
En. No. GD 6897

CERTIFICATE FROM THE SUPERVISOR

This is to certify that the above statement made by the candidate is correct to the best of my knowledge.

(Prof. Ikrar Hussain)
Professor
Department of Physical Education
Aligarh Muslim University,
Aligarh

(Signature of the Chairman of the Department with seal)
COURSE/COMPREHENSIVE EXAMINATION/PRE-SUBMISSION
SEMINAR COMPLETION CERTIFICATE

This is to certify that Ahsan Ahmad, Department of Physical Education has satisfactorily completed the course work/comprehensive examination and pre-submission seminar requirement which is a part of his Ph.D. programme.

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(Ahsan Ahmad)
struggle, and some time feeling nervous during my Ph.D. thesis. I will of you have been there to support and encourage and motivated me when I struggled. Dr. Muhammad Akram, Dr. Tariq Ahmed, and Dr. Muzaffar Ahmad, both of whom are my seniors, have been a source of inspiration and guidance. I commend my sincere gratitude to my friends and colleagues who helped me to complete this thesis.

All praise and thanks are due to the Almighty Allah whose blessings me to the

Acknowledgements
My special, profound and affectionate thanks, love, gratitude and deep indebtedness are due to my wife, Parveen Kouser who has been struggling with me. Her understanding, support, commitment and looking after my loving daughter during my study. At the same time, I would like to express my love and thanks to 'the beats of my heart,' my daughter Ramsha who are the only source of inspiration to me, and it is their love and innocent smiles that have made the hardship of this task bearable. I especially thankful to Ms. Naheed Kouser, I offer my sincere thanks to Ms. Mufeeda Hussain.

I would also like to extend my thanks to all the staff of the department, specially thanks to Mr. Anwar A. Khan and Mr. Ashok K. Singh and Coaches, Managers & Players who participated in this research which really helped me to make the data collection process smooth.

Finally, I wish to express my deepest gratitude to my family members for their endless love, concern, encouragement and precious spiritual support throughout my life. Parents, the ones who can never be thanked enough, for the overwhelming care and love. Words cannot express how grateful I am to my mother-in-law, father-in-law, for all of the sacrifices that you’ve made on my behalf. My deep love and thanks are due to my brothers, Mr. Astar Ahmad, Mr. Izhah Ahmad, and Mr. Shadab Ahmad and I also to thanks to Mr. Iqtedar Ahmad, Mr. Najeeb Ahmad, Dr. Faizan Ahmad, and the entire family.

And special thanks and appreciation go to UGC for granting me a MANF meritorious fellowship as a JRF and SRF to carry on my higher studies and in return I’m so grateful for their financial support and concern during my studies.

AHSAN AHMAD
# CONTENTS

## CHAPTER I  INTRODUCTION
1.1 Introduction to the problem  
1.2 Concept of Specific Fitness in cricket  
1.3 Need and importance of the study  
1.4 Definition and explanation of terms  
1.5 Planning with a test  
1.6 Purpose, construction of a test  
1.7 Historical perspectives  
1.8 Current trends in test & measurement  
1.9 Statement of the problem  
1.10 Objectives of the study  
1.11 Delimitation of the study  
1.12 Limitations of the study  
1.13 Significance of the study  

## CHAPTER II  REVIEW OF THE RELATED LITERATURE  

## CHAPTER III  METHODOLOGY  
3.1 Selection of the subjects  
3.2 Selection of Test Items  
3.3 Description of the test variables  
3.4 Pilot study  
3.5 Construction of the test  
3.6 Specific Physical Fitness Component  
3.7 Experimental test items  
3.8 Method of Execution  
3.9 Procedure for Administration of the Test  
3.10 Statistical Techniques  

## CHAPTER IV  ANALYSIS AND INTERPRETATION OF DATA  
4.1 Objectivity, validity and Reliability  
4.2 Correlation Matrix  
4.3 Factor Analysis  
4.4 Development of the Specific Physical Fitness Test Battery  
4.5 Development Of Norms  

## CHAPTER V  SUMMARY, CONCLUSIONS AND RECOMMENDATIONS  

## BIBLIOGRAPHY  

## APPENDICES
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table No.</th>
<th>Title</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Descriptive Analysis of 24 Fitness Test Items</td>
<td>130</td>
</tr>
<tr>
<td>2</td>
<td>Objectivity and Reliability of Correlation of Co-efficient</td>
<td>132</td>
</tr>
<tr>
<td>3</td>
<td>Correlation Matrix</td>
<td>133</td>
</tr>
<tr>
<td>4</td>
<td>Factor Analysis</td>
<td>135</td>
</tr>
<tr>
<td>5</td>
<td>Factor Analysis</td>
<td>136</td>
</tr>
<tr>
<td></td>
<td>Extraction Method, Principal Component Analysis</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Factor I</td>
<td>137</td>
</tr>
<tr>
<td>7</td>
<td>Factor II</td>
<td>138</td>
</tr>
<tr>
<td>8</td>
<td>Factor III</td>
<td>139</td>
</tr>
<tr>
<td>9</td>
<td>Factor IV</td>
<td>140</td>
</tr>
<tr>
<td>10</td>
<td>Factor V</td>
<td>141</td>
</tr>
<tr>
<td>11</td>
<td>Specific Physical Fitness Test Battery For Cricket</td>
<td>143</td>
</tr>
<tr>
<td>12</td>
<td>Percentile Norms of Specific Physical Fitness Test Battery For Cricket</td>
<td>145</td>
</tr>
</tbody>
</table>
# LIST OF FIGURE

<table>
<thead>
<tr>
<th>Figure No.</th>
<th>Title</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1(a,b,c,d)</td>
<td>Illustrating Zig Zag Running</td>
<td>82</td>
</tr>
<tr>
<td>3.2(a)</td>
<td>Illustration of 50 Yard Dash Running at Start</td>
<td>84</td>
</tr>
<tr>
<td>3.2(b)</td>
<td>Illustration of 50 Yard Dash Running at Finish</td>
<td>84</td>
</tr>
<tr>
<td>3.3(a)</td>
<td>Illustration of Backward Running at Start</td>
<td>85</td>
</tr>
<tr>
<td>3.3(b)</td>
<td>Illustration of Backward Running during Finish</td>
<td>85</td>
</tr>
<tr>
<td>3.4(a)</td>
<td>Illustration of Standing Vertical Jump Initial Phase</td>
<td>87</td>
</tr>
<tr>
<td>3.4(b)</td>
<td>Illustration of Standing Vertical Jump Phase</td>
<td>87</td>
</tr>
<tr>
<td>3.5(a,b,c)</td>
<td>Illustration of Standing Broad Jump</td>
<td>88</td>
</tr>
<tr>
<td>3.6(a)</td>
<td>Illustration of Cricket Ball Throw</td>
<td>90</td>
</tr>
<tr>
<td>3.7</td>
<td>Illustration of Rope Skipping</td>
<td>92</td>
</tr>
<tr>
<td>3.8</td>
<td>Illustration of Over Arm Hanging</td>
<td>92</td>
</tr>
<tr>
<td>3.9(a,b,c,d,e,f)</td>
<td>Illustration of Hopping</td>
<td>94</td>
</tr>
<tr>
<td>3.10(a,b,c)</td>
<td>Illustration of Side Stepping</td>
<td>97</td>
</tr>
<tr>
<td>3.11(a,b,c,d)</td>
<td>Illustration of Criss-Cross</td>
<td>99</td>
</tr>
<tr>
<td>3.12(a,b,c)</td>
<td>Illustration of Shuttle Run</td>
<td>101</td>
</tr>
<tr>
<td>3.13(a)</td>
<td>Illustration of Sit-ups</td>
<td>103</td>
</tr>
<tr>
<td>3.13(b)</td>
<td>Illustration of Sit-ups</td>
<td>103</td>
</tr>
<tr>
<td>3.14</td>
<td>Illustration of Storck Stand</td>
<td>106</td>
</tr>
<tr>
<td>3.15</td>
<td>Illustration of Full Squat</td>
<td>110</td>
</tr>
<tr>
<td>3.16(a)</td>
<td>Illustration of Full Squat</td>
<td>111</td>
</tr>
<tr>
<td>3.16(b)</td>
<td>Illustration of Full Squat</td>
<td>111</td>
</tr>
<tr>
<td>3.17(a,b,c,d)</td>
<td>Illustration of Sit and Reach</td>
<td>113</td>
</tr>
<tr>
<td>3.18(a,b,c)</td>
<td>Illustration of Single Leg Squat</td>
<td>116</td>
</tr>
<tr>
<td>3.19(a)</td>
<td>Illustration of Dips</td>
<td>118</td>
</tr>
<tr>
<td>3.19(b)</td>
<td>Illustration of Dips</td>
<td>118</td>
</tr>
<tr>
<td>3.20(a)</td>
<td>Illustration of Pull-Ups</td>
<td>120</td>
</tr>
<tr>
<td>3.20(b)</td>
<td>Illustration of Pull-Ups</td>
<td>120</td>
</tr>
<tr>
<td>3.21(a)</td>
<td>Illustration of Hand Reaction</td>
<td>122</td>
</tr>
<tr>
<td>3.21(b)</td>
<td>Illustration of Hand Reaction</td>
<td>122</td>
</tr>
<tr>
<td>3.22(a)</td>
<td>Illustration of 600 Mtr Run/Walk</td>
<td>124</td>
</tr>
<tr>
<td>3.22(b)</td>
<td>Illustration of 600 Mtr Run/Walk</td>
<td>124</td>
</tr>
<tr>
<td>--------------</td>
<td>----------------------------------</td>
<td>-----</td>
</tr>
<tr>
<td>3.23(a,b,c,d)</td>
<td>Illustration of Squat Thrust</td>
<td>126</td>
</tr>
<tr>
<td>3.24</td>
<td>Illustration of Bass Stick Test (Length Wise)</td>
<td>128</td>
</tr>
<tr>
<td>3.25</td>
<td>Illustration of Bass Stick Test (Breadth Wise)</td>
<td>128</td>
</tr>
<tr>
<td>Graph No.</td>
<td>Title</td>
<td>Page No.</td>
</tr>
<tr>
<td>----------</td>
<td>-------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>1</td>
<td>Factor-I Factor Loadings</td>
<td>138</td>
</tr>
<tr>
<td>2</td>
<td>Factor-II Factor Loadings</td>
<td>139</td>
</tr>
<tr>
<td>3</td>
<td>Factor-III Factor Loadings</td>
<td>140</td>
</tr>
<tr>
<td>4</td>
<td>Factor-IV Factor Loadings</td>
<td>141</td>
</tr>
<tr>
<td>5</td>
<td>Factor-V Factor Loadings</td>
<td>142</td>
</tr>
<tr>
<td>6</td>
<td>Percentage variance of Rotated Factor Loadings</td>
<td>144</td>
</tr>
</tbody>
</table>
Chapter 1

Introduction
CHAPTER – I
INTRODUCTION

1.1 Introduction to the Problem:

Sports and games unite individuals, societies and Nations. A competitive sport is a universal passion and usually seen as an alternative to the smile which removes barriers. Sports have now achieved a significant position in the culture of the society and this culture is measured through its achievement in sports. Sport is as old as man himself and it is ingrained in the instinct of mankind. According to Barrow, sports are product as well as process. As product, it emphasis on win at all cost, when sports is process oriented, it emphasis is an as aesthetic quality of performance and achievement and actualization (Barrow, 1983). Today’s sports are have different forms in the sense that earlier, more emphasis was laid on creative aspects, competition has become the defining feature of sports in modern society. Sport is an ideal medium to build the character for the youth in school. By its very nature, sports are enjoyable, challenging and they require a certain amount of skill as well as physical fitness. At the international level, winning the medal enhances the prestige of the nation. Nowadays, large numbers of youths are motivated to take sports more seriously and dedicatedly.

Thanks to Technology, which encompassed every aspect of human life, sports nowadays have become highly scientific. As a result, new records are being created shattering the old ones at the higher rate. Every country seeks to beguile its superiority. This challenge stimulates and inspires all human to sweat and strive to run faster, jump higher and to throw farther than others, and show greater strength, speed, endurance and skill to lead and dominate to over others. Nineteenth century was an extra ordinary period of development in terms of both ideas about sport and fitness. Muscular activity and competition became not only acceptable but favorable. Moral development began to be tied to sports and fitness.

In modern life those who participate in sports attach great significance to winning, as the philosophy of participation in games and sports has undergone a notable change. This excellence and success can be secured only through a scientifically well planned and systematic sports training program. When athletes are roughly equal in skills, the
ne with the higher overall fitness level will have the advantage of being more able to

Physical fitness is a composite, versatile observable fact, collection of aerobic,
aerobic capacity of muscular strength, flexibility, joint mobility and speed. For
effective and specific fitness development, it is the responsibility of a coach and
performer to identify the fitness components, which contributes to the performance in
one's sport, then select and administer an appropriate method to develop it. Due to the
aid domain complexity; this may required a detailed analysis of the sport. So we can
ly that an individual who is "naturally gifted" will need proper care and specific
aining to make the most of their talent.

All types of training and exercise undertaken need to be planned for the specific
mands of the sport. The athlete's needs to be trained with the vision of their specific-
sitions or nature of work they supposed to perform in the sports. Our training
jective should be focused to make a player physically, mentally and technically
ady to compete and fit into the specific places in their participating sports. There are
any sports in the world, and has varied nature, demands different types of specific
ness components, so for cricket too.

To boost the ability to play cricket efficiently, there are numerous factors of
rdiovascular and motor fitness that need to be included in the training programme.
velop a specific kind of fitness, keeping in view the specific task need to
form by the players (i.e., Batting, bowling, fielding, etc). The fitness components
needed to be arranged in a specific proportion to assure that the specific fitness
ill be restored after completing it.

here is a growing demand with regard to fitness, skill and related capabilities of
ortsman, as performance has been considered a major aspect of competition. Hence,
er is a need to pay attention to physical fitness in general and specific fitness in
articular which determines performance to a great extent. On the basis of different
ings by researchers and sports scientists. Fitness has been analyzed as the degree
a person to function effectively, and the aim to fulfill her/his potential. Fitness is
ecessary to perform day to day functions effectively. It reflects the status of human
ody by measuring specific components. It assigns our body and mind by reducing to
stress, anxiety, depression and nervousness. Human performance can be viewed from a number of factors which are so complex that they are almost indefinable. Any performance might be formally or informally examined to determine its components in terms of general and specific factors. In every day speech, we recognize the specificness of fitness in such phrases as, ‘fit to fight’ and ‘fit to compete’. These are concrete perceptions of the individual’s adequacy to meet the social demand with which he is faced. Such perceptions help us understand the idea of fitness in participating the physical activities.

Many researchers, scientists and physical educationists have written much about the “principles of specificity”. But very few have defined a specific fitness. As Singh, (1976) has stated that each sports activity demands different types and levels of different motor abilities and when a sports man possesses these, he said to have specific fitness. Any performance might be formally analyzed to determine its components in terms of general and specific factors. Once these are identified they can be developed through training programme for the players which can later be evaluated by a scientific method.

Moreover, Thistrup, 1972 and Berger, 1973, connected that fitness is specific to the activity/game. They say that specific fitness is the key point of success for sportsmen in the higher level competitions. The development of specific fitness requires the appropriate level or amount of motor abilities in relation to the requirement of the game concerned have also to be kept in view. Henson (1987) also opined that the training is affected by the specificity and so, it must be specific to the requirements of the event.

For an athlete's overall development and best performance the sports specific strength training programme is a basic necessity. Now coaches have scientific view, they don't fear that strength exercises may affect the performance and technique of performer. Sports specific tests are getting popular day by day as it is giving the ideas to improve performance and techniques.

It is generally accepted that sports specific tests are more appropriate than standard tests (general fitness tests) for assessing athlete’s capacities that are challenged during a real competition (Meckel, 2009), the appropriate variables for sport-specific selection and orientation (Sattler, 2012), and the physical qualities that are useful for
iscriminating between different positions in team sports (Kondric, 2012; Melchiorri, 009).

ports specific tests play a vital role in cricket game as it is important for other games. Through specific exercise, performance of a cricket player can be improved by dividing the specific exercises systematically.

Other factors that are important to a player's progress are his genetic background, diet and mental fitness. Improvements in performance depend upon the training methods used. Frequency, intensity, progressive overload, type of exercise and specificity and recovery all play a part in determining performance. Sport-specific strength training programs are fundamental to an athlete's development and success. Therefore, the discussion of fitness focuses on the question, fit for what purpose? The requirements of fitness are highly specific to sports. A Football player needs different type of fitness than hockey or cricket player. It generally suggests an ability to perform a dynamic or specific task and to recover quickly. The fitness required for one sports is different from that of another. A number of researcher, sports scientist and coaches have advocated the doctrine of “specificity” in sports training, that is, training for fitness must be related to a specific fitness to sports. The development of specific fitness requires the appropriate level or amount of motor abilities in relation to requirements of the concerned game.

Fitness is one of the used and misused terms in the English language. It can be referred to the feeling of pleasure which a person experience. Physical fitness is an individual matter and, as such has little meaning unless viewed in relation to the specific needs of an individual. Many people fail to understand the level of physical fitness which is actually required. Keeping in view the importance of fitness, Guild (1962) said that without motherhood there is extinction, without justice there is lavery, without honor there is swindling and without fitness there is death.

Physically fit citizens are a major asset for a strong Nation, and hence physical fitness of the youth should be a National and general concern. Physical fitness tends to vary from one individual to another. Apparently, it changes its nature in accordance with behavior of a person depending whether he is sedentary or dynamic. As we observe individual differences in characteristics of physiological studies, a similar evaluation could be said to hold good with respect to physical fitness also. There may be some
generalized facts of individual fitness in a group, but each individual will differ in some or other way as far as physical fitness is concerned. So, we can say that physical fitness is considered as a basic requirement upon which an apex (specificness) can be raised. Nowadays, nobody has the time to do things other than their work which could keep them fit and working for long. We have seen that not only old people but children having the problem of diabetes, cholesterol, etc. The major question is why these problems today? Because modern technology has reached so high that a child likes to watch TV, and wants to play games on computer. The concepts of physical fitness for children start in the primary grades and are emphasized in the elementary grades. It is essential that children learn the skills, and develop the knowledge and behaviors that will enable them to be physically active now and in their adult years. As the investigator interested in developing a specific physical fitness for cricketers, it become mandatory to explore the existing knowledge regarding the cricketer’s specific physical fitness.

1.2 The Concept of Specific Fitness in Cricket:

Sodhi and Sidhu (1984), define specific fitness of a sportsman as “The fitness that serves as a pre-condition required for a particular sport.”

To meet the specific need of an activity an athlete requires focusing on fitness goals. It refers to those athletes who involve in a particular sport. Such types of athlete identify their specific exercise requirement and then select exercises to increase their fitness in specific areas. Such type of selected exercises helps directly to enhance performance of athlete in their selected sports. Tewarson (1983) remarked that “This era has become an age of specialization but of super specialization as well as micro specialization”.

For sports you must be specific. “Specificity” means adaptation to imposed demands. The body responds to the way demands are placed on it. If you functions in certain way your body begins to take that shape. The fitness of a cricketer which is specific to the game has no utility for the fitness of other game. Here the concern of researcher is specific fitness, particularly for the game of cricket.

Henry (1958), says that there is a degree of generality and specificity in the performance of motor tasks. In connection with the development of general motor
ilities, tests were supposed to measure the degree of generality in the performance of a physical task and vice-versa.

A number of well-known sports scientists, researchers, coaches, trainers, and physical educationists had advocated the doctrine of specificity in sports training that is aiming for fitness related to those sports. Loarance (1977) stated that “if your main objective is sports, it is better to play that sport”. This phenomenon in physiology is called “specificity”. It means, if you want to train for any event, you practice that event in a manner that stimulates the requirement.

The first step an athlete must take before undertaking specific fitness training is to identify the needs of his/her sport or activity. These needs can vary tremendously between different sports and thus will call for different workouts. A cyclist, for example, will focus on exercises that increase lower body strength and cardiovascular endurance, and a baseball player might focus primarily on upper body strength and usually will require some degree of overall fitness. A workout that is too targeted over me, actually be detrimental to an athlete’s performance. After determining the specific fitness needs of a chosen activity, the athlete then formulates a workout that will prioritize those benefits over other areas of fitness. The primary benefit of this sport-specific fitness technique is that the athlete wastes little energy building fitness levels in areas that are not directly beneficial to his/her sport. For example, a bodybuilder will not spend time going for extended runs because doing so would drain energy that he would be better off dedicating to lifting weights. Similarly, a marathon runner will not choose to lift weights because this would take time away from more important aerobic exercises and would increase muscle mass, thus slow down the runner. As useful a sport-specific fitness can be in maximizing an athlete’s performance at a given task, there can be some negative consequences if an athlete does not maintain an awareness of his/her overall fitness (Messmer, 2014).

Underarajan (1993) says that in modern times, the term physical fitness is almost replaced by the term ‘functional fitness’, composed of the perfect combination of physical, physiological and psychological components in appropriate properties according to the varying demands of functional needs of requisite types, with an ability to complete the task comprehensively.
Getting too focused on one area of fitness can limit the athlete's versatility within his/her sport because most sports require a variety of skills. Another problem that can arise as a result of sport- or task-oriented fitness is that the athlete can create unnatural imbalances in his/her fitness that can eventually have health repercussions. It also is important for athletes to remember achieving their specific fitness goals.

Harre (1979) for achieving a higher level of efficiency in technique and tactics in most of the sports, a high level of specific fitness is more important. Because a Specific fitness is the key point of success for sportsman in the higher level competitions.

Cricket fitness training is a form of sport-specific training designed for cricket players. The top cricket players in the world use fitness plans to developed and customized for their needs by their coaches. And other people can consult with personal trainers and cricket coaches to get advice on creating a cricket fitness training program, provide information and assistance with fitness training, including recommended workout schedules that people can use as a basis for the program. Cricket is a physically demanding sport. Players need to be capable of high intensity bursts of energy, but they also need the endurance to make it all the way through a match. Coordination, flexibility and agility are also important as cricket players move around all over the ground during fielding. People who play cricket professionally and who want to develop their amateur games need fitness training to be able to take their performance to the next level.

Recent research has begun to back the theory that slow training (like long runs) makes slow athletes. This is because power sports such as cricket require short burst activities that use the fast part of your muscles (fast twitch fibers). If you train the slow twitch part you get better at doing stuff slowly. So train in the way you play with fast, powerful movements. Training is very specific fitness. For example, strength training does not improve endurance. So even at this early stage where the focus is on general fitness we need to consider cricket specific aims. For this reason, all training should be done at a consistent pace with as little rest as possible and exercises must focus on the muscles that you use while playing. Before practicing we cannot ignore warm-ups, warm ups are not only a great way to prepare your body for play and reduce the chance of injury, they can also be used to improve your game.
In respect of physical fitness the Indian players are lagging far behind in comparison to foreign players. It is not denying the fact that they are naturally gifted with the imatic condition and the physique. Through conditioning and scientific training the barriers can be tackled. Considerable physical fitness is necessary for playing any game. Fitness plays a small, though, significant part in the success of a cricketer. The modern day cricketer is stronger, fitter and more agile than ever before. Power and speed has become the name of the game in all aspects of the contest with special attention being paid to ball striking ability and speed in the field. It is a given for the professional cricketer to be at a certain level of fitness in order to succeed at Franchising. At the elite level, sides like Australia and England are now extremely utilizing various fitness techniques to enhance the athletic abilities of their squads.

Here are a range of physical and mental factors that contribute to successful performance in sports. Cricket is basically a 'skills' game. A player has to be fit enough to perform a given job on the field without getting tired. However, even after the induction of modern training methods, there had been time, when the Indians have appeared flat and disoriented on the field.

Cricket is a running based game. Running between wickets, chasing the ball to the boundary in the field, running for a catch and running in to bowl are all major parts of the game. Brett Lee is an international cricket player, whose bowling speed is closely related to the velocity he runs, i.e. the faster he runs in the quicker he bowls (Campbell, 2011).

With the introduction of one day cricket and more recently T-20 the game has gone through major changes and the physical demands made on a cricketer's body have increased dramatically. Depending on the version of the game being played and the role of the player in the team, the importance of fitness requirements of a fast bowler will be greater and also different than that of an opening batsman, and one-day cricket will be more demanding than a test match (Samsudeen, 2012).

It is clear that balance and coordination is seen as one of the most important aspects of cricket fitness followed by speed and power, as well as dynamic exercises are important as they imitate the true activity you will be doing on the cricket field. As we now that dynamic exercises increase the range of motion of joints and muscles.
To play better cricket one must be fit. Cricket appears to include long spells of rest in the field, regular short bursts of activity and though long periods of batting take their physical toll. The best cricketers have fitness on their side. For example, you are doubtful to bowl at your best if you are breathing heavily after just a few balls. And you are more liable to make a basic batting error if you are breathless after a previous run. Whether batting, bowling or fielding, cricketers require good cardiovascular fitness. According to Coaching Youth Cricket by Ian Pont, aerobic fitness relates to how well your body takes in oxygen and gets clear of carbon dioxide. Aerobic exercises may also help prevent muscle injuries and fatigue. Useful aerobic workout for cricket includes running, cycling and swimming. Another tip is to practice running with full pads and cricket tools on. You may be able to run 100 feet wearing a T-shirt, but running in full pads is another matter. (Hinchcliffe, 2007) suggests several cricket-specific routines. For example, leg lunges work the muscles used for positioning yourself for perfect batting shots and gaining a fast sprint start. Bench pressing and dumbbell exercises work the muscles needed to bowl fast balls. However, strength more than size is usually the aim of cricket fitness programs. Using the rowing machine helps you develop overall upper body strength for improving specific fitness for cricket. Developing a circuit training program is a great way to improve cricket fitness. Therefore, exercises should be focal point on a combination of explosive power and stamina. You need no specialist equipment for these exercises. For example, Discovery Publishing House (DPH, 1999) in the Sports Series book Cricket, Ashok Kumar suggests pull-ups, burpees, back raises, push-ups, abdominal curls and sprint runs as part of an overall fitness program for cricketers. Flexible fielders can make the most acrobatic of catches. Flexibility also helps batsmen move their body into position quickly for a shot and even prevents bowlers from picking up too many injuries. Pilates and yoga are two useful ways to get agile for cricket, according to Cricket for Dummies. Short energetic exercises, such as an indoor group cycling session, can improve your overall endurance and explosive power. Try sprint exercises with varied pacing to help you get used to the stop-start nature of cricket.

The aerobic training is necessary to assist the player in maintaining strength and to battle fatigue during a long match need not be powerful. In the course of a weekly training program, two 45-minute to one-hour sessions of moderately paced running, cycling, or other activity, at approximately 50-60% of the athlete's maximum heart
The target is improved stamina and recovery times in the day of the mainly anaerobic necessities of cricket competition (Rank, 2014).

The anaerobic qualities of cricket are clear in the requirements of all positions. Plyometrics drills that stress jumping repeats and similar explosive movements are a useful drill for the cricketer. In a similar fashion, interval running exercises that mimic the conditions of the cricket fielder, by requiring short explosive runs of between 32.8 ft and 164 ft (10-50 m) at a segment, will be likely to assist in developing the sprinting abilities of the fielder in tracking down a ball to be retrieved and thrown back to the wickets. These drills can be performed with the athlete bonita from a standing start, a running start, and a point start, as if the fielder had laved for and missed a ball so as to follow the types of starts that the fielder would encounter in a game situation (World of Sports Science, n.d).

Variations of interval training that develop the lateral speed of the fielder to react to a hit ball include foot speed drills, where the athlete must discuss his way through a series of squares, moving sideways as quickly as possible (Rank, 2014).

There is no physical dimension or weight limit placed on cricketers; the nature of the sport and its "all round" characteristics is likely to encourage athletes with a measure of agility, at the expense of muscle. Muscle development is however a necessary component of proper cricket training programs. High-repetition, low-weight regimes are commonly seen as the best way to balance the gap between muscular size and agility. The key muscle structures that should be developed for improved cricket performance are the triceps (important to both throwing and batting), the upper chest muscles (batting and bowling), and the abdominal and oblique muscles of the upper body, stability in all aspects of the game (World of Sports Science, n.d).

Low fit do you have to be to play cricket? Would a cricket fitness program in fact make a great difference to performance on the field?

Usually, cricket has seemed as a relatively easygoing sport from a physiological point of view. The irregular nature of the game with its long rest intervals provides plenty of recovery time between any short spells of higher intensity activity.

However, the demands of cricket may be underestimated (Noakes & Durandt, 2000). In one study of the 1999 South African World Cup, a number of physiological tests
for explosive power and aerobic endurance capacity showed they were as 'fit' as the South African National rugby side. While there may be explanations other than the demands of cricket, it seems interesting that a group of athletes playing a physically 'easy' sport compared favorably to some of the fittest athletes on the world. Fitness aside, cricket players are susceptible to overuse injury (Leary & White, 2000; Finch, 1999 and Orchard, 2005). Strength training and conditioning plays an important role in chronic and acute injury prevention, particularly in asymmetrical sports such as cricket (i.e. batting, bowling and throwing are performed with a dominant arm or stance).

Conditioning for cricket should not only be sport specific but also position specific. Fast bowlers require different preparations from spin bowlers, for example: of course, there are many aspects of cricket training applicable to all players as each individual will be required to bat and field during a game. Hence, Physical fitness tests are functional as well as objective and are not beyond the reach of anyone who is desirous of administering the same (Gheysen, 2008). Physical fitness test batteries, originally developed for military purposes, have been constructed for junior high, senior high, and college students; presently, however, few scientifically constructed physical test batteries for players of different games exist (Kroes, 2002). No specific physical fitness test is existing for the cricketers of any age.

Earlier traditional beliefs were used as guidelines by coaches and physical education teachers for the rearing and to evaluate the proper growth and development of cricket players (Kroes, 2004 and Livesey, 2007). In spite of the fact that there is little evidence that these traditional beliefs are accurate or even partially accurate, many are held widely today, just as they were in the past (Petermann, 2008). Why is this so? The best general answer is that not enough scientific evidence exists to prove that the traditional beliefs are not correct.

Cricket is a game that would show to require little muscular strength. Viewed from a distance, cricket is such a seemingly moderate pursuit that the notion of strength training and exercises would seem to have a limited application. However, as with many sports that involve relatively lengthy periods of low activity punctuated by intervals of great muscular focus, cricket is deceptively hard and it also presents significant physical training challenges for the athlete, especially at an elite level.
for batsmen, bowlers, and fielders, the primary energy system utilized during competition is the anaerobic lactic processes. In the acts of bowling, batting, and fielding, the intervals of activity requiring energy generation to power the athletes' muscles will almost certainly be fewer than 40 seconds. As all players in cricket are at some stage of a match called on to bat and field, much basic fitness training will be common to all players. Cricket training is not entirely an anaerobic focus. Players are often either stationed in the field or at bat for a number of hours at a time. Cricket, as both a traditional English summer sport as well as a competition played year round in warm, humid regions such as India, Pakistan, Sri Lanka, Bangladesh, Australia, and the West Indies, places the demands of the environment on the players. Enhanced aerobic fitness and a strong cardiovascular system assist the players in dealing with the fatigue and impact on their attentiveness in the course of a long match.

The areas of particular fitness attention at each cricket position include:

**Batsman:** Brute muscular power is not a liability to this position, but reaction time, batting technique, and balance in the crease are of basic importance. A batsman may be required to maintain his position for a number of hours. The cricket batting stroke relies upon core strength, particularly in the abdominal and oblique muscle groups, the gluteal muscles, and the upper arms and shoulders.

**Bowler:** The nature of the position requires that a bowler has the ability to move explosively in the run up to delivery, as a speedy run up will physically translate into faster delivery of the ball; the arm, shoulder, and core body strength and stamina are necessary to deliver the ball repeatedly.

**Fielder:** Fielding is one of the most essential features of cricket. The fielders need a good reactive ability to catch a ball falling from on top of their heads and powerful over-arm throwing skill (Bartlett, 2003). Speed of movement and agility are critical to his place. We review the existing literature, journal in terms of scientific, technical, mental, physiological and physical factors are very important to fielding, to recognize information gaps and better understanding of the performance are necessities of fielding in cricket. The fielder’s ability is to throw a ball over considerable space with speed and accuracy, if your aim is for a run out, you require an outstanding throwing skill and technique (Elliott, 1990). The requirements in cricket excessive physical, and psychological aptitude, as well as the capability to focus sincerely for a very long
period, for which a high level of physical fitness is required (Noakes, 2000). It is a basic responsibility of fielders during matches that they have to concentrate on every ball of the innings, despite of their positions. Therefore, in the fielding optimizing the movement, actions and skills are mandatory to effectively field can have an importance which influence on the game. Outfielders frequently have to cover up substantial distance, thus sprinting ability is a basic requirement to throw the ball exactly (Shilbur, 1990). However while the motto should be ‘catches win matches’.

**Wicketkeeper**: Wicketkeepers have special physical fitness requirements compared to the other of the team. The most important fielding position in cricket is wicket keeper. Talented and skilled wicketkeeper needs to every team. A good wicket keeper will need to have a number of characteristics to do the job well. Fast reactions and accurate judgment should be a basic requirement for wicket keeping. A quality of good wicket keeper is he has a very short time to react as fast deliveries, particularly if there are some changes in the ball line due to swing in variations. As a wicket keeper you should have a great level of physical fitness, flexibility, agility, power, speed and endurance are very important components for keeper. So the requirements of wicket keeper are to be just a hard as others players like batsman, bowler, and fielders. Wicketkeepers have unique fitness needs compared to the rest of the team. The frequent 'squatting down' requires endurance strength and core stability and when wicketkeepers move they be liable to move quickly which relying on speed and power. In addition, a good wicket keeper will need a high level of skill. He will need to be aware of what is happening around him, particularly where the batsmen is in relation to his stumps and crease and have the ability to catch balls that are moving very quickly. He will be frequently bending and stretching and will need a high level of reaction ability and agility.

A test may be categorized in many different ways not necessarily in order of importance. The reasons for testing have been divided into nine reasonably categories: (i) Classification of student, (ii) Diagnosis of student needs and weakness, (iii) Evaluation of instructions, (iv) Evaluation of program, (v) Marking, (vi) Motivation, (vii) Instruction, (viii) Prediction and (ix) Research.
.3 Need and importance of the study.

The study has a great importance because physical education has to developed trends to incorporate a greater variety of activities. Introducing students to activities like owling, walking/hiking, at an early age can help students develop good habits that will carry over into adulthood. Some teachers have even begun to inculcate among the students stress-reduction techniques such as yoga and deep-breathing. Teaching non-traditional sports to students may also provide the necessary motivation for students to increase their activity, and can help students learn about different cultures.

Another trend is the incorporation of health and nutrition to the physical education curriculum. The physical education curriculum is formulated to allow students to experience at least a minimum exposure to the following categories of activities: quatics, conditioning activities, gymnastics, individual, dual sports, team sports, rhythms, and dance. Students are encouraged to continue to explore those activities in which they have a primary interest by effectively managing their community resources. In these areas, a planned sequence of learning experiences is intended to support a progression of student development (Kreutz, 2013).

In physical education, it is essential to update content of knowledge, fitness level, motor skills and attitude and feelings related to physical activity. In connection, there are terms that are used interchangeably are test, examination, and quiz. Each of these words refers to a type of instrument or procedure that measures attributes or properties of an individual. Paper and pencil quizzes and examinations can certainly be administered in many circumstances, but because of the wide variety of areas to be auged, the term test is most appropriate for the majority of physical education situations, while “examination” carries the implication of a lengthy comprehensive testing process. Thus, test is an all-encompassing term which refers to instruments, protocols, or techniques used to measure a quantity or quality of properties or attributes of interest.

Test and measurement serve two general purposes. The first purpose, usually stated last, is for research design to improve the professional program. It is through the objectification of the measurement of performance that really scientific programs are made possible. In physical education, properties or attributes including areas such as cognitive knowledge, components of fitness, values, general motor skills, and motor
skills specific to certain sports are subject to testing. Many types of test may be effectively utilized in physical education testing. For example, student's conception of fitness, or understanding of a particular sport's rules and strategies may be assessed with written test. Certain questionnaires or inventories may be used to evaluate attitudes or feelings about physical activity. For example, a shuttle run can measure agility; a 50 yards sprint can test running speed; the 12-minutes run is commonly used to test cardiovascular endurance. Numerous tests have been designed to identify particular sports. Whatever test is chosen, it is crucial that it meets the criteria of being a valid and reliable test for the group being measured. In constructing tests it is important to make sure that they really measure the factors required to be tested, and are thus objective rather than subjective.

1.4 Definition and Explanation of Terms:

a) Test: "In scientific terms, test means an instrument to be used for accurate measurement of anything. Test maybe defined as "A form of questioning or measuring tool used to assess the status of one's skill, knowledge, attitudes or fitness" (Kansal, 2008).

b) Measurement: "Measurement is a technique of evaluation that use tests and other procedures and instruments, is generally precise and objective, generally results in quantitative data, and characteristically can express its results in numerical form when indicating ability or capacity in some trait or characteristics involving fitness, motor skill, knowledge, value or process" (Barrow & McGee, 1979).

c) Evaluation: "Evaluation is a process of education that uses data gathered from the product and the process by means of measurement techniques. It is expressed in either a subjective or objective manner and can be used for comparisons with preconceive criteria to make judgments" (Barrow & McGee, 1979).

1.5 Planning with a Test

Test in education is maximally constructed to be as a last minutes task. These last minutes task test usually result in too much or too little emphasis on certain instruction objectives. Test developers may have only the numbers of possible points
in mind when beginning to write items and fail to cover the entire concept developed during the procedure of test.

To plan for any test effectively the teachers and researchers must clearly state the purpose of the test, and its impact and importance. Test planners, also define in behavioral terms and objectives that are to be measured by the test and identify the actual content to be covered by the test. Testmakers, teacher, and researcher must realize that a given test is a sample of all possible questions that could be developed for the teaching unit.

**Benefits of Fitness Testing:**

The major use of fitness testing is to establish the strength and weakness of athlete. It is possible to compare test results among athletes in the similar population group, the same sport or same training group. In training programme the different nature of tests make it more interesting. It predicts future performance of athlete, measures improvement and indicates weaknesses.

**1.6 Purpose, Construction of a Test:**

Measurement and evaluation serve many purposes in physical education and other purpose is to provide a sound basis for evaluation of teachers and the curriculum. Teacher can use evaluation to develop norms as well as to help predict future successes of their students, and diagnose learning problems of specific skills. Progress during the unit of instruction and achievement after the unit can be evaluated by using formative and summative evaluation procedures respectively. The improvement of students can be measured and evaluated by using proper procedures. The students can be motivated with a measurement and evaluation program by providing them with immediate feedback.

Physical performance tests are generally more complex than written tests and the actual time period available to physical test is usually shorter than other academic tests. Apart from validity, reliability and objectivity, other criteria must also be taken into consideration while constructing a test.
Social psychological aspects of test & measurement:

Social and psychological measurement develops in physical education as identification of the objectives of the profession become clear. The first scale in the social area was Van Buskirk's character rating scale in (1928) it included statement that measured development in leadership, active efficiency and sociability. Social behavior measurement has also received much emphasis in the past two decade. A number of personality inventories not specifically developed for measurement in physical education have been utilized in an increasing number of studies. However within the past decade, there has been an increased effort to understand the sociological dimension of physical education and sports. Instrument has been developed to evaluate whether socialization take places by participation in physical education and sports, whether social mobility suggest itself through participation in sports as well as many other activities.

A review of the literature that deals with tests and measurement in physical education reveals that valuable contributions have made by different individuals as well as by various organizations. Different types of tests have been developed, and a vast number of measuring instruments have been employed ranging from the simple yardstick to the complex electrical equipment used in testing. The quantity and quality of research in sports have continued to improve. This is certainly not meant to imply any criticism of the early researchers on the contrary, physical education has been extremely fortunate to have had such excellent and inspiring leadership in the areas of research, and tests and measurements. As in any profession, students must profit from the experience of the professors and strive to improve upon the work of those who have gone before. It has been observed that scientific endeavors in all fields have had rather simple beginning. To confirm this phenomenon we need only recall the primitive practices in the history of medicine, the simple, awkward designs of the first attempts of men to fly. Yet, when one considers the tremendous advances that have been made in these fields in the last quarter of a century, the prognosis for progress in evaluation in physical education should indeed be encouraging. Physical education is a relatively new field. This is attested to by the fact that many of the persons named in this chapter as being early leaders in the area of tests and measurements are still active today or only recently passed away. We must lookout against complacency and discouragements. The history of test and measurement in physical education reveals
that in some areas no further research efforts have been reported for twenty or thirty years. It is imperative that we continue to seek new and better ways of measuring those traits which we have already had some success in measuring and at the same time make renewed and vigorous efforts to assess those qualities which here fore have buffered attempts at measurement.

A fundamental responsibility of professional physical educators, teacher, and sports scientist has been the evaluation of the physical status of population especially players. Measurement and evaluation are necessary in order to determine one’s motor fitness proficiency and as a means of determining if physical education programs are adequately fulfilling established goals and objectives. Test and measurements in the field of physical education are comparatively recent development of the general testing movements (Berks, 2003; Barnett & Peter 2004). Beginning late in the 19th century as strength tests, tests of track and field and anthropometric measurements, they have increased in number and completeness with amazing rapidity (Bruininks & Bruininks, 2005). The relative objectivity of most of the skills on abilities measured, the development of tests in physical education has avoided many of the pitfalls that have been encountered by test builders in the mental disciplines (Eurydice, 2002; Flegel & Kolobe, 2002).

During the last two decades, the whole field of education has been making an increasingly extensive use of objective measurements (Folio & Fewell, 2000). This has been not only an indication of the growing trend of education toward a more scientific basis, but one of the causes of that trend as well. The use of mental tests and standardized measurements has become a commonplace in connection with classroom instruction; but much less well known to the educational administrator are the equally valid tests of a similar nature available for use in the field of physical education (McCloy, 2004; Gallahue & Ozmun, 2006) and especially the specific physical fitness test has been so ignored that no test exists in the literature to measure physical status of cricketers. The concept of specific physical fitness requires that the test avoid as much as possible highly specialized skills (Gallahue & Donnelly 2003; Haywood & Getchell, 2005). In considering the construction of a physical fitness test battery for players of any chronological age, one should consider the measuring instrument suitable for the particular age, growth, and maturational characteristics of the subjects. Furthermore, administrative feasibility, availability of equipment, economy of time,
and the practice of testing a maximum number of subjects in a minimum amount of time should be considered in developing an effective specific physical fitness test battery (Kambas, 2002).

**Economy:**

Economy in testing means the cost and time involved in the construction, administration, and the scoring of classroom instructions. Most physical Education programs do not have the luxury of an unlimited budget, so test should be economically feasible in terms of equipment and personnel.

Equipment and materials are not the only cost factor associated with test administration. To ensure valid results, test need to be monitored by trained individuals. Since more test batteries contains several items it is economical to have more than one person available to function as a test administrator. When students, parents, or other teachers assist in testing, time must be devoted to training them. A test that takes a great deal of time to complete, demand a high degree of skill and experience to administer, and requires extensive training and practice time may not be a judicious use of personnel.

**Time:**

Time is more important aspect of the economy in a measurement program. Test should be conducted for the administration in a relatively short period of time. With the demands placed on teacher accountability, it is appropriate that the majority of time in physical education be devoted to learning experiences designed to meet predetermined objectives. Recognizing this, most experts in curriculum design and measurement recommend that formal testing programs consume no more than 10 percent of the total instructional time (Barrow and Mc Gee, 1979; Baumgartner and Jackson, 1987; Johnson & Nelson, 1986).

**Safety:**

Safety checks should be done prior to any testing session, such as checking for the proper working of equipments, and adequate supply of safety equipment such as mats, water bottle and first aid kits. Test should always be constructed in such a way that
can be conducted in a safe environment and that are not inherently dangerous (Cureton, 1947; Chow, 2006).

**Educational Value:**

The main goal of the test is to help students in starting life-long habits of regular physical activity. Testing and measurement are the means of collecting information upon which subsequent performance evaluations and decisions are made. As an internal part of the education process, testing should not just be an evaluation process, but should be learning experience for the student as well. (Scully & Clark, 1997; Taylor, 2002). As a result of test taking, they should learn something about themselves and the qualities being assessed. For example, taking the AAHPERD physical test that can inform students about important components of an individual's life style. Further, test results can be used to profile the level of physical performance capacities, thereby broadening the student's awareness of, and interest in, personal health and functional well-being (Petrolini, 1975; Burton & Miller, 1998; Graf, 2004).

Tests additionally break up and add variety to the training program. They can be used to satisfy the athlete's competitive urge out of season. Maximal tests demand maximum effort of the athlete so are useful at times as a training unit in their own right. Many microcomputer software packages are available that offer tutorials about physical fitness, nutrition, sports, and health. Often these learning packages contain review questions that give students an opportunity to test their knowledge about a particular topic. Keeping in mind that testing can be educational and the allowing it to become separate from instruction can be deleterious to the overall program.

**Enjoyment:**

Tests should be constructed in such a manner that taking test becomes a non-threatening and relatively enjoyable experience. Most people have experienced anxiety and apprehension associated with taking a test. These feelings are due to a threatening environment, particularly with physical performance tests, educators need to take measures to ensure that the testing is as enjoyable as possible and in no way discourages youth from participation in physical activity.
Testing large groups:

While constructing test, test developers should take care that he/she may develop such a test which test large number of players simultaneously (Cohen, 1988; Carnbell, 1989; Croce, 2001).

Ease of Scoring, interpreting & reporting:

A test should allow for easy and accurate scoring and should be used as a self-assessment technique by player (Carmines & Zeller, 1979).

For standardization of any test objectivity, reliability and validity is most important part during construction of the test. There are various types of validities for construction of tests and they are as follows:

Validity: Validity is the most important of the technical standard because it measures the honesty of a test. Validity is the extent to which a test measures what it claims to measure. It is vital for a test to be valid in order for the results to be accurately applied and interpreted. Validity of tests can be established using either a qualitative or quantitative approach. Although numerical techniques can be included, the qualitative approach depends upon the use of common sense and logic in making subjective judgments about the test in question (Davies, 2008; Scott & Hill, 2006). The quantitative approach is a data-based approach that involves calculating correlation of coefficients to determine the validity. Choosing a procedure for establishing validity of a test is often depends on the type of test that is being administered (Daniels, 1990). With this in mind, five procedures for establishing validity will be discussed, starting with qualitative, or data free, techniques and followed by the more powerful quantitative, or data-based methods (Dunn, 1979).

Face validity: This is probably the weakest way to try to demonstrate construct validity. The weakest procedure for establishing validity is called face validity. This argument is based on cursory examination of the testing instrument to see if it measures what is a purport to measures. Because face validity is based on subjectivity, it does not present a strong argument for validity (Doll, 1964). The quality of face validity assessment can be improved considerably by making it more systematic. For instance, if a test maker, teacher or instructor wanted to test the ability of groups of students to shoot free throws in basketball, the test would be let the
player shoot a predetermined number of free throws and count the number of successful attempts. Certainly, this test would measure what it intended to measure. Logic tells the instructor that is a valid way to test the ability to shoot free throws. No other powerful procedure for determining validity needs to be considered (Derom, 1993). However, this type of logic contains pitfalls that demand more than a superficial examination to ensure validity (Safrit, 1962).

**Content validity:** Content validity is a type of logical validity that implies a close relationship between teaching and testing. The content of a course may be broadly defined to include content, subject matter, and objectives. Content validity involves comparing test content with behavioral objectives and may be defined as the extent to which a test measure subject matter, content and the behavioral changes under consideration. For many assessment techniques used in physical education (e.g., certain questionnaires, attitude surveys) content validity is the strongest method available. To established content validity of an instrument, a more in-depth study is made of the test to ensure the representative of the items. Content validity argues that here is a rationale for each item based on what the instrument designed to measure (Fine, 1979; Folio & Fewell, 1983).

**Concurrent validity:** Concurrent validity is concerned with the relation of test scores to an accepted contemporary criterion of performance on the variable that the test is intended to measure. Concurrent validity is calculated statistically with correlation, and the higher the coefficient the higher the validity. However, unlike predictive validity, the correlation is computed between scores on a test and criterion measures available at the time the test is given. To use this method, one must have a known valid instrument to measure the variable of interest. Both the established test and the new test are administered to the same students. The results of the two tests are then correlated. The higher correlation coefficient, the stronger the rationale is for the validity of the new test.

Concurrent validity procedures provide an estimate of the validity of the test. Few tests are perfectly valid (Halverson 1982; Harris 1984). A weakness of the previous procedures discussed is that they assume an 'either-or' stance on the validity of the test and provide no estimate-either they are valid or they are not (Harrison, 1983).
Because quantitative procedure can give an estimated degree of validity, they provide a stronger, more powerful argument for validity.

**Construct validity:** Construct validity may be defined as the extent to which performance can be interpreted in terms of certain constructs. Construct validity is another form of logical validity which, for the most part, has less specific and practical use for the class room teacher. To use this procedure, one must first locate two groups that are known to differ significantly on the variable, or construct, being tested. A test is then administered to both groups to determining if there is a significant statistical difference, between the scores in the groups. If there is no significant difference, then the test is not valid. (Gesell & Amatruda, 1949; Guyatt, 1987; Goodwin, 1986). Because extreme groups are normally used in determining construct validity; it is a best evidence of general level of validity (Honig, 1996; Hartingsveldt, 2005).

If a new test is easier to administer, less expansive, requires less equipment, or is in some way more adaptable to local needs, then there is good reason to develop and validate it (Cheatum & Hammond, 2000). For instance, a maximal oxygen uptake treadmill test has proven to be valid way to measure cardio-respiratory endurance. This type of test requires thousands of dollars equipment, several people to administer it properly, and is a time-consuming procedure. However, other tests of cardio-respiratory endurance, such as 12-minutes run, have been developed and have shown high concurrent validity to treadmill testing (Rajtmajor & Proje, 1990). Additionally, the 12-minutes run can be administered inexpensively to a large number of people in field situation.

**Predictive validity:** Predictive validity shares similarities with concurrent validity in that both are generally measured as correlations between a test and some criterion measure. For instance, we might theorize that a measure of math ability should be able to predict how well a person will do in an engineering based profession. We could give our analysis to experienced engineers and see if there is a high correlation between scores on the measure and their salaries as engineers. A high correlation would provide evidence for predictive validity. Thus predictive validity provides somewhat more useful data about test validity because it has greater fidelity to the real
situation in which the test will be used. After all, most tests are administered to find out something about future behavior.

**Reliability:** Reliability is one of the most important elements of test quality. It is defined as the degree of consistency, with which a measuring device, or reproducibility, or an examinee's performance on the test. A highly reliable test yields the same or approximately the same scores when administered twice to the same individuals, provided conditions and subjects are essentially the same. Unfortunately, the conditions of the subjects may not be the same each time. For example, if you were to administer a test with high reliability to an examinee on two occasions, you would be very likely to reach the same conclusions about the examinee's performance both times. A test with poor reliability, on the other hand, might result in very different scores for the examinee across the two test administrations.

There are several methods for computing test reliability including test-retest reliability, parallel forms reliability, decision consistency, internal consistency, split-half and inter rater reliability. For many criterion-referenced tests decision consistency is often an appropriate choice.

**Objectivity:** Objectivity means the degree of uniformity with which no disagreement occurs among competent persons in scoring any given subject while using the same test (Willgose, 1961).

**Norms:** Norms represent the achievements level of a particular group to which obtained scores can be compared. A norm is a scale that permits conversion from a raw score, to a score capable of comparisons and interpretations. For every test, the availability of current normative table is must. Normative table provide the means to compare students performance with larger representative population. These comparisons can provide valuable information to assist the test makers, teachers, researchers and the students in determining the relationship of individual performance scores. While the categorization of norms according to age, and gender is common, some normative tables further classify scores by height and weight.

There are several important factors, all of which must be taken into consideration in the development and use of norms. The important point to remember is that norms are
reflections of performance scores, and the norms are reflections of a specific group from which the norms were compiled and should be interpreted accordingly.

The normative database should be representative of the performance of the population for which it was devised. Sampling a population that is in some way unique could result in incorrect interpretation of obtained scores. For example, using performance scores of college football players to develop norms for a particular test of minimal muscular strength and endurance would result in disproportionately high norms and would not be representative of the general population. To allow for a fair interpretation of student scores, comparisons should be made with a similar population.

The geographic location of the population should be considered in devising the norms. Climate, socio-economic level, cultural influence, and other environmental conditions could certainly bias the sample (Hollingshead, 975; Kuzemski, 2000). Variation in the norms can be somewhat controlled by devising local norms (Hay, 1992).

The norms should be current and updated on a regular basis. The technological capabilities of a computer allow for frequent revision (Himes, & Dietz, 1994). Maintaining a current bank of raw scores and revising the norms on a yearly basis will take into account the ever changing characteristics and abilities of youth (Fisher, 2005).

**Discrimination:**

Discrimination refers to the ability of a test to differentiate between good, average, and poor. During selecting a test, researcher, instructor or teacher may wish to choose one that is difficult enough so that no player receives a zero (Jago, 2005). Consider the problem of players' receiving the minimum or maximum score. How would you determine who is the better player: Although two players who receive a zero on a pull-up test are both weak, they are probably not equal in shoulder strength their body weight. The AAHPERED physical fitness test battery is one such test. Each test item is designed to measure the qualities of a function, which extend along a continuum from severely deficient to high levels of functional capacity.
Independence:

Usually a single physical test is insufficient to measure the overall physical abilities or performance of the player. To obtain total profile of a player's physical skills or physical fitness requires administration of a test battery, which is composed of several tests that are individually designed to measure a specific component (Katie, 2002; Sabin, 2001). Each test should be independent and not related to other items in the battery. Having players run the 50 yard dash (45.72 meters), 100 yard dash (91.44 meters), to measuring running speed, hence highly related. Giving just one of the tests would provide all the information necessary to determine running speed performance (Mckenzie, 2002; Koutedakisy & Bouziotas, 2003).

If the measures in a test battery are unrelated, the correlation between them is low (Bala, 1981; Bala, 1999). When scores from two tests are highly correlated, they are probably measuring the same trait. The practice of using related tests to measure performance is not only time consuming, but also unfair to player who consistently core poorly on tests that measure the particular trait (Bid, 1997; Bowden, 1985). When two (or more) tests in a battery are not mutually exclusive (i.e.: they are highly correlated), retain only one that is most appropriate for the situation.

Sex Appropriateness:

Test should be constructed while taking into account the differences between males and females in such a way that the process does not bias in favor of one sex or another (Case-Smith, 1996; Dankert, 2003). While constructing test, tester should be continuously aware of the inherent differences that exist between boys and girls (Bergman, 1988; Dankert, 2003). From physiological respective, boys generally have more muscular strength and endurance, are taller and heavier, possess a lower percentage of body fat, and display greater cardiovascular endurance (Bouchard, 1997). On other hand, girls tend to have greater flexibility (Clark, 1975). Researcher, or test developers need to develop procedures for assessment and evaluation that take into account these differences in a non-discriminating way (Shumway & Woollacott, 1995; Bala & Stojanovic, 2007). Constructing tests with norms allow the teacher to compare student’s raw performance scores with those of others of the same age and gender. This type of evaluation procedure is more acceptable than having a criterion-referred scale that applies to all players regarding of sex. Differences attributed to sex
are pertinent only on measures of physical ability or functional capacity (Cooper, 1968) and need to be concern when selecting attest to measure abilities or behavior traits associated with the cognitive or affective learning domains (Cratty, 1979).

Why record information?

Well- designed scoring sheets make recording scores more efficient and avoids errors. They should include space for all relevant information. For the coach and athlete it is important to monitor the program of work, to maintain progression in terms of the volume of work and its intensity. Both coach and athlete must keep their own training records. A training diary can give an enormous amount of information about what has happened in the past and how training has gone in the past. When planning future training cycles, information of this kind is invaluable.

What factors may influence test results?

There are various factors which may have an impact on the test’s result and its reliability. The temperature, noise level and humidity of the surrounding atmosphere are very critical. The amount of sleep the athlete has before testing, the emotional states of the athlete, the medication use to take are also important to decide the nature of test result. Moreover, the time since the athlete’s last meal, the test environment, surface i.e.: track, road, grass, gym and the athlete’s prior test knowledge should be kept in consideration. Test result may be determined by the accuracy of measurements. It is important to keep watch on whatever the athlete is actually applying maximum efforts in maximal test. Inappropriate warm-up may affect the feasibility of the test. People present in the ground influence the test result. Last but not least, the personality, knowledge and skill of the tester decide the nature of the result of the test.

1.7 Historical Perspectives:

The history of test and measurement in physical education is a distinct and has occupied an important place in total education system. It has a unique area to measure and an equally rich heritage in measurement and evaluation. Knowledge of the history of measurement and evaluation will help enable us to obtain a better understanding of construction of specific physical fitness test, measurement and evaluation in physical education.
A physical fitness test is a test designed to measure physical components—agility, speed, strength and endurance. They are commonly employed in educational institutions as part of the physical education curriculum, in medicine as part of diagnostic testing, and as eligibility requirements in fields that focus on physical ability such as military or police. Throughout the 20th century, scientific evidences demonstrate the usefulness of strength training and aerobic exercise in maintaining overall health, and more agencies began to incorporate standardized fitness testing.

The origin of testing and measurement co incidents with that period of the history often cited as the beginning of formal physical condition, the mid nineteenth century. The appointment of Dr. Edward Hitch Cock in 1861, to the position of the director of the department of hygiene and physical Education at Amherst College gave academic status to the discipline of physical Education. Of more important historical significance, Dr. Hitch Cock’s work in the science of anthropometrics (body symmetry and proportion) introduced a quantifiable and objective approach to Physical Education. These pioneering efforts initiated the beginning of an era in which measurement was developed, implemented, and promoted.

During the period from 1860 to 1880, measurement techniques were most commonly used in the study of anthropometrics and the resulting longitudinal studies to develop normative data about the physical dimensions and growth patterns of youth. Dr. Dudley Sargent of Harvard devised more than 40 different anthropometric measurements. While his research was used to describe the “typical” college males and females, Sargeant went one step further in the process of using data. From obtained measurements, he prescribed a program of exercises for the individuals. Although Sargent’s efforts were reported in journals and in a manual on measurement and testing, his impact was greatest on the youth of America (Haubenstricker & Seefeldt, 1986; Haywood & Getchell, 2001). His testing system was adopted by public school, colleges, and the YMCA. There is no doubt that the use of measurement in physical education contributed to its rise to a more respected position in the overall Education scheme during the latter part of the nineteenth century (Haywood 1981., Hopkins & Prechtl, 1984).

Around 1880, the measurement in the field of physical education broadened to include more than the study of anthropometrics. The high interest in competitive
athletics and strength development to improve performance caused leaders in physical education to focus attention on capacities of performance rather than on body symmetry (Henry, 1960; Haywood, 1981). Sargent invented a battery of tests that includes items to measure the strength of the arms, legs, back, grip, and vital capacity. This test battery became known as the intercollegiate competition (Hay & Donnelly, 1996).

As the medical profession made advancement in the area of cardiac and respiratory function, physical educators started tapping newly acquired knowledge and sought methods of testing the cardiovascular efficiency of the body (Harris 1999, Hogan & Norton, 2000). Results of these studies suggested a relationship between the functional capacity of the body during movement and the efficiency of the heart and circulatory system. From its birth in the late 1800s the assessment of the cardio respiratory system has matured into one of the most vital areas associated with physical education (Johnson & Beauchamp, 1987).

In the beginning of the twentieth century, public school and colleges began to launch achievement tests into their curricula. Using tests for the purposes of assigning a grade and classifying students by skill level marked the beginning of an application practice widely used today. In the area of physical education, this period is known for its further refinement of strength testing and the onset of achievement tests. No longer was strength considered to be the prime factor in performance. Measures of muscular endurance and speed were found to be independent from strength and identified as variables that enhanced athletic performance. Test batteries that measured the endurance of various muscle groups were developed (Montoye, 1970).

The 1920s were particularly significant for the area of measurement and evaluation. New statistical techniques were developed and more precise methods to construct test became available. Reliability, validity and objectivity of tests were enhanced. The development of tests to measure motor ability and capacity flourished (Cozens, 1936; Garfield, 1923). Modern test construction continues to be modeled on what was learned during the period from 1920 to 1930.

The concept of measuring social skills was also introduced in the 1920s. Since physical education and support programs claimed to positively impact were necessary rating scales and inventories to assess social and moral attributes were developed
Jennings, 1948; Cowell, 1958; Kambas & Aggeloussis, 2006). The assessment of social qualities is often overlooked but is nevertheless a viable measurement area, important in the overall evaluation of physical education and sport programs (Kankaanranta, 1996).

World war second prompted a renewed national concern for physical fitness in colleges and public schools, physical education curricula responded to the need for physically fit citizens by shifting emphasis from a sports orientation to physical training (Cureton, 1947). Not unexpectedly, a change in the focus of measurement in physical education accompanied this existing trend toward physical fitness. New physical fitness tests were developed at a rapid rate and designed to meet the needs of nation at war, could be easily administered to large groups and scores could be quickly tabulated and interpreted (Cureton, 1947). While initially purported for the various branches of the arm forces, many items included in these test batteries have evolved into appropriate tools for today's practitioner (Kroes, 2002; Miller, 1982).

In many respects, physical education prospered during the 1970s. Enrollment in school and college programs reached all time highs. External and internal funds were available to support programs, and the demand for teachers remained high during the early part of the decade. Equipment used for measurement and evaluation became more sophisticated and reasonably priced. Physical programs seemed secure, but this was not the case for long. The dawn of the 1980s brought with it declining enrollments, budget cuts, drastic decreases in federal and state grant funds, the limitation of school college teaching positions, and a rethinking about how educational programs should be held accountable. State and local governments were under pressure to improve the quality of Education for students. Physical Education was not exempted from these eroding factors (Kirschenbaum, 1983; National, 1983).

Physical Education in the 1980 was characterized by relaxed requirements in the schools. Many districts, school began to reduce the time deployed to physical education that once was a vital part of the curriculum (Mitchell, 1979). Fewer students in the United States are taking high school physical education than during the mid 1980s. The U.S. Center for Disease Control reported that of a sample of students in grades 9-12 only 48 percent were enrolled in physical education classes during 1985 (Malina, 1986). As compared to 65 percent in 1984 (Chicago Tribune, 1991).
Not surprisingly, this trend was accompanied by a "dramatic decline in the fitness of
the nation's youth" (AAHPERD, 1990). The total enrolment of school-age youth
reached its long-predicted low in the latter part of the decade. During this period the
general public was demanding greater accountability of school boards (Malina, 1990).
Physical education programs were needed to provide quantifiable evidence of
demonstrated improvement and progress towards goals. It appears that the public
outcry for quality in education arising during the 1980s will lead us into the next
millennium (Malina, 1984).

Clearly, education programs must justify their existence with quantifiable outcomes.
No longer will be kept in consideration programs that rest only on philosophical
beliefs and professional opinion. To this end, physical educators must seek and
properly use methods and techniques to gather data to support programs. During the
past 125 years the physical education profession has taken great steps forward, and it
should be noted that many of these steps coincided with advances in research,
measurement and evaluation (Minkes, 1994). To continue the progress, physical
educators must recognize the importance of measurement and evaluation techniques
in the development of effective physical education programs.

1.8 Current trends in Test & Measurement:

It is an era of automation, sophistication, and technology. It is also an age of
explosion of knowledge. Following are some trends in test & measurement that seem
to be shaping up and are in various stages of fruition.

a) Refinement in Skill Testing:

In the history of tests and measurements, several stages from anthropometric to fitness
have been experienced. Perhaps at the present time there is a renewed emphasis on
evaluation of specific sport skills (Newborg, 1984). This is a logical approach because
education of the student in physical education generally must be done through the
psychomotor domain (Mather & Jinks, 1963). Therefore, there is a movement to
develop better skill tests. An AAHPER Committee has developed a number of new
tests and is in the process of developing others. If Franklin Henry and his colleagues
are correct in their contention that skills are highly specific to the task, more and
better skill tests are needed in the area (Newborg, 1984).
> More Testing in the Cognitive Domain:

There is a trend at present for more standardized knowledge tests in physical education. These tests will include not only rules, techniques and terminology, but also the growing body of knowledge that is developing, known as the cognitive domain (Nuemark, 2003). An AAHPER publications, “Knowledge and Understanding in Physical Education”, present this body of knowledge for elementary and secondary schools and the National testing service of Princeton, New Jersey have developed standardized tests from this material. This may not be the final answer by any means, but it does mark a beginning not a trend (Okely, 2001).

> More use of Subjective Technique:

There seems to be a growing feeling that if physical educators are to claim certain objectives, there must be an attempt to evaluate them or at least, the progress students are making toward them. Many qualitative elements exist in physical education, and these facets of the program do not lend themselves to objective type measurement. If they are to be evaluated, then the commonly recognized subjective techniques such as the rating scale and inventories must be employed. More and more use is being made of rating scales even in measurement of more objective traits. This is sometimes a matter of expediency since skill testing is time consuming. It also may be partly a reaction against some of the traditional skill tests that are cumbersome and unwieldy. There is definitely a move from the quantitative to the qualitative, but first the qualitative must be quantified (Barrow & McGee, 1979).

1) More Sophisticated Techniques:

The age of automation is an age of exactness. In physical education this trend calls for a re-evaluation of some time-honored tests that have been looked upon as classics. Many of them were designed years ago with limited knowledge and techniques (Rajat, 1993). Many of them do not provide validities and reliabilities and some that do have used questionable criteria for validation purposes and their validities are suspect. Many of them need refinement, adaptation, and updating (Rich, 1968; Reid, 1987).

2) More Practical Testing in Public School:

Testing needs to be taken from the laboratory where research people have placed it and moved to the classroom, the gym and the play field. There are signs of this being
done. Testing means statistics to some teachers and this frequently leads to mental blocks (Sallis, 2000). As per professional training courses become more proficient, all teachers will know more about the philosophy and techniques of testing and will use tests more often. Accountability will insure competence (Stuckey, 1993).

f) More diagnostic testing to determine individual needs:

Diagnosis and prognosis will become necessities and programs will have to serve many purposes. If teachers are to take advantage of the many possibilities for diagnosis of students, then purposes must be identified. The degree of refinement and sophistication of techniques will depend on these many purposes. May be physical educators are just beginning to see that testing has broader purposes than grading.

g) Continued emphasis on cardiovascular testing for fitness:

This is the age of the joggers and the running of 5 miles and more. Medical people support the idea that man must literally run for his life, and there are many training programs in colleges and universities. Clinics and cardiac rehabilitation programs are now common. Cooper of the air Force has done much too attractive the field with his Aerobics (Copper, 1968). The 5-minutes treadmill run and the 12-minutes run are now standard procedures, and emphasis is on accurate testing through use of sophisticated instruments.

h) Emphasis on perceptual- Motor Evaluation:

Much more must be learned about the field of perception and movement. Better measurement of perceptual-motor abilities is needed, whenever it is learned what these are. In addition, a better means of assessing the programs designed to improve dysfunction in this area is needed.

i) Emphasis on teacher evaluation:

Today is an era of accountability and teachers are no exception. In spite of the history of difficulties and controversy in evaluating the teacher, an effort must be made to implement such evaluation in more effective manner. College administrations are becoming tougher where tenure and promotion are concerned and, in the future, will apply the merit system in more than one respect. However, basically the overriding purpose of teacher evaluation will continue to be improvement in instruction (Annarino, 1980; Wessel & Kelly, 1986).
Greater use of proficiency tests:

There is a decided movement toward the development and use of proficiency tests. Studies show that many institutions either have some type of proficiency tests or are developing them (Salvia & Yseldyke, 1995). Such programs are of two kinds: proficiency tests for the basic instructional program and proficiency tests for the professional training program. There is no doubt that permitting some of the more competent students to pass out of the program, or at least some of it, is done for two reasons. First, it is in keeping with the practices in other disciplines which do it either or credit or advance placement. Second, it is a way to combat the explosion of the college population by permitting the most competent to be phased out of the program so that more of the time staff and facilities can be devoted to the less competent who need it more (Sattler, 1992). In generalizing about such schemes, it is the usual procedure to employ both knowledge and skills testing. Proficiency tests for teacher training programs will become a part of the competency-based teacher education Scanlan, 1988).

c) Emphasis away from general motor ability:

A number of researchers, including Franklin Henry of California and Slater- Hammel of Indiana, think that motor tasks can no longer be considered as general entities (Shirly, 1963) but rather as highly specific entities. Henry contends that each skill pattern is a stored program in man’s brain (Slaton, 1987). He calls it the ‘memory [rum theory’.

Measurement of Motivation:

One trend is concerned with motivation. It is a day when many people know what to do or what is best for them to do, but they still don’t do it. Therefore, we need to study and measure motivation. More should be known about what motivates people so when it can be identified through measurement, some use can be made of it (Spraduso, 1995; Singlleyon & Harvey, 1995). If people in a training program are to continue exercise throughout life, they will need to have some compelling reason or some type of motivation.
m) Use Criterion-Referenced Standards:

For many years norm-referenced standards have been the rule rather than the exception in evaluating the student in physical education. However, a current trend growing out of more humanistic approach to education has brought into focus a new emphasis on criterion-referenced standards. The criterion-referenced norms is related to the theory of mastery learning, where the goals of the learner are established in terms of behavioral objectives and the students performance is judged in terms of mastery of these objectives (criterion), rather than comparison with peer group performance (Pangrazi & Darst, 1991). Success is in relation to achieving the criterion, and the criterion is set so that mastery may be attained by most students. Ideally, the use of these two types of standards is not mutually exclusive since they complement and supplement to each other. Criterion-referenced standard take their place in a more humanistic from of education along with self pacing and individualized and personalized instruction (Shepherd, 1997).

Research Steps in constructing and validating physical performance tests.

If one wishes to construct a new test from beginning to end, the following list of steps is suggested:

1. Establish philosophically the traits or characteristics to be measured. Use a few experts in the field involved and more experts on test construction. Opposite to each test item list the trait tested and a popular interpretation of what is being measured (Skald, 1972).

2. Carefully prepare the testing specifications for each item (Taylor, 1999).

3. Consider the feasibility of an external validity criterion so that the validation can be done against an outside rather than the composite score on all items in the battery (internal criterion). However, correlating each test item against the total score is one validity scheme (Teeple, 1978).

4. Study the physical accuracy of the measurements including, possibly, the mechanical calibration of the instruments used (Trost, 2001).

5. Compute the mean, standard deviation, range and standard scores for each test item and criterion; also compute and construct a norms table that includes
matched standard scores from 0-100. Use the categories of excellent, very good, above average, average, below average, poor, and very poor with approximately 15 standard scores in each classification (Ulrich, 1984).

6. Compute the criterion correlation, i.e.; each item are correlated against the composite total of the standard scores (internal validity criterion) (Vandenberge, 1962).

7. Compute a prediction equation to predict the validity criterion from each of the following types of scores: (a) raw scores; (b) deviations scores; and (c) standard scores (Wilson, 2000).

Definition and Explanation of Terms

Physical Fitness:

Physical fitness comprises two related concepts:

- General Fitness: A state of health and well-being.
- Specific Fitness: A task-oriented definition based on the ability to perform specific aspects of sports or occupations.

Physical fitness is generally achieved through exercise.

In previous years, fitness was commonly defined as the capacity to carry out the day’s activities without undue fatigue. However, as automation increased leisure time, changes in lifestyles following the industrial revolution rendered this definition insufficient. These days, physical fitness is considered a measure of the body’s ability to function efficiently and effectively in work and leisure activities, to be healthy, to resist hypokinetic diseases, and to meet emergency situations.

Specific fitness:

Specific or task-oriented fitness is a person’s ability to perform in a specific activity with a reasonable efficiency: for example, sports or military service. Specific training prepares athletes to perform well in their sports.

Physical Fitness Test:

A physical fitness test is a test designed to measure physical strength, speed, agility, endurance, co-ordination, etc. Physical fitness are commonly employed in
educational institutions as part of the physical education curriculum, in medicine as part of diagnostic testing, and as eligibility requirements in fields that focus on physical ability such as military or police.

Throughout the 20th century, scientific evidence emerged demonstrating the usefulness of strength training and aerobic exercise in maintaining overall health, and more agencies began to incorporate standardized fitness testing. In the United States, the President's Council on Youth Fitness was established in 1956 as a way to encourage and monitor fitness in schoolchildren (Naneseslone, 2009).

Development and Construction of Performance Tests in Physical Education:

While selecting the tests, one thing should be kept in mind that is purpose of test. Whereas the purposes are of major concerns among other factors to be considered are the length of the test, maturity of students, testing condition and type of scoring methods used. Another thing is the test should be economical of time and money if it is to have practical value.

Test construction may be divided into several main steps as: Selecting, Limiting, Defining, Thinking, Developing, Collecting scores, Describing and Distributing, and Development of norms.

Competition evaluation:

Following competition, it is important that the coach and athlete get together as soon as possible in order to evaluate the athlete's performance. Elements to be considered are pre-race preparations, focus and performance plans and achievement of these plans. An evaluation form is useful to help the athlete and coach conduct this review. Keeping these factors in views the construction and standardization of a specific physical fitness test battery for North-zone level cricket players and setting up norms is deemed very necessary. Such a study specific fitness test for cricketers has not been reported in India. The researcher finds it necessary to take up the present study.

1.9 Statement of the Problem:-

During the last two or three decades, the field of education has been making an increasingly extensive use of objective measurements. This has not been only an
ndication of the growing trend of education toward a more scientific basis, but, one of the causes of that trend as well.

The present study has been designed as “Construction and Standardization of Specific Physical Fitness Test for Cricketers”. Based on the literature available and review, it has been suggested that no test is available in present educational scenario to measure he optimum Specific fitness abilities for north-zone level cricket players.

Goal of the study is divided into two parts:

- Primary Goal: To have a sound theoretical knowledge provided by in-depth and up-to-date review of related literature to “construct a specific physical test battery” (SPTB) for north-zone level cricketers.

- Secondary Goal: To develop norms for those who choose to utilize the proposed testing protocols in the future.

Demand to design the physical fitness test battery:

The physical efficiency battery is a fitness test consisting of five different components to measure the fitness level of the players. A specific physical fitness tests battery decide the physical ability to perform the frequent and critical job tasks demanded. Physical test battery to assess the overall abilities or performance capacities of the players. Usually a single test is inadequate to measure the overall physical abilities or performance capacities of an individual. To obtain an overall profile of a student’s physical skills, or physical fitness requires of a physical test battery (Katic, 2002; Zabin, 2001).

The AAHPERD physical fitness test battery is one such test. Each test item is planned to measure the quality of a function, which extended along a variety for severely asking to high level of function capability. (Physical education performance tests are generally more difficult than written tests and the actual time period available to physical education is usually shorter than the other academic tests. In physical education, there is a need to test content knowledge, fitness level of the players, and attitudes and approach related to physical activity. In physical education properties included in area as cognitive knowledge, components of fitness, values, and specific fitness to exact sports are subject to testing).
1.10 Objectives of the Study:

- Construction of specific physical fitness test for cricketers.
- Standardization of proposed test determining validity, reliability and objectivity.
- Development of norms for the proposed test.

1.11 Delimitation of the Study:

Every research study is limited in several ways. It has to be delimited in terms of population covered, sample selected, and scope of available studies. The following have been out-lined as delimitations.

- The study was delimited to University Level Cricket (Male) Players.
- The study was delimited to North-Zone cricket players.
- The player falling between 18 to 25 years of chronological age considered for the study.
- The study considered batsman, bowlers (fast and spinners) and fielders, from the cricket arena.
- The study involved 80% of University level Cricket players of north zone for the development of the norms.

1.12 Limitations of the Study:

- Different training schedules in the university was considered as limitation of the study.
- Time schedule for data collection would differ from place to place and the change of environment and the climate was considered as limitation.
- The efforts individual players exert during the each test will act as the limitation.

1.13 Significance of the Study:

- The findings of the study would be helpful in the evaluation of the cricketers.
- The findings of the study would be helpful in the selection of the cricketers.
• The findings of the study would be an asset to the cricketers of higher level to determine their fitness level at any point of time.

• The findings of the study would be an asset to any specialization in cricket of higher level to determine their fitness level.

• The conclusion of the study will contribute to determine the level of specific fitness by the cricketers.

• The findings of the study will enable the cricketers to determine their fitness level before, during and after the training session.

• The result of the study will contribute one to determine and compare his level of specific fitness as cricketer and his specialty as bowler or batsman or fielder.
Chapter-2

Review of Related Literature
CHAPTER II
REVIEW OF RELATED LITERATURE

Review of studies is an integral part of the research. It gives valuable insight to the investigator regarding the problem to be solved. The important objective of the reviewing literature is that it helps us in the formulation of the research topic. In addition, it is also desirable to test theory and to review the empirical research already done. The review of literature can be extremely helpful to the investigator in identifying the methods that have been successfully used to solve the particular types of problems. Valuable elements from other studies may include the characteristics of the subjects, data collection, testing procedure, statistical designs and analysis criteria. The literature in any field forms the foundation upon which all future frameworks will be built. Hence a study of relevant literature is an essential step to get detailed information, insight and a good comprehension of what has been done earlier with regard to the present problem under investigation.

In order to get a thorough knowledge about the proposed area of study, the investigator searched available research references, periodicals, encyclopedias, journals, and relevant books which deal with similar studies. While going through various sources of literature, it has been observed that no work has been done on specific physical fitness related to the game of cricket. However, sufficient work has been noted which has been carried out in the allied areas, the doctrine of “specificity”. This area is a leading step towards specific fitness. Therefore, Researcher to undertake the problem about the specific physical fitness test of cricket players, and to construct specific physical fitness test battery for them by utilizing conventional techniques of factor analysis.

The researcher had made sincere efforts to review and briefly present his/her analysis in this chapter.

Hung, Liao, Chang, Wang and Wu (2014) have studied on cardiovascular disease, the number one cause of death worldwide. Meanwhile, obesity has been recognized as a global epidemic. This study aims to examine the extent to which cardiorespiratory fitness is associated with body mass among adult males and females in Taiwan. A nationally representative data set consisting of 68,175 adults aged 18–60, including
11,743 males and 36,432 females, was used. Several multivariate regression models were used to investigate the relationship between cardiorespiratory fitness and body weight status, after controlling for adults sociodemographic status. A one-unit increase in the BMI lowered the cardiorespiratory fitness score by 0.316 and 0.368 points for adult males and females, respectively. Among adult males, compared to those of normal weight, adult males who were underweight, overweight, or obese had a lower cardiorespiratory fitness score by 1.287, 0.845, and 3.353 points, respectively. Similar results could be found in female samples. The overweight and obese adults had much lower levels of cardiorespiratory fitness as compared to their normal weight counterparts. Given the upward trend in the prevalence of overweight and obesity, it is important to help overweight and obese people to become fit and reach their healthy weight.

Kumar and Rohilla (2014) have conducted the study to compare the physical fitness components of Handball and Volleyball male players. To fulfill the objective of the study, 50 handball male players and 50 volleyball male players were selected from Delhi state who was attending national camps. The data were collected in different coaching camps. The age of the selected subjects ranged from 19 to 25 years. Standing broad jump and 600 meter run/walk test were used to measure the selected physical fitness components of the players. In order to analyze the data, t-test was used to analyze the data and investigator observed the significant different between handball and volleyball male players of their differences in selected physical fitness components tests.

Ahmad, Hussain and Ahmad (2014) have conducted a study on construction of specific physical fitness test for batsman. In the study to construct a scientifically designed to assess the specific physical fitness test battery for batsman, 16 experimental test items purported to measure Speed, Strength, Endurance, Agility, Flexibility, coordination and Balance were administered to a random sample of 30 players of North- Zone level intervarsity cricket players. The age ranged from between 18 to 25 years of age. The data collected was subjected to factor analysis (SPSS VERSION 17.0). Since factor analysis start with Pearson product moment correlation coefficient which generated four factors. Then the factor matrix was extracted to have rotated factor loadings. By considering the administrative feasibility, logistic interpretation with respect to the relevant field of application, rotated factor
loadings and communality a test battery of four test items to measure the specific physical fitness test for batsman of North-Zone level cricket players.

Panissa, Julio, Pinto-E-Silva, Andreato, Schwartz and Franchini (2014) have conducted a study to evaluate absolute and relative (%VO₂ max) oxygen uptake (total, during effort and pause), and time spent above 90% of VO₂ max during high-intensity intermittent running in subjects with different training status. Fourteen males were evaluated and divided (moderate and high aerobic power) according to their VO₂ max obtained in an incremental treadmill test to volitional exhaustion. They were then submitted to high-intensity intermittent aerobic exercise (1 min: 1 min at maximum velocity attained during the treadmill test, totalling 4 km). A Student's t test for independent data was conducted to identify differences between groups. The moderate aerobic power group spent more time above 90% VO₂ max compared to the high aerobic power group (30.2 ±9.1%; 7.3±6%, respectively, P=0.001). Moreover, the moderate aerobic power group presented lower VO₂ total (P=0.011), VO₂ effort (P=0.007), higher VO₂ total (%VO₂), VO₂ effort (P<0.001), VO₂ pause (VO₂ max %) (P=0.006) compared with the high aerobic power group. There was no difference in VO₂ pause between groups (P=0.091), the difference between VO₂ effort and pause was greater for the high aerobic power group compared with the moderate group (4.4±2.1; 7.8±2 mL.kg⁻¹.min⁻¹; P=0.009) and the difference between VO₂ effort and pause (%VO₂ max) was not different between groups. To conclude, these results demonstrated that individuals with better aerobic fitness spent less time above 90% of the VO₂ max and that this response can be due to better capacity to recover during the pause.

Farhan, Justin, Amil & Shamal (2013) have conducted the study to investigate the effect of a training program on physical performance in junior male soccer players. The twenty five players (mean age = 13.28 ± 0.45 years), were randomly assigned to either an experimental group (n=13) or a control group (n=12). The experimental group followed the warm-up training program 5 days per week for 12 weeks. The control group performed the usual warm-up training. Before, middle and after the intervention, both groups performed a battery of soccer-specific physical tests, including (1) Standing long jump test (explosive leg power), (2) Sargent jump test (vertical leg power), (3) Illinois agility test (agility), (4) Prone hold test (core stability/abdominal muscle endurance), and (5) Running speed test (speed). Data were
analyzed by Repeated Measures ANOVA for comparison between groups to evaluate he changes over time. At the end of the intervention the experimental group showed uperior changes compared to the control group for explosive leg power (12.85% vs .58%), vertical leg power (18.45% vs 3.78%), agility (-4.49% vs 0.76%), muscle endurance (98.85% vs 8.08%) and running speed (- 6.16% vs 1.11%). These findings demonstrate that the warm-up training program is an appropriate and effective tool for improving soccer-specific physical performance characteristics of junior soccer players.

Jljevic, Spasic & Sekulic (2013) have carried out the study of Sport-specific motor fitness tests, not often examined in water polo. The study was designed to examine he reliability, factorial and discriminative validity of 10 water polo specific motor-fitness tests, namely: three tests of in-water jumps (thrusts), two characteristic swimming sprints (10 and 20 metres from the water start), three ball-throws (shoots), one test of passing precision (accuracy), and a test of the dynamometric force produced while using the eggbeater kick. The sample of subjects consisted of 54 young male water polo players (15 to 17 years of age; 1.86 ± 0.07 m, and 83.1 ± 9.9 kg). All tests were applied over three testing trials. Reliability analyses included Cronbach Alpha coefficients (CA), inter-item correlations (IIR) and coefficients of he variation (CV), while an analysis of variance was used to define any systematic bias between the testing trials. All tests except the test of accuracy (precision) were found to be reliable (CA ranged from 0.83 to 0.97; IIR from 0.62 to 0.91; CV from 1% to 21%); with small and irregular biases between the testing trials. Factor analysis revealed that jumping capacities as well as throwing and sprinting capacities should be observed as a relatively independent latent dimensions among young water polo players. Discriminative validity of the applied tests is partially proven since the playing positions significantly (p < 0.05) differed in some of the applied tests, with he points being superior in their fitness capacities in comparison to their teammates.

Lockie, Callaghan & Jeffriess (2013) have studied on characteristic of cricket sprints, which may require specific assessment, is that players carry a bat when running between the wickets. This study analyzed the relationships between general nd specific cricket speed tests, which included 30 m sprint (0 to 5, 0 to 10, 0 to 30 m intervals; general); 505 change-of-direction speed test with left and right foot turns general); 17.68-m sprint without and with (WB) a cricket bat (0 to 5, 0 to 17.68 m
intervals; specific); and run-a-three (specific). Seventeen male cricketers (age = 24.4 ± 5.0 years; height = 1.84 ± 0.06 m; mass = 86.9 ± 13.9 kg) completed the tests, which were correlated (p < 0.05) to determine if they assessed different physical qualities. The subjects were also split into faster and slower groups based on the 17.68 m WB sprint time. A one-way analysis of variance ascertained between-group differences in the tests (p < 0.05). The 17.68 m WB sprint correlated with the 0 to 10 and 0 to 30 m sprint intervals (r = 0.63–0.78) but not with the 0 to 5 m interval. The run-a-three correlated with the 505 and 17.68 m WB sprint (r = 0.62–0.90) but not with the 0- to 5-m interval. Poor relationships between the 0 to 5 m interval and cricket-specific tests may be because of the bat inclusion, as the sprints with a bat began with the subject ahead of the start line, and bat placed behind it. Furthermore, although the 17.68 m WB sprint and run-a-three differentiated faster and slower subjects, the 0 to 5 m sprint interval, and left foot 505, did not. The results indicated the necessity for cricket-specific speed testing. The 17.68 m WB sprint and run-a-three are potentially valuable tests for assessing cricket-specific speed. A bat should be incorporated when testing the running between the wickets ability.

Martuscello, Nuzzo, Ashley, Campbell, Orriola & Mayer (2013) have studied to systematically review the literature on the electromyographic (EMG) activity of 3 core muscles (lumbar multifidus, transverse abdominis, quadrates lumborum) during physical fitness exercises in healthy adults. CINAHL, Cochrane Central Register of Controlled Trials, EMBASE, SPORT discus, and Web of Science databases were searched for relevant articles using a search strategy designed by the investigators. Seventeen studies enrolling 252 participants met the review's inclusion/exclusion criteria. Physical fitness exercises were partitioned into 5 major types: traditional core, core stability, ball/device, free weight, and noncore free weight. Strength of evidence was assessed and summarized for comparisons among exercise types. The major findings of this review with moderate levels of evidence indicate that lumbar multifidus EMG activity is greater during free weight exercises compared with ball/device exercises and is similar during core stability and ball/device exercises. Transverse abdominis EMG activity is similar during core stability and ball/device exercises. No studies were uncovered for quadrates lumborum EMG activity during physical fitness exercises. The available evidence suggests that strength and conditioning specialists should focus on implementing multi joint free weight
exercises, rather than core-specific exercises, to adequately train the core muscles in their athletes and clients.

Mendez & Buchheit (2013) has generated an interesting debate on the real-world utility of fitness testing in professional association football (soccer). In the present authors’ opinion, this exchange could also have been placed more in the context of the physical testing and subsequent benchmark profiling of the youth player within elite academy talent identification and development processes. This point is further strengthened by the current media debate at the time of writing on the development of elite youth football players in England and the Elite Player Performance Plan or EPPP. The Premier League. (2011). Elite Player Performance Plan. London: Author, published by the English Premier League as part of a vision for the future development of youth football in the League and throughout the English professional game. The EPPP recommends the implementation of a national database to enable comparison of Academy player performances against national physical testing “benchmark” profiles. In continuing the above debate, this letter questions the real-world utility and potential pitfalls of nationwide athletic benchmark profiling programmes for elite youth football.

Chittibabu (2013) has conducted study is to assess the effect of handball specific repeated sprint training on aerobic capacity of male handball players. To achieve the purpose of the study thirty male handball players were selected randomly from Department of Physical Education and Sports Sciences, Annamalai University, Chidambaram, Tamilnadu. The selected subjects were assigned into 2 groups: handball specific repeated sprint training group (n=15) and control group (n=15). The selected subjects mean age: 23.15±3.00 years; weight: 68.74±7.25 kg and height: 176.37±7.67 cm. The criterion variable selected in this study was aerobic capacity which was measured by multistage fitness test. The handball specific repeated sprint training group underwent eight weeks of training. Pre and post aerobic capacity was measured on the indoor. The data was analysed using Analysis of co-variance (ANCOVA). The result of the study showed post test (F = 20.13) and adjusted post test mean (F = 10.68) showed significant (p < 0.05) difference among repeated sprint training group and control group on aerobic capacity. It is concluded that handball specific repeated sprint training for eight weeks is more effective in increasing aerobic
capacity of men handball players. The training load adopted in repeated – sprint training which resulted in 11.79% of changes in aerobic capacity.

Coe, Pivarnik, Womack, Reeves & Malina (2012) have studied to determine the association between health-related fitness (HRF) and academic achievement in middle school youth. Subjects were 312 middle school students. HRF was assessed using the FITNESSGRAM test battery. Students were grouped by the number of fitness tests in which they performed within the Healthy Fitness Zone, ranging from <1 test (lowest fitness) to all 5 tests (highest fitness). Academic achievement was assessed using grades (A - F) from four core classes, which were converted to interval data (A=5, F=1) and summed over the academic year and a standardized test (percentile). Maturity offset was calculated to control for the possible effect of maturity status on the association between HRF and academic achievement. Differences in academic achievement among HRF groups were determined using ANOVA. Grades and standardized test percentiles were higher in HRF group 5 (P<0.01) compared to HRF groups <2, 3, and 4. Cardiorespiratory endurance and muscular strength and endurance were the HRF components most strongly associated with academic achievement. HRF was related to academic achievement in youth. Students with the highest fitness level performed better on standardized tests and students with the lowest fitness level performed lower in class grades.

Kimura, MiZuta, Yamada, Okayama & Nakamura (2012) study was conducted to developed an index of physical fitness age (fitness age score, FAS) for older Japanese adults and investigated sex differences based on the estimated FAS. Healthy elderly adults (52 men, 70 women) who underwent physical fitness tests once yearly for 7 years between 2002 and 2008 were included in this study. The age of the participants at the beginning of this study ranged from 60.0 to 83.0 years. The physical fitness tests consisted of 13 items to measure balance, agility, flexibility, muscle strength, and endurance. Three criteria were used to evaluate fitness markers of aging: (1) significant cross-sectional correlation with age; (2) significant longitudinal change with age consistent with the cross-sectional correlation; and (3) significant stability of individual differences. We developed an equation to assess individual FAS values using the first principal component derived from principal component analysis. Five candidate fitness markers of aging (10-m walking time, functional reach, one leg stand with eyes open, vertical jump and grip strength) were
selected from the 13 physical fitness tests. Individual FAS was predicted from these
five fitness markers using a principal component model. Individual FAS showed high
longitudinal stability for age-related changes. This investigation of the longitudinal
changes of individual FAS revealed that women had relatively lower physical fitness
compared with men, but their rate of physical fitness aging was slower than that of
men.

Jrid, Trivicand and Tabakov (2012) have conducted a study on judo, which has
been characterized as a high-intensity intermittent combat sport, consisting of many
different techniques and actions employed during a match. In judo, diagnostics is
performed to gain information in talent identification and selection, to define athlete’s
current fitness condition, and to monitor training effects. This to provide an overview
of a specific test that is commonly used in judo to evaluate judo-specific performance.
Pub med and Web of Science were screened (last search on October 1st 2012) using
the following keywords: (Special Judo Fitness Test) and (SJFT). For this purpose,
articles, titles and abstracts were screened for relevance. The SJFT showed reliability
with a low measurement error, applicability and sensitivity for training monitoring
even with high level (elite) judokas. Furthermore, this test identified differences
between judokas of various fitness levels, and highly correlated to well-controlled
aboratory tests; it was also relevant to attacks during a judo match. As a result of the
material collected and presented here, the SJFT was considered as an adequate and
comprehensive testing tool in all levels of judo practitioners as well as in athletes
doing sports similar to judo.

Toriola & Monyekim (2012) have conducted a study of physical inactivity (PI) is
found to be a major contributor to the high incidence of overweight and obesity
among children and adolescents. As such, PI was significantly related to risk factors
of cardiovascular disease. Studies especially in the 14-years in adolescents learners
are sparse. The purpose of this study was to determine the health-related physical
fitness (HRPF), body composition and physical activity (PA) status among adolescent
learners. A total of 283 adolescents learners (111 boys and 172 girls) with mean age
of 14.90±0.72 years from the Physical Activity and Health Longitudinal Study
(PAHLS) were participants in the study. Body composition according to the standard
procedures of the International Society for the Advancement of Kinanthropometry
(ISAK), HRPF using the Eurofit protocol test and PA levels using the International
Physical Activity Questionnaire (IPAQ) were assessed and administered. Subsequently, total PA scores were calculated. The results show that on average, the boys (165.41±9.55cm) were significantly taller than the girls (157.88±6.94cm) (p<0.000). Girls had a slightly higher significant BMI (21.43±4.37 kg/m²) than the boys (20.01±3.71kg/m²) (p=0.002). When the learners were categorised based on their BMI scores, the girls were more overweight (32.4%) compared to the boys (17.1%). Additionally, the girls (%body fat 26.01±8.51) were substantially (p<0.000) fatter than the boys (13.19±8.56). Furthermore, the results also indicated that the boys had consistently better performances in all the HRPF tests than the girls (p<0.000). More girls (19%) than boys (16%) watched TV for more than 3 hours daily. A total of 85 (30%), 78(27.5%) and 88(31.1%) of the adolescent students had low, moderate and high PA involvement. It was concluded that girls were more overweight and less active than boys. In view of the health implications of the findings, there is a need to create enabling environment and opportunities that will promote physically active lifestyle and develop life-long positive attitudes towards PA among the learners. Community-based strategies designed to facilitate effective and sustainable PA intervention programmes in schools are recommended.

Cepulenas, Bruzas, Mockus & Subacius (2011) have studied on the indices of boxers’ athletic and special fitness are important structural components of sports fitness as they influence the acquisition of the sports form. Thus, it is relevant to study the changes in the indices of boxers’ athletic fitness, special physical fitness and working capacity after the physical training meso cycle. The research participants were 10 elite boxers, candidates to the Lithuanian national boxing team, participants and prize winners at the Lithuanian boxing championships. Their mean age was 22.50±3.38 years. The physical training mesocycle lasted for four weeks in the preparation period. Special physical fitness and specific working capacity of boxers were tested using special diagnostic equipment “Kiktest-100” which consists of a standard boxing bag with a special device inside – dynamometer and a sensing element registering the impulses of blows; computer block registering the force of blows (kg), the number of blows, intervals between the blows, summative force of blows (kg) in a unit of time, and energy outlay (J). After the physical training meso cycle the indices of boxers explosive strength, speed strength and quickness improved. The single blow force to the boxing bag improved as well. After the
physical training meso cycle, the force of single blows of boxers with their main and front hand and the force of the straight blow with their main hand improved to 253.37±31.09 kg, the side blow to 297.00±45.07 kg, and the low blow to 303.62±42.18 kg. The average single blow power hitting the boxing bag 3×3 min increased from 76.72±29.71 kg to 82.54±33.41 kg. Four-week physical training meso cycle, consisting of 40% of athletic training and 60% of special physical training, had a positive effect on the changes in indices of boxers athletic fitness. There was an improvement observed in the indices of boxers athletic fitness performing explosive strength, speed strength and speed exercises. The force of blows hitting the boxing bag with the main and front hand increased as well. There was an increase in the indices of special anaerobic working capacity: number of blows, summative forces of blows, and energy out lay hitting the boxing bag for 3 s, 5 s, and 8 s.

Yadav, Dudhale & Yadav (2011) the study was to construct Jump Shot Test in Handball. One hundred male handball players from South-West Zone and North-East Zone Universities (four University teams from each Zone) who qualified for the All India Inter Zonal Varsity Handball Tournament held at Banaras Hindu University, Varanasi, Uttar Pradesh from 25th to 29th October 2002, were selected to serve as subjects for this study. The criterion measure was the average of the playing ability scores of the handball players assigned independently by three handball experts. It was concluded that the newly developed Jump Shot Test in handball within the limitations of the study, it was concluded that the jump shot test showed highly significant relationship with handball playing ability and the newly developed jump shot test in handball meet the criterion of scientific authenticity i.e. the test was reliable, objective and valid.

Baker, Cote and Abernethy (2010) have studied on the role of sport-specific practice in the development of decision-making expertise in the sports of field hockey, netball, and basketball was examined. Fifteen expert decision-makers and 13 experienced non-expert athletes provided detailed information about the quantity and type of sport-specific and other related practice activities they had undertaken throughout their careers. Experts accumulated more hours of sport-specific practice from the age of 12 years onwards than did non-experts, spending on average some 13 years and 4,000 hours on concentrated sport-specific practice before reaching international standard. A significant negative correlation existed between the number
of additional activities undertaken and the hours of sport-specific training required before attaining expertise, suggesting a functional role for activities other than sport-specific training in the development of expert decision-making.

Anderson & Ward (2010) have studied on a classification system for youth sports that is maturation-based, using the anthropometric prediction of vertical jump impulse potential. Impulse was calculated for children between 8.0 and 17.9 years of age from vertical jump height \( I = m \times (2 \, gh)^{0.5} \) in a truncated version of the Coquitlam Growth Study database. A series of stepwise regressions was performed for each gender, predicting impulse scores from 32 anthropometric variables, height, body mass, and chronological age. Equations were developed that accounted for differences in muscle tissue development while utilizing variables easily measured in both males and females, including age, and measures of height, forearm girth, and calf girth. Using restricted ranges of impulse scores, males and females can be classed into appropriate groups for competition and sport, competing together through the age of 13. Beyond the age of 14, females have a similar capacity to generate impulse and could compete in one group, while restricted impulse categories would be useful for males until the age of 18 years.

Niebuhr, Scott, Powers, Li, Han & Krauss (2008) have assesses the recruit motivation and strength study- preaccession physical fitness assessment predicts early attrition. The study was designed to pilot-test the use of a physical fitness screening tool for Army applicants before basic training. The ARMS test consists of two components, namely, a 5-minute step test and push-ups. Attrition among 7,612 recruits who underwent preaccession ARMS testing and began service between May 2004 and December 2005 was studied. ARMS test performance was found to be significantly related to risk of attrition within 180 days; the hazard ratios for failing relative to passing the ARMS test were 2.27 (95% confidence interval, 1.70-3.04) among female subjects and 1.36 (95% confidence interval, 1.13-1.64) among male subjects. The attributable risk of attrition associated with failing the ARMS test was 40% among female subjects and 30% among male subjects. The ARMS study is the first prospective study conducted in the U.S. Army to assess physical fitness before accession. Physical fitness and motivation to serve were shown to correlate with attrition during initial entry training.
Harris and Cale (2007) have studied children's fitness testing. The study aimed to determine whether it was necessary, cost effective and practical to investigate Welsh children's fitness levels in order to promote active, healthy lifestyles. A multi-method study comprising a comprehensive review of literature, a questionnaire survey and interviews was used. This was a feasibility study commissioned by the National Assembly for Wales undertaken between October 2003 and March 2004. The methodology involved a world-wide literature search carried out using metalib and in consultation with UK experts and stakeholders in Wales via a questionnaire (n = 35) and individual interviews (n = 5). The response rate for the questionnaire survey was 36.4 per cent. The study indicated concern amongst experts and stakeholders about Welsh children's health, fitness and activity, but also revealed a number of misconceptions about children's fitness and fitness testing. The study highlighted that the measurement of children's fitness is fraught with difficulties, including methodological limitations, the possible negative impact on some children, and the relatively weak association between children's physical fitness and health. Additionally, utilizing children's fitness test data to inform policy and practice was considered problematic by the experts and stakeholders, and there was limited evidence from the literature that previously conducted large scale surveys on children's fitness have positively impacted on children's health, activity and fitness. It was concluded that a research project focusing solely on fitness testing Welsh children is neither necessary, cost effective nor practical. However, a lifestyle oriented project including the monitoring of physical activity was recommended as increasing activity levels is achievable for all and the process will lead to health gains.

Gabbett, Kelly and Pezet (2007) have established relationship between physical fitness and playing ability in rugby league players. The study investigated the physiological, anthropometric, and skill characteristics of rugby league players and determined the relationship between physical fitness and playing ability in these athletes. Eighty-six rugby league players (mean ± SD age, 22.5 ± 4.9 years) underwent measurements of standard anthropometry (height, body mass, and sum of 4 skin folds), muscular power (vertical jump), speed (10, 20 and 40m sprint), agility (run), and estimated maximal aerobic power (multistage fitness test). In addition, 2 expert coaches independently assessed the playing ability of players using standardized skill criteria. First-grade players had significantly greater ($p < 0.05$)
basic passing and ball-carrying ability and superior skills under fatigue, tackling and defensive skills, and evasion skills (i.e., ability to beat a player and 2 verse 1 skills) than second-grade and third-grade players. While no significant ($p > 0.05$) differences were detected among playing levels for body mass, skin fold thickness, height, 10, 20, or 40m speed, agility, vertical jump height, or estimated maximal aerobic power, all the physiological and anthropometric characteristics were significantly ($p < 0.05$) associated with at least 1 measure of playing ability. The results of this study demonstrate that selected skill characteristics but not physiological or anthropometric characteristics discriminate between successful and less successful rugby league players. However, all physiological and anthropometric characteristics were related to playing ability. These findings suggest that while physiological and anthropometric characteristics do not discriminate between successful and less successful rugby league players, a high level of physical fitness contributes to effective playing ability in these athletes. A game-specific training program that incorporates both physical conditioning and skills training may facilitate a greater transfer of physical fitness to competitive performances in rugby league.

**Plotz and Spamer (2006)** have studies on comparison of talented South African and English youth rugby players (18-year old) with reference to game-specific-, anthropometric and physical and motor variables. Three groups of elite rugby players were selected from the two countries and were tested on 13 anthropometric, six physical and motor and eight game-specific tests. The results showed that there were no big differences as far as anthropometric variables are concerned. The English players, however, significantly demonstrated the worst results in all the physical and motor abilities while the South African players performed the best in game-specific skills due to possible better coaching.

**Girard, Chevalier, Leveque, Micallef and Millet (2006)** have studied Specific incremental field test for aerobic fitness in tennis. Nine junior competitive tennis players randomly performed two incremental protocols to exhaustion: a treadmill test (TT) and a tennis specific fitness test (FT). The FT consisted of repeated displacements replicating the game of tennis at increasing speed on a court. In both tests, ventilatory variables and heart rate (HR) were determined at the ventilatory threshold (VT), respiratory compensation point (RCP), and maximal loads (max). Blood lactate concentration was determined at the point of volitional fatigue.
Percentage (mean (SD) maximal HR (83.6 (5.1) v 83.0 (2.8) and 92.1 (2.1) v 92.3 (2.1)% respectively) and percentage and maximal oxygen uptake (VO2max): (69.4 (8.1) v 73.5 (6.1) and 84.4 (6.5) v 85.5 (8.7)%, respectively) at the VT and RCP were not different between the FT and TT subjects, whereas VO2max was higher in the FT than in the TT (63.8 (3.0) v 58.9 (5.3) ml/min/kg; p<0.05). Blood lactate concentration (10.7 (3.0) v 10.6 (4.3) mmol/l) did not differ between the TT and FT. Although cardiorespiratory variables were not different at submaximal intensities between the two tests, VO2max values derived from laboratory measurements were underestimated. Using field testing in addition to treadmill testing provides a better measurement of a player’s individual fitness level and may be routinely used to accurately prescribe appropriate aerobic exercise training.

Vanheesa, Lefevreb, Philippaertsc, Martens, Huygensch, Troosters and Beunen (2005) have studies on regular aerobic physical activity (PA) increases exercise capacity and physical fitness (PF), which can lead to many health benefits. Accurate quantification of PA and PF becomes essential in terms of health outcome and effectiveness of intervention programmes. In this manuscript a review was presented regarding the assessment of physical activity and fitness. Three types of PA assessment methods can be distinguished: Criterion methods like doubly labelled water, indirect calorimetry and direct observation are the most reliable and valid measurements against which all other PA assessments methods should be validated, but they also hold important drawbacks. Objective PA assessment methods include activity monitors (pedometers and accelerometers) and heart rate monitoring. Finally, questionnaires and activity diaries are considered subjective methods. For the assessment of PF, we distinguish field tests and laboratory tests. The Eurofit for Adults is a test battery that is designed to assess health-related fitness of individuals, communities, sub-populations and populations. It is mainly used for evaluating the morphological component, the muscular component, the motor component and the cardio-respiratory component. In the laboratory, exercise capacity is preferentially assessed through maximal incremental exercise testing. Cardio-pulmonary exercise testing is a well-established procedure that provides a wealth of clinically diagnostic and prognostic information. The peak oxygen uptake is the gold standard in the assessment of exercise tolerance. When maximal exercise is contraindicated or not achievable, the VAT or the submaximal slopes provide reasonable alternatives.
Lidor, Falk, Arnon, Cohen, Segal and Lander (2005) have studies on to identify motor, physical, and skill variables that could provide coaches with relevant information in the selection process of young team handball players. In total, 405 players (12–13 years of age at the beginning of the testing period) were recommended by their coaches to undergo a battery of tests prior to selection to the Junior National Team. This number is the sum of all players participating in the different phases of the program. However, not all of them took part in each testing phase. The battery included physical measurements (height and weight), a 4 × 10-m running test, explosive power tests (medicine ball throw and standing long jump), speed tests (a 20-m sprint from a standing position and a 20-m sprint with a flying start), and a slalom dribbling test. Comparisons between those players eventually selected to the Junior National Team 2–3 years later with those not selected demonstrated that only the skill test served as a good indicator. In all other measurements, a wide overlap could be seen between the results of the selected and non selected players. It is suggested that future studies investigate the usefulness of tests reflecting more specific physical ability and cognitive characteristics.

Bowles, Fitz Gerald, Morrow, Jackson and Blair (2004) have constructed validity of self-reported historical physical activity. The purpose of the study was to determine the construct-related validity of self-reported historical walking, running, and jogging (WRJ) activity on the basis of data from the Acrobics Center Longitudinal Study (Dallas, Texas). A total of 4,100 men and 963 women underwent at least one medical examination between 1976 and 1985 and completed a follow-up questionnaire in 1986. Levels of glucose, cholesterol, and triglycerides, resting systolic blood pressure, body mass index (weight (kg)/height² (m)), and cardio-respiratory fitness were measured at the time of the medical examination. The follow-up questionnaire assessed WRJ and other strenuous activities for each year from 1976 through 1985. Data analysis included spearman and partial correlations, analysis of variance, analysis of covariance, and t tests. Results indicated significant correlations between recalled WRJ and treadmill times for each year throughout the 10-year period \( r = 0.40–0.61 \). Participants were classified as historically either sufficiently physically active to receive a health benefit or insufficiently active for a health benefit. Engaging in sufficient levels of historical WRJ was associated with higher treadmill times and lower body mass indices for men and women, and lower triglyceride levels for men.
Self-reported historical WRJ can be assessed with reasonable validity in comparison with measured treadmill performance, with no decay in accuracy of reporting for up to 10 years in the past.

Boddington, Lambert and Waldeck (2004) have studied validity of a 5-Meter multiple shuttle run test for assessing fitness of Women field hockey players. The aim of the study was to establish validity of a 5-m multiple shuttle test (5-m MST) using indirect (criterion and construct) and direct measures of performance. For criterion validity, comparisons were made between data from established fitness tests and a 5-m MST. Construct validity was determined by comparing results from a 5-m MST with subjects of different playing abilities. Direct validity was determined by comparing values attained from a 5-m MST with data from a time-motion study of field hockey. For criterion validity, the strongest relationship existed between the 20-m MST (42.7 ± 7.1 ml·kg⁻¹·min⁻¹) and total distance from the 5-m MST (650.9 ± 59.2 m; r = 0.92). For construct validity, regional representative players covered more distance than club-level players (689.9 ± 46.6 m vs. 661.1 ± 31.0 m; p < 0.01). For direct validity, the highest correlation was found between total distance from the 5-m MST (706.0 ± 37.5 m) and mean displacement during matches (61.0 ± 6.0 m; r = 0.74). It was concluded that the 5-m MST had both indirect and direct validity for the fitness assessment of field hockey players. The data obtained from the 5-m MST directly relates to the physical fitness of the players during competition.

Asc (2003) has studied the effects of physical fitness training on trait anxiety and physical self-concept of female university students. To investigate the effects of participation in a physical fitness programme on anxiety and physical self-concept of female university students in Turkey 40 female university students volunteered to participate in the study and were randomly assigned to experimental (n=20; M_age=21.35±0.88) or control (n=20; M_age=21.20±1.67) groups. The experimental group participated in one aerobic and two step dance sessions per week for ten weeks at 60-80% of heart rate reserve. During this period, the control group did not participate in any regular physical activity programme. The State-Trait Anxiety Scale (STAI) and Physical Self-Description Questionnaire (PSDQ) were administered to participants before, in the middle, and after the ten week treatment. Participants in the experimental group improved more in physical activity, coordination, sport competence and flexibility subscales of physical self-concept than the control group.
In addition, there was a significant reduction in trait anxiety scores of participants in the experimental group in comparison to the control group. A ten-week physical fitness programme was effective in reducing trait anxiety and strengthening the physical self-perceptions of female university students.

Cheng, Macera, Addy, Sy, Wieland and Blair (2003) have studied the effects of physical activity on exercise tests and respiratory function. To explore the role of physical activity in maintaining cardiac and respiratory function in healthy people. Cardio-respiratory fitness was measured by a maximal treadmill test (MTT), and respiratory function was tested by spirometre. The cross-sectional study included data from 24 536 healthy persons who were examined at the Cooper Clinic between 1971 and 1995; the longitudinal study included data from 5707 healthy persons who had an initial visit between 1971 and 1995 and a subsequent visit during the next five years. All participants were aged 25–55 years and completed a cardio-respiratory test and a medical questionnaire. In the cross-sectional study; after controlling for covariates, being active and not being a recent smoker were associated with better cardio-respiratory fitness and respiratory function in both men and women. In the follow up study, persons who remained or became active had better MTT than persons who remained or became sedentary. Men who remained active had higher forced expiratory volume in one second (FEV<sub>1</sub>) and forced vital capacity (FVC) than the other groups. Smoking was related to lower cardio-respiratory fitness and respiratory function. Physical activity and non-smoking or smoking cessation is associated with maintenance of cardio-respiratory fitness. Change in physical activity habits is associated with change in cardio-respiratory fitness, but respiratory function contributed little to this association during a five year follow up.

Wangwad (2001) developed norms for selection of junior volleyball player of Maharashtra state. The purpose of the study was (1) to assess and evaluate the morphological variables (i.e. height and weight), physical fitness (i.e. speed, leg power and agility), and skills of volleyball and (2) to establish a standardized norms for selection of junior volleyball team of state level. The male volleyball players (n=272) below the age of 18 years participated in Maharashtra state volleyball championship in 1998 were the subjects of this doctoral study. This ensures that 100% population was covered in this study. Standard procedure was followed to conduct test items for the collection of data. Standing body height (cm), body weight (kg),
100m dash (speed), 4x10m shuttle run (agility), jump and reach (leg power), and volleyball skills (i.e. underhand pass, upper hand pass, serving, reception and service, for spike and smash) were measured by using standard tests. The selection criteria developed and standardized in this investigation is a reliable and valid test that can effectively assess the efficiency of volleyball players to get entry in state level junior volleyball team. The norms of the selection criteria were easy to grade that can discriminate talented volleyball players with optimum accuracy so as to constitute a standard junior volleyball team.

Sir, Newton, Curtis, Fardell and Butler (2001) have studies on 146 professional rugby league football players, contracted to 2 teams competing in England (n = 45) and Australia (n = 101). All players completed the following series of physical fitness performance tests: 1 repetition maximum squat and bench press, 15- and 40-m sprint, agility run, 5-minute run for distance, 60-second sit-up, 30-second plyometric push-ups, and measurement of body weight and subcutaneous skin fold (4 sites). Analysis of variance with a criterion α level of $p < 0.05$ was used to determine if any significant differences could be found when grouping players into 3 different positional categories specifically identified in the sport. There were a number of significant differences with respect to test results between categories, and this was apparent for all 3 systems of categorization. On the basis of these findings, it was recommend that to more efficiently structure the physical fitness training of players, the players should be grouped either according to the 2 broad positional categories of forwards or backs or according to the 4 categories of forwards, distributors, adjustable, and outside backs. Grouping players according to the 9 specific positions played on the team is not warranted.

Inniss and Short (2000) have published a book as The Brockport Physical Fitness Test Manual: A Health Related Test for Youths with Physical and Mental Disabilities. A total of 1,542 youngsters with and without disabilities were tested and data from several projects including thousands of youngsters were analyzed for a variety of purposes as a part of test construction. As a result of the methods and procedures applied in the study, a personalized health-related physical fitness test entitled the Brockport Physical Fitness Test (BPFT) was developed. In addition a training manual signed to enhance health-related fitness, a videotape providing a background on alth related and description of the test items, and a computer software program to
select test items, and print out results, goals, and fitness needs for individuals and groups of students was developed. The computer software package also includes a technical manual which provides the scientific basis for the test. This presentation is designed to present an overview of the BPFT and demonstrate materials associated with it.

Dey and Debray (1998) studied on talent identification in sports of eastern and northeast region of India. The present study was conducted on Eastern (ER) and Northeast (NER) region children to see the variations of these norms with the Indian norms, which are being used for talent identification throughout the country. In the present investigation percentile norms of various anthropometric and motor quality variables were made from the sample of children of ER and NER of India. These norms were compared with the existing national norms for Indian children sports performance of the children of ER and NER in the national context. The percentile norms thus formed for ER and NER children are of great importance particular in talent spotting in these regions. It was observed that ER children are relatively more talented than their NER counter parts. The children of NER may reveal better scores in the specific skill test exploiting their mesomorphic qualities. Present finding indicated that the national norms are relatively higher after 8 years and onwards for the children of both the regions.

Kumar (1998) the main purpose of this study was to evolve physical fitness norms on various items of Fleishman’s fitness battery for high and higher secondary school boys and also to evaluate the physical fitness level of the secondary school male students of Himachal Pradesh. To accomplish the study 3,840 students of urban and rural area were randomly selected between the age group of 13 to 16 years. The results have shown that there was a significant difference from fifteen years to sixteen years male subjects of Himachal Pradesh in almost all fitness components. The boys of 16 years age were found significantly superior than 15 years to 13 year boys. The fifteen year boys were better than 14 and 13 years boys. Similarly 14 years boys were superior then 13 year boys in all the components of Fleishman’s test battery. The result of the study have also shown that the male subjects of rural areas were significantly superior than urban subjects in six of ten fitness components of Fleishman’s test battery.
**Anayanwa (1997)** attempted to establish physical fitness norms for Nigerian boys and girls in the age group between 11 to 18 years. The study included the following test items. Shuttle run, push-ups for boys, pull-ups for boys, chair push-ups for girls, flexed knee sit ups, 45 meter dash, standing long jump, and flexed arms hang for girls. The results of the study revealed that the high correlations were obtained on the test re-test method. The objectives of the test items were considered. The activities can be accepted as true test items for the component of physical fitness, which they support to measure. In most of the test items the performance of the boys improved from the lower to upper age level. The boys performed better than girls in all the test activities. The mean score revalued that the girls of lower age level tend to possess better physical fitness status than the girls of the upper levels.

**Booth, Macaskill, McLellan, Phongsavan and Okely (1997)** have studied methods of the NSW schools fitness and physical activity survey. Participation in physical activity, fundamental motor skills and body composition are important contributors to the health and the development of a healthy lifestyle among children and youth. The New South Wales Schools Fitness and Physical Activity Survey, 1997, were conducted to fill some of the gaps in knowledge of these aspects of the lives of young people in New South Wales. The survey was conducted in February and March, 1997 and collected data on a randomly-selected sample of students *(n=5518)* in the age group 2, 4, 6, 8 and 10. Measures were taken on body composition (height and weight, waist and hip girths, Skin fold), health-related fitness (aerobic capacity, muscular strength, muscular endurance, flexibility), fundamental motor skills (run, vertical jump, catch, overhand throw, forehand strike and kick), self-reported physical activity, time spent in sedentary recreation, and physical education (PE) classes. The methods were described to assist in the development of surveys of other populations and to provoke debate relevant to the development and dissemination of standard approaches to monitoring the fitness, physical activity habits and body composition of Australian children and youth.

**Bravo, Pierre, Pierre, Daniel, Gaulin, Dubois and Peloguin (1994)** worked on the Functional fitness assessment battery: reliability and validity data for elderly women for patients with Alzheimer's disease: the TEMP-AD protocol. The study examined the test-retest reliability of each item in the battery and tested the validity of the cardio-respiratory endurance item. Reliability and validity data were obtained from
two convenience samples. The 29 subjects in the reliability study were community-living women enrolled in seniors' exercise classes. The validity of the cardio-respiratory endurance item was tested by comparing it with maximal work capacity on a treadmill test. The 52 women in that part of the study were all participants in a study to assess the effect of weight-bearing exercises on women with low bone mass. Both samples were combined for a principal component analysis. Low reproducibility was observed for coordination (0.54) and strength/endurance (0.56). After slightly modifying the test protocol for these two items, reproducibility reached 84 and 94%, respectively. The correlation between the cardio-respiratory endurance score and maximal work capacity was -0.65, while that between the composite score and maximal work capacity was -0.64. Given these minor modifications, then, the Functional Fitness Assessment battery is a reliable and valid tool for the assessment of fitness in elderly women.

Pillai (1991) conducted a study on computation of norms for 12-minute run and walk among schoolboys. He described that the cardio-vascular endurance is one of the basic and important components of physical fitness, a state level norm will be useful for boys to understand their present status compared with other boys of the same age, for the teacher and coach either to understand or to prescribe a programme to improve the student ability and to compare it with other states. Since 15,000 subjects are involved in the study, 12-minutes walk test has been considered as the more appropriate test for assessing cardiovascular endurance. Twenty districts except the Nilgris district was short listed for this study. Data collected from 250 subjects in each age category of 13, 14 and 15 years school boys. Tests were conducted on 12-minutes run/walk and the distance covered the nearest 50th meter were recorded as their performance. Two-way analysis of variance was applied to find out whether there was any significant difference between the district and age group in 12-minutes run/walk performance. It was found that significant difference was noticed only among different age groups. Hence, norms were constructed throughout the state for different age groups by using Hull scale.

Kaur (1989) has developed the physical fitness test norms for the high school girls of Punjab state belonging to the age group of 12 to 15 years. The subjects were selected from the various urban and rural schools of Punjab. Sample consisted of four thousand students by using Fleishman's test battery. In this study she conducted the
lower performance level of rural students in most of the physical fitness variables as compared to their urban counter-parts. The percentile norms for physical fitness test and were valid and suitable to judge the physical fitness level of the school girls. She observed that and the subjects belonging to urban residence were significantly superior to rural subject in terms of dynamic flexibility, arm and shoulder strength and trunk strength variables. But, the results were not found to be significant between the urban and rural girls against flexibility, speed of change of direction, endurance level of arms and shoulders, co-ordinate agility, cardiovascular endurance and speed of running. The four age steps were found significantly different from each other against most of the physical fitness variables, while there were no significant differences in some variables between some age steps.

Singh (1988) undertook a normative study of the Physical Fitness of Male Teenagers of the State of J & K in the ages 13 through 19 years. The variables of the study were pull-ups to measure arm and shoulder girdle strength, bent knee sit-ups to measure abdominal strength, standing broad jump to measure explosive strength, 50 meters dash to measure speed, shuttle run to measure agility and 600 meters run walk for cardio-vascular endurance. From the above research he concluded that the subjects belonging to age group 16 through 19 years showed better performances in all variables over the other age group of 13 through 15 years.

Singh (1986) has conducted a normative study of physical fitness of Punjab university men students. He applied Fleishman's test battery on four thousand male students belonging to the various colleges affiliated to Punjab University to collect the data. The students ranged between 17 to 22 years of age. He found linearity of physical fitness status according to age. The students of rural areas were significantly superior in all the test items than urban students. He developed percentile norms and established their reliability, subjective and validity.

Singh (1986) has conducted a study to develop physical fitness norms of Punjab state high school boys. He randomly selected five thousand school boys of Punjab state. The sample included rural and urban subjects in equal number for the collection of data. He included following test items (1) standing broad jump, (2) sit and reach test, (3) agility run, (4) sit-up bent knee, (5) 50 meter dash, (6) push-ups(chair), (7) cricket ball throw, and (8) 600-meter run walk. He observed significant difference in number
of test items between urban and rural school boys. Significant difference between age and performance of the subjects was also observed. The test items were standardized through the development of percentile norms which was found to be suitable to access the physical fitness of Punjab state high school boys ranging between 12 to 15 years of age.

Yadav (1986) has conducted a study on standardization of physical fitness test norms of the school children of Haryana (13 to 16 years of age) with the purpose of estimating the fitness level, establishing the norms for physical fitness and comparing the standard of physical fitness of urban and rural boys of Haryana. The study recruited 3600 school boys studying in class twelve of Haryana districts were randomly selected and the performance of the boys was recorded on 50 mt dash, shot put, standing broad jump, zigzag run, sit-ups and step test. The norms in terms of percentile rank of said group were developed.

Golding and Jackson (1982) conducted a study on physical fitness. The norms-reflected standards were developed from scores of over 1500 men and women, who were tested at different Young Men's Christian Association throughout the United States. The standards included the test scores associated with selected percentiles. A percentile was the percentage of people of a given age group and gender who achieved the score. Minimum fell in the ninety fifth percentiles for men in the age group of thirty five years and below. This means that of all men tested who have 35 years and younger ninety five per cent had an average score of 54ml/kg. Minimum or lower and only five per cent had an average score of more than 54ml/kg.

Sittmann (1981) prepared norms for Northeast Missouri State University students of health and physical fitness concept classes in which 372 male and 648 female subjects were tested. The test conducted was the sum of 6 skin folds, predicted percent fat, predicted VO₂ max, grip strength; leg strength, back strength, vertical jump distance and vertical jump power. Statistics used was mean, standard deviations and range of all variables. Classification was based on sex. Percentiles in increments of 5 were constructed for each variable in each classification.

Das (1980) has developed Norms in Physical fitness tests for boys of class 9-11 of Government school of Delhi with the purpose of computing a norm for evaluating performance in physical fitness as required in the curriculum for the required
programme of physical education. AAHPERD youth fitness test and N. P. F. D. battery 'A' were administered and norms were worked out. A comparison of obtained data with American student's shows that Indian students seem to be poor in abdominal strength and shoulder girdles strength.

**Falls (1979)** has established norms on the AAHPERD youth physical fitness. The norms were computed for more than 10,000 young subjects. Those who fall below the 50th percentile in any area were advised to participate in a fitness-developed programme physical performance test was selected by Fleishman in 1964 on the basic of the factors isolated from much larger batteries of tests. Fleishman reviewed the previously published literature in the field of physical fitness and added by his own personal experience in presetting and pilot, studies. He selected a battery of 30 test items generally considered to be measure of strength and another battery of 30 test items hypothesized to be measure of speed, flexibility, balance and co-ordination. Norms or standards performance scores were developed for boys and girls between 15 to 18 years of age on the basic of the score scores for more than 2,000 students for most of the tests.

**Watson (1978)** established norms for Nebraska boys and girls. The tests selected for Neb Eel physical fitness test were standing, long jump or vertical jump, 50 yard dash, sit-ups, stick jump and 300 yards distance run. The tests for secondary test were pull-ups or flexed arm hang, 50-yard dash, standing broad jump (SBJ), sit-ups, side step and mile or 9 minute run or 12 minute run. The sample was selected randomly. One-percent sample was selected from Neb schools to establish of norms. The norms were established for each test for girls, boys and groups according to chronological age. Percentile statistics was used.

**Robson (1978)** has conducted a study on a simple physical fitness test battery for elementary school children. He took 152 boys and 150 girls of Kendriya Vidyalaya, Gwalior. The test battery was practicable and simpler than the existing physical fitness test 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 groups by assessing their physical fitness. The following items were included in the test: 1. 50-meter dash, 2. 600 meter run and

**Zuti and Corbin (1977)** prepared physical fitness norms for college freshmen. The age group selected for this was from 17.6, 18.5 to 19.5 years from freshmen of Kansas State University. The total subjects were 3000. The test was conducted for strength test, flexibility body composition, and cardiovascular fitness. The result showed that the college freshmen at Kansas State University were above average and standards were appropriate for their use at National level.

**Beckford (1976)** prepared a study to evaluate the physical fitness level of Navajo girls 14, 15 and 16 years old. For AAHPER Youth Fitness Test was administered on the subjects selected from seven schools of the region to measure the physical fitness level. Also norms were established on the basis of sources obtained from test results from these schools. These norms were compared to National Norm. The result of the study gave an indication of the overall fitness level of 14, 15, and 16-year old Navajo Girls of the seven test items. The Navajo norms were below the National norms on 5 test items and above on softball throw and 600 yards run and walk.

**Bookwalter (1973)** has constructed the motor fitness test using twelve items standard; two measures each of strength, velocity motor ability and endurance. Researcher developed following four indices and validated for high school and college age men: (1) Motor Fitness Index I – (Chin + push-ups) – vertical jump. (2) Motor Fitness Index II – (Chin + push-ups) – standing broad jump. (3) Motor Fitness Index III – (Straddle chins + push-ups) – vertical jump. (4) Motor Fitness Index IV – (Straddle chins + push-ups) – standing broad jump. The validities of twelve items criterion are as follows. Index I .859; Index II .818; Index III .841 and Index IV .812. As these coefficients of validity are of approximate size; the instructor may select the Index most applicable to his programme and facilities. Indices I and III are preferable because of their higher validity coefficients.

**McKinney (1972)** has constructed motor fitness test battery for under graduate male physical education majors. Forty nine test items were selected as valid measures of the eight motor fitness components and were administered to 121 under-graduate males. The data were analyzed according to the principle axes method with varimax criterion for rotation. Five factors were isolated and named; speed endurance, gross
strength, power, flexibility and relative muscular strength and muscular endurance. Two test batteries having five items each were developed on the basis of the rotated factor loading. Test battery I contained highest loading items (1) time limit shuttle run, (2) cable tension, (3) 10-yard dash, (4) Thigh flexor flexibility and (5) bar push-ups. A physical ability test battery for New Zealand schools was developed by modifying the Fleishman battery of physical ability tests by Mc Caughan to produce national norms for a battery of physical ability tests that can be used to assess the relative fitness of New Zealand secondary school boys. Modifying four original test (No. 1, 4, 6 and 9), nine tests recommended by Fleishman were used. Percentile and T-score norms had been produced from over 58,000 test scores with the results covering boys of ages 13 to 17 years, in nine tests of physical ability.

Shore (1972) has constructed motor fitness test battery for lower elementary grade boys. Thirty Experimental test items considered as valid and reliable means of motor fitness were administered to 238 boys. After analyzing the data two test batteries containing seven items each were developed on the basis of the rotated factor loading of the test items. Test battery contained the highest loaded test item for each factor: (1) Clark’s strength composite, (2) Mc Cloy’s endurance ratio, (3) Well’s sit and reach, (4) Bass balance or stick, (5) Log flexor can extensor flexibility, (6) Arm flexor or the back flexibility, (7) Modified push-ups test battery II. Contained more administratively feasible test items strength (1) Grip strength, (2) 300 yard run, (3) Well’s sit and reach, (4) Bass balance on stick length wise, (5) Leg flexor and extensor flexibility, (6) Arm flexor or the back flexibility (7) M modified push-ups.

Maksud and Coutts (1971) has conducted a study to establish norms for the cooper’s 12-minute run/walk test applicable to young males. In this study eighty boys, age range from 11 to 14 years of age, served as the subjects. There was statistically significant difference between the two groups (P < 0.01). The correlation coefficient between aerobic capacity and run/walk performance was 0.65, while the correlation was statistically significant (P < 0.01). It was advised in attempting to predict aerobic capacity from run/walk performance with young urban subjects.

Roche (1971) has examined the performance of 12811 boys and girls aged 7 to 17 in 9-minute run/walk test for students aged 7 to 10 and a 12-minute run/walk test for
students aged 11 to 17; scores from this test were percentile ranked according to age and sex, and were presented for as a field test of running endurance.

Mood (1971) has conducted a study of two forms of the test of physical fitness knowledge of senior physical education for major students. One hundred and eighty four experimental test items, the contents of which were based on 60 physical fitness facts secured from recent physical education literature and on the opinions of 73 members of the Research Council of AAHPER, were administered to 1,360 physical education major students enrolled in 35 collegiate institutions in the United States. As a result of item analysis data, two parallel forms of the tests were constructed. For the purposes of obtaining validity and reliability of data and establishing national norms the two final test forms were administered to 4,167 students enrolled in 150 collegiate institutions in the United States. Two forms of the test of physical fitness knowledge were constructed so that growth in comparison of physical fitness can be analyzed.

Busch (1970) has prepared a normative study of the AAHPER Youth Fitness Test for girls in grade 7 through 10 in the State of South Dakota in which he was selected one school to represent each region or section of the South Dakota High School Activities Association. The selected number from each school was in proportion to schools enrolment. The AAHPER Youth Fitness Test was administered to 1,000 South Dakota girls in grades 7 through 10. Norms were established by computing every fifth percentile. The South Dakota girls were compared with those of National girls, using age only. The medians of South Dakota girls were then compared with the medians of the National girls on each test item. It was found that the medians of South Dakota girls were higher than those for National girls on all items, except the flexed arm hang. The scores of South Dakota girls tended to show improvement as age increased whereas the scores for National girls tended to level off or drop. A new revision of the California Physical performance test for boys and girls from ten to eighteen years of age was announced in 1961. A single battery of six test items was adopted consisting of standing long jump; knee bent sit-ups in one minute, side step, pull-ups, chair push-ups, and six-minute jog-walk. Subsequently the flexed arm hang was allowed as an alternate test for girls who could not perform a single pull-up. The norms consisted of separate percentile tables for boys and girls at each age for each of the six tests.
Lowry (1968) has conducted a study of physical fitness using AAHPERD youth fitness test. In his study, 1,400 senior high school boys were selected as subjects from fifty-nine schools throughout Arkansas. It was found that six of the twelve factors investigated had significant relationship to the fitness level of the subjects. Percentile ratio for senior high school boys in Arkansas on each item of the AAHPERD youth fitness test was also developed.

Bitcon (1965) has constructed norm tables for grades 9-12 by taking pull-ups, 2 minute sit-ups, standing broad jump and a 300 yard shuttle run and showed its validity against the AAHPER Youth Fitness Test. Validity and reliability coefficients were 0.934 and 0.961 respectively. The researcher proposed to administer the test to about 4000 girls in the age groups of 13, 14, 15 and 16 years taking about 1000 girls in each age group from about 75 schools of all the 11 Talukas in Goa. Seven test items in the test battery were split up into two sets and were conducted on two consecutive days. The data collected on the subjects in respect of different physical fitness items were utilized for constructing the Percentile scale, Sigma scale and Hull scale-test employed for comparing subjects representing different age groups in various test items considered in the study. The level of significant was set at 0.05 level of confidence. There is no significant difference in the physical fitness of the girls (13 to 16 yr.) from the state of Goa. The subjects belonging to the 15 years age group were found to be significantly superior to that of 13 years age group in vertical jumping ability.

Morrison (1965) administered twenty-item criterion battery to 120 college women at Madison College during a four-week period. T-score were summed for each category of test items (body impetus giving impetus to an object, and using an implement to give impetus to an object) and for the battery of twenty items. The data were treated by means of the BIMD 34 programme. A three-item and a five-items battery were selected to predict basic sports skill ability. The validity coefficient, reliability and objectivity coefficient was calculated and norms for five groups of ability were developed for both tests.

Avent (1964) has studied on test of static and dynamic strength for girls nine to twelve year old. In this study height, weight and twenty eight tests commonly used to measure strength were administered by to nine and ten years old and 100 eleven and
twelve year old Caucasian girls. Regression equations were set up for estimating the following: general static strength based on McCloy's unweighted strength score and dynamometrical measures: general dynamic strength based on the average of T-scores of five dynamic strength measures and ten dynamic strength variables; and total static and dynamic strength based on the average of T-scores derived from dynamometrical measures and the five-item dynamic strength measures. Norms were established.

Fleishman (1963) has conducted a study on thirteen tests measuring eight physical fitness factors, which were administered to over 20,000 students between the ages of 12-18 in 45 cities, distributed throughout the United States. The results of this provided (a) normative table by which individual programme can be evaluated by test, age, sex and (b) Growth curves which show the development of the different physical proficiency components during the adolescent and sub-adult period. Finally, the recommendations were made for batteries of tests which provided more comprehensive and efficient coverage of physical factors.

Pisco (1962) conducted a study to establish norms and to compare skin fold and other anthropometric measurements of pre-adolescent boys from three ethnic groups. The subjects were 647 Halian, Jewish and Negro pre-adolescent boys. The skin fold was measured at five sites. Other measurements included height, weight, bi-iliac dimensions and selected girths. Co-relations were determined between skin folds and selected body build components. Skin folds ranged from moderate to high values. The largest percentile scores were found in Jewish groups. Analysis of variance was employed to compare body fat, height and weight of each group. Significant differences between ethnic groups were found in certain skin folds and weight at 0.01 levels.

AAHPER (1962) Youth Fitness Test represented the test battery. It was the first attempt by the physical education profession to establish national norms. A special committee of the AAHPER Recreational Council developed the original test battery in 1957. The Youth Fitness Test consists of 6 items for boys and girls of age groups 10 to 17 and College men and women. The norms were revised and made more scientific after comparing the achievements of the Youth of Great Britain, Japan, etc., with the American norms to up-to-date it.
Arnett (1962) has developed short (minimum items) motor fitness test batteries for high school girls who could be economically administered in terms of equipment and class time. The components, which might contribute to motor fitness, were listed and appropriate items pertaining to the components were selected for their content validity and suitability utilizing appropriate statistical techniques. The modified pull-ups, 600-yard run and standing jump were selected as the items for the batteries. The motor fitness test batteries recommended over the three batteries since this battery had a validity coefficient of test 0.755 and an estimated reliability coefficient.

Glover (1962) has developed test items for the first, second and third grades. After examining performance items that could be utilized in a motor fitness test battery, eighteen tests were chosen. Judges familiar evaluated these tests on two occasions with physical fitness and with primary school children. On the first occasion, the judges indicated either selection, need for revision, or rejections of each test. As a result, twelve items were retained for further consideration. On the second occasion, the judges made evaluation while the tests were being administered to children. As a consequence seven tests comprised the final selection. Percentile norms were developed for all seven items for all grades. However, the fourth test was found to be most valid, reliable and discriminatory. The test items are Standing Broad Jump, sit-up, and shuttle race and seal curl.

Francise (1960) has established the percentile norms for girls in the age group of 12, 13, 14 and 15 on the North Carolina AAHPER Tests. The norms were prepared for each of the five test items; the five test items were sit-ups, side stepping, standing broad jump, modified pull-ups and squat thrusts. The sit-up item provided effective differentiation on the percentile scale for each age group. The concentration of scores in the middle of the distribution for the side stepping test and the squat thrust test resulted in effective discrimination in the center of the ranges for all age groups. The standing broad jump test shows the greatest ranges and the best differentiation of scores on the percentile scale for the age groups. The modified pull-ups test failed to differentiate the lower end of the distribution for all age groups but did discriminate above the 20th percentile.

Elder (1958) has developed a motor fitness test designed to evaluate the following nine basic components: strength, endurance, power, agility, flexibility, speed, and
balance, body size and age. The composite score on fourteen motor fitness items
served as the criterion for the selection of tests to compose the final battery. The test
items selected were: floor push-ups, standing broad jump, trunk flexion forward,
cozens dodge run, and 20-second squat-thrust. Six-sigma scale norms were developed
for six divisions of the California classification system. This was based on the boy's
age, height and weight.

Blesh and Scholz (1957) have devised a test at Yale University to appraise the motor
fitness of freshmen students. The six-item test was selected on a two-fold basis,
capable of being administered accurately with little equipment, and significant in
indicating the overall strength of different body parts. The test items and the minimum
standards for the physical education programme were pull-ups (8) push-ups (25) sit-
ups (50) fence vault (4 feet 6 inches) standing broad jump (86 inches) and vertical
jump (18 inches). The Harvard step test was initially included in battery as an
endurance measure but was discontinued because of the testing time involved with
large numbers.

Miller (1954) has conducted a study on achievement level in basketball skills for
women physical education majors. This study provides tables of norms in the form of
T-scores and percentile rankings for raw scores made on three basketball skill tests:
bounce and shoot, half-minute shoot, and pass for accuracy. Norms in the form of T-
scores and percentile ranks have been determined based on the achievements of a very
adequate number of subjects. It is expected that the tables of norms provided by this
study has considerable aid to teachers in the professional physical education
curriculum, in judging the adequacy of achievements of their students in basket ball
skills, and assisted students in diagnosing their own strengths and weaknesses in this
activity.

Latchaw (1954) has proposed seven tests that were devised from a number of
established tests to measure performance in selected motor skills in grades four
through six, boys and girls. The tests included: Basketball wall pass, volleyball wall
pass, vertical jump, standing broad jump, shuttle run, soccer wall volley, and softball
repeated throws. Face validity was accepted for each test, and the tests proved
reliable. T-scale norms were developed for the interpretation of scores.
Barrow (1954) has conducted a study to develop an easily administered test of motor ability for college men. Expert opinion was used in the validation process and eight factors of motor ability and 29 items measuring those factors were chosen. The selected tests were administered to 222 college men and statistical analysis covered by item reliability, objectivity, and correlation with the criteria and inter-correlation. Two test batteries including one short indoor test were recommended. Test scores to indicate performance in relation to norms, which have been established to indicate performance in relation to norms, and have been established for the particular groups classified. Such norms were provided for both battery number one and battery number two for the following two groups. (a) For college men on an unclassified basis and (b) for physical education major students. The test’s raw scores were recorded on a scorecard. By referring to the scoring table, the raw scores were converted into T-scores and weighted standard scores. The weighted standard scores were summed and a general motor ability obtained. These scores were summed / referred to the appropriate table of norms and the student’s motor ability rating was found.

Development of norms as selection criteria, especially for the Indian sports talent, area wise is a demand of the day. Since the present investigation is devoted to establish “suitable selection criteria” for area wise to select the talented boys. Such criteria will, in fact, help to discriminate the talented sports person for coaches, physical educationists, and sports scientists for selection and make the sports policy and coaching schemes according to the capacity and quality of these talented boys and girls.
Chapter-3

Methodology
CHAPTER-III
METHODOLOGY

The methodology followed in conducting the study plays a prominent part in determining the dependability and usefulness of the findings. Identification and defining the nature of population, techniques used to select the representative sample and efficiency of the techniques used in data interpretation are the important processes of the investigation. The basic thrust is the construction and standardization of specific physical fitness test battery and development of norms for north-zone level cricket players. In this chapter selection of the subjects, description and administration of the test, and statistical procedures are presented.

The entire study was executed in two phases. The first phase was related to construction and standardization of the preliminary specific physical fitness test battery and the second phase was to develop norms by using appropriate statistical techniques.

3.1 Selection of the Subjects

The subjects for the study were 350 cricket players of age between 18 to 25 years. The samples were recruited for the construction of the test only. No grouping of players was made during this phase. The sample for the construction phase was 120 players exposed to as much as 24 different fitness test items. The sample for the development of norms and standardization of the test was 350 players of cricketers who has participated or had participated earlier.

3.2 Selection of Test Items

A successful measurement and evaluation program depends on the adequate preparation, evaluation and selection of test and knowledge and techniques concerning organization, administration and interpretation of testing programs. The proper selection of test is of little value unless testing programs are conducted in an efficient manner. Many tests of physical fitness test and specific sports physical fitness tests are available such as AAPHER Youth Fitness test, Grover Physical fitness test for Primary grade Children, North Carolina Motor Fitness Test Battery, California Physical Performance Tests, NSWA Physical Performance Test, and so on.
But all these were constructed according to the characteristics of their purposes. Considering these standard tests every possible care has been taken to select a test item that most closely approximates the actual cricketer's physical fitness characteristics. In order to select the broad component of test, the available literature of physical fitness were critically reviewed and opinions of experts regarding these tests were obtained. Also existing literature on the appropriate component of physical fitness in Indian geographical condition/situation were considered. All the components of the physical fitness were considered. On the basis of these the following components for the specific physical fitness test for cricketer are considered.

The physical fitness components are:

1) Cardio-vascular Endurance.

2) Muscular Endurance.

3) Speed.

4) Flexibility.

5) Power.

6) Agility.

7) Balance and coordination.

8) Strength.

3.3 Description of the Test Variables:

Cardiovascular Endurance (cardio respiratory/heart–lungs)

The total volume of oxygen an individual can inspire, deliver and utilize per kilo of body weight per minute of exercise and the capacity of muscles to sustain or repeated contractions and an important component of physical fitness for cricket so that players can reduce the effect of fatigue during long period of play. Fitter players will cope with the heat stress of playing cricket all day in the sun.
Muscular Endurance: Muscular Endurance is the ability of a muscle or group of muscles to work continuously for a long time without tiring. Muscular endurance is a crucial element of fitness for the cricketers, especially fast bowlers than batsmen generally require more endurance as it takes a lot of energy and endurance to bowl. So without muscular endurance cricket players will find it difficult to stay there for a full day in the field.

Speed: The maximum velocity at which one can locomotive is closely associated with muscular power and coordination. Running speed and acceleration are very important part in cricket for movement between the wickets and fielding.

Flexibility: Range of Motion at or around a joint. How elastic the muscle is directly affects the motion. The flexibility tests should be specific to the actions of cricket. Being flexible enables greater range of movement in the execution of strokes, bowling, throwing, fielding and may reduce injury in the long term.

Power: Muscular Power is a combination of strength and speed. It is measures how quickly one apply his/her muscular strength. It is the heart of functional ability of a cricketer and is important in the controlling of movement and executions.

Agility: The ability to maintain speed whilst changing direction. Running speeds, acceleration, changing direction of motion and on spot are very important in cricket for movement within the crease and on the field.

Balance and Coordination: Balance and coordination is the ability to perform complex motor skills specific to a particular exercise or sport with a degree of ease and grace. This is somewhat subjective, however comes to the fore in sports.

Strength: The ability of a muscle or group of muscles to exert maximal force during construction. Core stability and abdominal function is important in the controlling of movement and execution of strokes, throwing ball, and so on.

The physical fitness test items selected against the fitness components are: The twenty four test items were identified out of forty eight test items through the pilot study, under the eight physical fitness components identified earlier have been listed below are:
1. 600 meter run/walk
2. Side Stepping
3. Skipping
4. Hopping
5. Criss-cross test
6. Over arm hang
7. Pull-ups
8. No of dips
9. Cricket ball throw
10. 50 yard dash
11. 10 yard backward run
12. Sit and reach test
13. Trunk lift
14. Standing broad jump
15. Sit-ups
16. Standing vertical jump
17. Shuttle run
18. Zig-zag run
19. Squat thrust
20. Hand reaction time
22. Strock stand
23. One leg single squat
24. Full squat

3.4 Pilot Study:

The aim of pilot studies is to explore certain issues before undertaking a large-scale study. Pilot studies are rarely just a small version of a larger study; they have other objectives than the large-scale study. This may involve testing feasibility in practice or improving the methodological quality of parts of the study. It is one of the most important aspects of the methodology followed in an investigation. The sample for the present study was made on cricketers of 18 to 25 years of chronological age. All the players were randomly obtained from different universities who were participating or had participated earlier but are less than 18 to 25 years of chronological age. No
groupings of players were made during this phase. Before construction of specific physical fitness test battery, with the help of pilot study the researcher was found to explore sample for the ‘construction phase’ of 50 players, and they exposed to 48 different motor fitness tests item. The purpose of this pilot study was to develop a preliminary test battery and a protocol for each of the test items that were representative of the task performed by North-zone level cricketers.

In order to develop the preliminary test battery, an extensive review of literature, the task analysis, physiological data-assessing the demands for performing the activities during the cricketing, personal knowledge and understanding, and experts guidance, the forty eight test items physical fitness were identified potential to be extracted in the final test battery. All of these test items were exposed to all 50’ sample population. The data collected were treated through statistical analysis factor analysis and correlation significance in order to identify the preliminary test items- which yield 24 test items for the construction of the specific physical fitness test.

3.5 Construction of the Test

The purpose of this part of the study was to develop a Specific Physical Fitness Test Battery and a protocol for each of the test items that were representative of the task performed by cricket players. In order to acquire test battery information required to identify potential test items of inclusion in a test battery was obtained through pilot study.

The detailed procedures were followed as described in the order, as mentioned below:

a. Procuring consent from managers, coaches and players.

b. Sampling.

c. Specific Physical Fitness component.

d. Experimental test items.

e. Method of execution.

Procuring Consent from Coaches and Players

Since every player was the members of the university cricket team represented as subjects for the proposed study, and the data collection was conducted during the
North-zone cricket intervarsity practice session and training camp, informed consent was obtained from all concerned authority, coaches/trainers and players.

**Sampling/procedure**

**a) Sampling Procedure**

It is one of the most important aspects of methodology followed in an investigation. The selection of the subject was done for North-zone level 350 cricket players aged 18–25 years (as per intervarsity age rule) were treated as samples of the study for construction of specific physical fitness test on 24 experimental variables. Researcher chooses theses samples from different universities of North-Zone.

The researcher had collected data at different places as Saharanpur (UP) with the help of assistants, coaches, and concern authority during the training session which was prior to competition of North-Zone Cricket tournaments in the year 2010, researcher collected data for the study during North Zone Cricket tournament which was held on Uttrakhand Technical University, Dehradun. Researcher also collected data from Ahilya Bai Holkar Sports Stadium, Aligarh and from Willington Cricket Pavilion, Aligarh Muslim University, Aligarh. Apart from this researcher also collected data from many other cricket camps who participating either or had participated earlier but are 18 to 25 years of chronological age, in the year 2011, 2012 and 2013 respectively.

All the players were randomly obtained with the permission of university games secretary, president of the club, managers and coaches of the teams from North-Zone cricket Inter-varsity held in Aligarh Muslim University, Aligarh.

The data collection was done for two different phase:

i. Construction and standardization of the Specific Physical Fitness Test; and

ii. Development of norms.

a) At the outset, sample from the University players were selected randomly and all member players of those universities were recruited for the construction of the test. The sample population for this phase was 120 players, exposed to 24 different test items of Specific Physical Fitness Test. After collection of the data, all the test items were factor analyzed of
identification of the test battery item. The constructed has been standardized determining its reliability, objectivity, and validity.

b) After the identification of the factors i.e., Test Battery items of Specific Physical Fitness Test were administered to 230 players of cricket who participated either or had participated earlier at North-zone level. The data collected were subjected to percentile analysis for the development of norms.

3.6 Specific Physical Fitness Component

In order to select the components of Specific Physical Fitness Test, the available literature of physical fitness was critically reviewed and opinions of experts regarding these tests were obtained. Also existing literature on the appropriate component of physical fitness in Indian situation were considered and the broad component of eight physical fitness tests were considered as mentioned above.

3.7 Experimental test items

During the process of selection of the components of Specific Physical Fitness Test, the test items for each component were also identified along with and 24 test items were considered as mentioned above.

3.8 Method of Execution

For the first phase of the study one hundred and twenty (120) players were tested during 6 months period. The time required for testing allowed each subject ample rest and recovery which could have otherwise affected his performance. Each test item’s administration was adhered strictly as administration procedure outlined.

Before attempting to any new motor test, we should know its proper execution and other organizational hints. And when it is a matter of test construction or administration then it becomes more imperative to dispense the knowledge of accurate execution of each and every test item. The researcher had used a demonstrator to demonstrate the test items to the subjects when and where ever required so that they may get a proper idea of execution of the accurate test items. Test administrators were educated with the knowledge of the equipments and the scoring procedure during the execution.
Following factors were taken into consideration while executing each test:

a) Purpose.
b) Equipment required.
c) Description.
d) Scoring Procedure.
3.9 Procedure for Administration of the Test

Test No. 1

ZIG-ZAG RUN

Purpose: To measure coordinated movement, speed and agility.

Equipment Required: Stopwatch, marker cones, clapper, non-slippery surface, and measuring tape.

Description: After sufficient warm up, the players start in the prone position to the left of the first cone with the tips of fingers behind the starting line. When the researcher/instructor says, "GO", the subjects stand up and sprint to the forward line, place one foot over the line, and sprint back to the starting line. Then make a left turn around the first cone, and then zigzag in a figure eight fashion around the four cones spaced 10 feet apart in a straight line from the start line to the turn line and zigzag back to the start line. Then turn left around the first cone, and sprint to the forward line and back one more time. The clock stops when any part of body crosses the finish line. If a subject knocks over a cone, misses a turn, or fails to touch the line when turning, test developers/instructor will stop him and return him to the end of the line for a restart.

Scoring Procedure: The score is the time taken to complete the run. The time recorded to the tenth of a second.
Figure 3.1 (a,b,c,d) Illustrating ZigZag Running
Test No. 2

50-YARDS DASH

Purpose: To determine acceleration and speed.

Equipment Required: Measuring tape or marked track, stopwatch, cone markers, clapper, flat and clear surface of at least 70 meters.

Description: The test involves running a single maximum sprint over 50 yards with the time recorded. Sufficient time was given to warm up, including some practice start and acceleration run. Subject has taken start for 50 yards dash from a stationary standing position. The front foot must be behind the starting line. Once the subject is ready, the researcher gives the instructions "set" than "clap sound". The subject runs fastest as possible up to finish line.

Scoring Procedure: Two attempts were given and best time was recorded up to nearest tenth of a second.

Test No. 3

10-YARDS BACKWARD RUN

Purpose: To determine agility, speed, strength and power.

Equipment Required: Measuring tape marked track, stopwatch, clapper, flat and clear surface of at least 10 yards.

Description: Two lines were drawn. Starting and end line separated by 10 yards. Lanes were marked with a width of 2 meters. Subjects were asked to stand behind the starting line back facing the end line. The subjects were asked to start with standing position. On the command “ready” the subjects were asked to be ready and alert and on the sound of clapper clap, the subjects took the stand running backward till the end line. The time keepers started the digital watch on seeing the clapper clap and stopped the clock when the subject touched the finishing line.

Scoring Procedure: The collapsed time between start and finishing was recorded in tenth of a second.
Figure 3.2(a): Illustration of 50 Yard Dash Running at Start

Figure 3.2(b): Illustration of 50 Yard Dash Running at Finish
Figure 3.3(a): Illustration of Backward Running at Start

Figure 3.3(b): Illustration of Backward Running during Finish
Test No. 4

STANDING VERTICAL JUMP

Purpose: To determine explosive strength.

Equipment Required: Measuring tape, chalk powder, and marking tape.

Description: The subject stands side on to a wall and reaches up with the hand closest to the wall. Keeping the feet flat on the ground, the point of the fingertips is marked and recorded. The subject then stands away from the wall, and leaps vertically as high as possible using both arms and legs to assist in projecting the body upwards. The subject attempt to touch the wall at the highest point of the jump.

Scoring Procedure: The difference in distance between the standing reach height and the jump height is the score. The best of three attempts is recorded in centimeters.

Test No. 5

STANDING BROAD JUMP:

Purpose: To measure the explosive power of the legs.

Equipment Required: Measuring tape, take off board and long jump pit with soft landing area.

Description: The subjects assumed a starting (semi-crouched) position behind the take-off line with feet approximately shoulder-width apart. When researcher asked the subjects to be “ready”, Subjects were encouraged to swing their arms and flex their legs at the knees in preparation for the jump. The researcher instructed subjects to jump as far as possible. The distance was measured from the point where the body touches nearest the take-off line. Two consecutive trials were given (first from right side and second from left side of the take-off board).

Scoring Procedure: The best jump (distance) of the subjects was recorded in centimeters.
Figure 3.4(a) Illustration of Standing Vertical Jump Initial Phase

Figure 3.4(b) Illustration of Standing Vertical Jump Phase
Figure 3.5(a,b,c) Illustration of Standing Broad Jump
Test No. 6

SPEED BALL THROW

Purpose: To measure strength of the arms.

Equipment Required: 15 Tennis balls, 01 backed, lime powder, measuring tape, and wall.

Description: The subjects were standing behind the restraining line which was 9 feet away from the selected wall. The researcher asked subjects to be “ready”. Subjects were taking position behind a restraining line along with backed which contained 15 tennis balls. On the signal to “start” the subjects were to throw the ball (overhead) against the wall and catches it on the rebound.

Scoring Procedure: The score was time elapsed between hitting the wall with the first ball and the fifteenth. The better of two trials was recorded to the nearest tenth of a second.

Test No. 7

CRICKET BALL THROW:

Purpose: To measures the shoulder strength.

Equipment Required: Cricket ball measuring tape, lime powder and clear open area of field.

Description: Mark a starting line where the subject has to stand and throw cricket ball. Subjects are allowed to throw the ball from static position by using overhand throwing technique. Subjects must throw the cricket ball without crossing the restraining line. If the line is crossed the throw is deemed a foul. Three practice throws were allowed.

Scoring Procedure: The distance from the restraining line to where the ball first lands is recorded. The measurement is recorded to the nearest meter. The best of three throws is recorded.
Test No. 8

SELF HIGH CATCHING

Purpose: To determine general perception.

Equipment Required: Cricket ball and open surface area.

Description: Player holds a standard Cricket ball by the side of the body up to waist level and throw ball with wrist movement in upward direction in front of the body. The player threw the ball high in the air as much as possible and tried to catch the ball. Five trials were given.

Scoring Procedure: The numbers of catches caught by the subjects were recorded. One point was awarded for each catch.
Test No. 9:

SKIPPING ROPE:

Purpose: To determine hand-eye-foot coordination, balance.

Equipment Required: Skipping rope and stopwatch.

Description: The subjects were to jump 1 to 2 inches off floor, giving rope just enough space to slip under feet. Only the forefoot of feet should touch the floor. Elbows are kept close to sides as subject turn the rope. The movement comes from the wrists and forearms, not the shoulders. The subjects had only one practice trial.

Scoring Procedure: The subjects were asked to skip the rope for 30- seconds without any pause. Numbers of skips completed were recorded as the score.

Test No. 10:

OVER-ARM HANG

Purpose: To measure upper body strength and endurance.

Equipment Required: Stopwatch, horizontal overhead bar at an adequate height, stool (optional).

Description: The researcher asked subjects to grasp the overhead bar. The grip for the subjects allowed using an overhand grip palms facing forward. Subjects body position with the arms flexed and the chin clearing the bar. The chest should be held close to bar with legs hanging straight. The subject holds this position for as long as possible.

Scoring Procedure: The total time in seconds is recorded - timing is stopped when subject’s chin touches or falls below the bar.
Figure 3.7: Illustration of Rope Skipping

Figure 3.8: Illustration of Over Arm Hanging
Test No. 11

HOPPING:

Purpose: To measure the leg power, balance and coordination of body.

Description: The subject has to start hopping on one leg for 20 meter. The subject has given three trails for hopping. Do not touch the floor with subject's other leg. Researcher's assistant demonstrated the task by hopping on one leg.

The subjects were shown 20 meter lane of hopping. Two practice trials were allowed for each leg (5 hops). Subjects were given practice trials.

Scoring: Score is the time taken to complete the hop, and recorded to the tenth of a second.

Test No. 12

BULL'S EYE THROW

Purpose: To determine hand–eye-coordination.

Equipment Requirement: Lime powder, Lawn tennis balls and target(s) wall.

Description: The subject stood 15 feet away from a target wall which was in the form of three concentric circles with one-inch lines: the diameters of center, middle and outer circles were 24, 48 and 72 inches respectively. The bottom of the outer circle was 36 inches from the floor. The researcher commanded "GO" and subjects threw the tennis ball towards target with their right/left hand in the manner of overhead throwing technique. 10 throws were permitted to each subject in continue manner.

Scoring Procedure: A ball hitting in the center circle was worth three points, second circle two points, and the outer circle one point. The sum of the points accumulated in 10 throws was recorded as final score.
Figure 3.9(a,b,c,d,e,f): Illustration of Hopping
Test No. 13

WALKING A LINE FORWARD / BACKWARD

**Purpose:** To check the balance and coordination of the body.

**Equipment Required:** Measuring tap and lime powder.

**Description:** The subjects were asked to stand on starting point with one-inch-wide line. On researcher's command "GO", subjects started forward walking in the manner of one foot in front of the other (heel to toe) till 10 consecutive steps. During test researcher instructed all subjects about the walking manner: heel of the front foot touched the toes of the rear foot. Backward walking start followed by forward walking as per the researcher's instruction: toe to heel for ten consecutive steps in the walking manner; heel of the front foot touched the toes of the rear foot. A second trial (for each test) was administered only if the subject failed to achieve maximum points on the first trial.

**Scoring Procedure:** The number of correctly executed steps (forward and backward) was recorded as the subjects score (maximum score was 20).

Test No. 14

20 YARDS CRAWLING

**Purpose:** To determine upper and lower body strength.

**Equipment Required:** Stopwatch, measuring tap, at least 20 meters smooth surface ground and lime powder.

**Description:** The subjects were asked to stand on the starting line. The researcher gave start with the command "GO" and subjects started crawling. Crawling as per instruction of researcher like body pull and push with their and elbows while scooting along with their knees like army soldiers on allotted field. The subject crawls as fast as possible to cover a distance of 20 yards in straight line. They performed bilateral coordination (using the arms and legs in reciprocal movements).

**Scoring Procedure:** The time taken by subjects to cover 20 yards distance through crawling was recorded. Time was reported to the nearest tenth of a second.
Test No. 15

ONE-MILE BRISK WALKING

Purpose: To estimate maximal oxygen consumption ($\text{VO}_2\text{max}$).

Equipment Requirement: Stopwatch, ground, clapper and lime powder.

Description: The researcher instructed the subjects to walk briskly the one-mile distance as fast as possible on the ground. Only one trial was permitted.

Scoring Procedure: The time taken to cover the one-mile distance was recorded in minutes & tenth of a second.

Test No. 16

SIDE-STEPPING

Purpose: To determine lateral speed, agility, and body coordination.

Equipment Requirement: Stopwatch and lime powder.

Description: Two lines of 12 feet long were parallel to each other, the subject straddling the centre line. On the command "Ready, Go", start the stop watch. The subject sidesteps to the right until the right foot crosses the outside right line. The subject then reverses direction and sidesteps to the left until the left foot crosses the outside left line. The subject must face the same direction the entire test, and cannot cross the feet during the side-steps movements.

Scoring Procedure: Record the number of outsides line crossed in the 30 seconds.
Figure 3.10(a,b,c): Illustration of Side Stepping
Test No. 17

CRISS-CROSS TEST

Purpose: To determine power, speed, balance and coordination.

Equipment Required: Stopwatch, lime powder, measuring tap, smooth surface and rope.

Description: Two lines of 3 feet in length were drawn on the smooth surface. Both lines were perpendicular to each other. The researcher has given numerical number for each quarter 1, 2, 3 & 4. These numbers were arranged in the following sequence: number 1 was awarded below x-axis line sector and similarly number 2 sector was lie below x-axis and left to y-axis which was vertical opposite sector number 3.

```
  4  |  2  
   ---|---
     3 |  1  
```

The subject stood on set position in sector number 1. On command "start", subject took both legs jump for sector number 2 followed by 3, 4 & 1. These jump sequences performed by subject continued up to 20 seconds.

Scoring Procedure: The total number of jumps minus the number of fault jumps was the score. Fault jump was an error to jump on a line, to jump in the wrong place, to fail to land on both feet at once. Falling was not an error if the player did not fall on a line or in the wrong quadrant, as the loss of time was the sufficient penalty.
Figure 3.11(a,b,c,d): Illustration of Criss-Cross
Test No. 18

SHUTTLE-RUN:

**Purpose:** To determine the speed and agility.

**Equipment Required:** Relay baton, measuring tape, stopwatch, non-slip surface.

**Description:** Two lines were drawn. Starting and end lines separated by 10 m. Hence lanes used marked with a width of 2 meters. Subjects were asked to stand behind the starting line. The subjects were asked to start with standing position. On the signal "Ready! Go!" the subject runs to the end line. Pick up one relay baton out of two from just behind the end line and run back to the starting line. Put down the relay baton at the starting line. Run again from the starting line to the end line. Pick up the remaining relay baton and run back to the starting line with it.

**Scoring Procedure:** Two trials were performed and the fastest time was recorded in tenth of a second.

![Diagram of shuttle run]

Test No. 19

300-METERS RUN/WALK

**Purpose:** To determine measure of cardiovascular fitness.

**Equipment Required:** Stop watch, lime powder, clapper and 400m standard truck.

**Description:** The researcher was given start to subjects for 300m from starting line through clapper. Subjects were cover 300m which was three-quarters of 400m standard truck as fast as possible either run or walk.

**Scoring Procedures:** The time taken by the subject for complete 300m distance was recorded in tenth of a second.
Figure 3.12(a,b,c): Illustration of Shuttle Run
Test No. 20

SIT-UPS

Purpose: To determine abdominal strength and endurance.

Equipment Required: Exercise mat, Stopwatch and Assistant.

Description: The subjects lie on the mat with the knees bent, feet flat on the floor and their hands on their ears where they must stay throughout the test. The assistant holds the subject's feet on the ground. The researcher gives the command “GO” and starts the stopwatch. The subject sits up touching the knees with their elbows, then returns back to the floor and continues to perform as many sit-ups as possible in one minute.

Scoring Procedure: The assistant counts and records the number of correct sit-ups completed in the 1 minute.

Test No. 21

ONE FOOT-TOUCH HEAD:

Purpose: To determine flexibility, agility and balance.

Equipment Required: Exercise mat.

Description: Stand on the left foot. Bent forward and place both hands on the floor. Raise the right leg and stretch it back. Touch the head to the floor, and regain the standing position without losing the balance.

Scoring Procedure: If the whole skill was executed smoothly in the first attempt, then 2 points were given. If the whole skill was completed in the second attempt then 1 point was given, third attempt was not allowed.
Figure 3.13(a): Illustration of Sit-ups

Figure 3.13(b): Illustration of Sit-ups
Test No. 22

SIDE LEANING REST TEST:

Purpose: To determine flexibility.

Equipment Required: Exercise mats.

Description: The selected subjects were made to sit down on the floor, legs straight out and feet together. Put the right hand on the floor behind the back. Tunnel to the right and took a side leaning-rest position, resting on the right hand and the right foot. Raised the left arm and kept this position for five counts.

Scoring Procedures: If the skill was executed smoothly in the 1st attempt, then two points were given. If the whole skill was completed in the second attempt then one point was given, third attempt was not allowed.

It was failure:

(a) Not to take the proper position;

(b) Not to hold the position for five counts.

Test No. 23

GRAPEVINE:

Purpose: To measuring flexibility of vertebrae.

Equipment Required: Exercise mats.

Description: Subjects were to stand with both heels tight together. Bent down, extended their arms down, between the knees, around, behind the ankles, and hold the fingers together in front of the ankles without losing the balance. All the subjects were instructed to hold this position for five counts.

Scoring Procedure: It was the failure if any player fell down or could not touch and hold the fingers of both hands together and/or did not hold the position for five counts.
Test No. 24

ONE LEG SIT BALANCE TEST:

Purpose: To determine the body balance.

Equipment Required: Smooth floor and stopwatch.

Description: The subject was asked to sit on one (stronger) leg, foot while the other leg was off the ground in front of the body so that the hip is flexed and the knee should be straight of the non-supporting leg. Subject’s arms were held by the side of the body with straight elbow at shoulder level which was parallel to the ground and palms were in pronation position.

Scoring procedure: The total time spend to maintain body balance on supporting leg was recorded in tenth of seconds is recorded. The score was taken from best of two attempts.

Test No. 25

STORCK STAND

Purpose: To measure body balance on the ball of foot.

Equipment Required: Stopwatch and smooth surface.

Description: The subjects stand on their stronger leg without shoes and place the hands on the hips, then position the non-supporting foot against the inside knee of the supporting leg. The subject raises the heel to balance on the ball of the foot. The researcher started stopwatch as the subject’s heel is raised from the floor. The stopwatch is stopped if the hand(s) come off the hips, the supporting feet rotate or skip in any direction, the non-supporting foot loses contact with the knee and the heel of the supporting foot touches the floor.

Scoring Procedure: The total time spend to maintain body balance on supporting leg was recorded in tenth of seconds is recorded. The score was taken from best of two attempts.
Figure 3.14: Illustration of Storeck Stand
Test No. 26

SINGLE HEEL CLICK

Purpose: To determine explosive strength of legs and body balance.

Equipment Required: Smooth surface.

Description: The subject stood on the stationary position. Researcher gave signal to start. Subject performs jump in air and clapped both feet and then land with both legs apart. It was treated as a failure if the players did not clap feet together once and to land with the feet touching each other.

Scoring Procedure: The scores were based on two trials. If the player succeeded on the first trial, then he secured 2 points; if he failed on the first trial but succeeded on the second trial, then he scored 1 point; if he failed on both trials scored zero.

Test No. 27

CROSS LEG SQUAT

Purpose: To determine balance and lower leg strength.

Equipment Required: Smooth carpet.

Description: The player stood erect on both feet, folding his arms across the chest. Then crossed the feet and sat down cross-legged. The player was asked to get up without unfolding the arms or having to move the feet about to regain the balance.

Scoring Procedure: Recorded the number of outline crossed in the 30 seconds. It was the failure if the player unfolds the arms, loses the balance, and/or was unable to get up from the floor.
Test No. 28

**ONE KNEE-HEAD TO FLOOR**

**Purpose:** To determine flexibility of vertebrae.

**Equipment required:** - Smooth carpet.

**Description:** - The subject had to take long sitting position on the floor. Bend one knee, placing the bottom of the foot on the thigh of the opposite leg. Relax the bend leg towards the floor. Lengthen the straight leg out through the ball of the foot and heel, spreading the toes. From the extension of the leg lengthen the spine out through the crown of the head. Reach the arms up over head and hip fold forward with a long spine bends. Subject gets the chest square over the front leg. Bring the hands towards the feet and bend the elbows to come deeper into the forward bend. Subject was taken head into alignment with subject’s spine. To comeback on initial position then release the bent knee and bring the leg straight out onto the floor.

**Scoring procedure:** - The total time spend to perform one knee touch head was recorded in tenth of a second. The score was taken from best of two attempts.

Test No. 29

**HOP BACKWARD:**

**Purpose:** - To determine balance and coordination.

**Equipment required:** - Any smooth surface.

**Description:** - The player stood on his dominant foot, took five hops backward.

**Scoring Procedure:** - Recorded time in tenth of a seconds. It was the failure in this test if the player opened his eyes and/or dropped his other foot.
Test No. 30

FULL SQUAT

**Purpose:** To monitor the development of the athlete's lower body strength.

**Equipment Required:** Stop watch, Smooth carpet/ Flat surface.

**Description:** The researcher asked the subject to stand with feet shoulder-width apart, arms extended horizontally at shoulder level and lean forward at the hips, keeping his weight on their heels. On the commend “Start” the subjects were to squat down until there thigh were parallel to the floor.

**Scoring Procedure:** Numbers of full squat were counted within 30 sec.

Test No. 31

TRUNK LIFT

**Purpose:** To measure trunk extensor strength, flexibility and endurance.

**Equipment Required:** Gym mat, Yardstick, ruler, measuring tape and Cone.

**Description:** The subject lies on the mat in a face down (pronation) position, with toes pointed back behind the body and hands placed under the thighs. Place a cone on the floor in line with the subject's eyes which help to keep their head in alignment to maintain eyefocused throughout the movement. On command “Start” the subject lifts the upper body off the floor in a slow and controlled manner. The head should be maintained in a straight alignment with the spine. The position must be held long enough for a measurement to be made of the distance - from the floor to the subject’s chin. Once the measurement has been done, the subject returns to the starting position.

**Scoring Procedure:**

Two trials were allowed, best one score was recorded in inches. The maximum score on this test was 12 inches; anything over this distance is recorded as 12 inches.
Figure 3.15: Illustration of Full Squat
Figure 3.16(a): Illustration of Full Squat

Figure 3.16(b): Illustration of Full Squat
Test No. 32

SIT AND REACH

Purpose: To measure the flexibility of the lower back and hamstring muscles.

Equipment Required: Floor and exercise mat.

Description: The researcher asked the subject to sit on the floor with legs stretched out straight ahead. Both knees were locked and pressed flat to the floor - the researcher may assist by holding them down. With the palms facing downwards, and the hands on top of each other or side by side, the subject reaches forward along the measuring line as far as possible. Ensure that the hands remain at the same level, not one reaching further forward than the other. After, the subject reaches out and holds that position for one-two seconds while the distance is recorded. Make sure there are no jerky movements.

Procedure Scoring: The score was recorded to the nearest centimeter as the distance reached by the hand.

Test No. 33

FORWARD HANDBACK:

Purpose: To determine balance, coordination and flexibility of the whole body.

Equipment Required: Flat surface.

Description: The player assumed the semi-crouched position with feet approximately shoulder-width apart. When ready, the player took off, jumped upward, swinging the legs forward, bend forward and touched the toes with both hands before landing on the floor. The player was instructed to keep the knees as straight as possible.

Scoring Procedure: The scores were based on two trials. If the player succeeded on the first trial, score 2 points; if he fails on the first trial but succeeded on the second trial, score 1 point; if he fails on both trails, score zero. It is a failure: (a) Not to touch both feet while in the air; (b) to bend the knees more than forty-five degrees.
Figure 3.17(a,b,c,d): Illustration of Sit and Reach
Test No. 34

FULL LEFT TURN:

Purpose: To determine body balance and coordination.

Equipment Required: Smooth carpet/exercise mat.

Description: The player assumed a standing position with feet together. On the signal 'start', the player jumped into the air and made a full turn to the left, landing on the same spot.

Scoring Procedure: The total time spend to maintain body balance, was recorded in tenth of a seconds. It was a failure:

(a) Not to get all the way around.

(b) To move the feet after they strike the floor.

Test No. 35

FULL RIGHT TURN

Purpose: To determine body balance and coordination.

Equipment Required: Smooth carpet/exercise mat.

Description: The player stood with both feet together. On the command, "Go" he swung his arms and jumped up in the air, making a full turn to the right. Instruction was given to land on the same spot and do not lose the balance, that is, do not move the feet after they first strike the floor.

Scoring Procedure: The total time spend to maintain body balance, was recorded in tenth of a seconds. It was counted as failure if the player did not make a full turn and did not land facing in the same direction as at the start. If the player lost his balance and had to step about to keep from falling then it was treated as failure.
Test No. 36

THE TOP

Purpose: To determine balance and coordination.

Equipment Required: Exercise mat.

Description: The player sat on the mat; put the arms between his legs and under and behind the knees; grasped the ankles; rolled rapidly around to the right with the weight first over right knee, then right shoulder, then on back, then left shoulder, then left knee; then sat up facing in the opposite direction from that in which the player started. The player had to repeat from this position and finish facing in the same direction from which he started.

Scoring Procedure: The total time spend to maintain body balance was recorded in tenth of seconds. It is a failure:

a) To let go of the ankles.

b) Not to complete the circle.

Test No. 37

SINGLE LEG SQUAT:

Purpose: To measure the strength of the lower body and particularly the quadriceps and gluteal muscle groups, and the hip stabilizers.

Equipment Required: Flat surface and stopwatch.

Description: The researcher asked the subject to stand on right/ left leg while the left leg is lifted off the ground in front of the body so that the hip was flexed to approximately 45° and the knee of the left/ right leg was flexed to approximately 90°. The arms were held straight out in front with the hands clasped together. From that position, squat down until about 60° knee flexion, then return to the start position. Note the leg that was tested.

Scoring Procedure: The total time spend to maintain body balance was recorded in tenth of a seconds. It is a failure:

(a) To remove the hands clasped.

(b) To touch the floor with the extended foot.

(c) To lose the balance.
Figure 3.18(a,b,c): Illustration of Single Leg Squat
Test No. 38

SIDE KICK

Purpose: To determine explosive strength and body balance.

Equipment Required: Smooth carpet.

Description: The player stood erect. Threw the left foot sideways to the left, jumping upward from the right foot, struck the feet together in the air and landed with the feet apart. The player was instructed by the researcher that his feet should strike outside the left shoulder line.

Scoring Procedure: The total time spent to maintain body balance was recorded in tenth of seconds. It is a failure:

(a) Not to swing the feet enough to the side.

(b) Not to strike the feet together in the air.

(c) Not to land with the feet apart.

Test No. 39

DIPS

Purpose: To measure arms strength and body endurance.

Equipment Required: Exercise mat/smooth carpet.

Description: The subject starts in the up position, with the arms straight and elbows fully locked. One complete dip is performed by bending the arms and lowering the body until the elbows are bent to at least a right angle, then pushing back up to the starting position. Resting in the up position is allowed.

Scoring Procedure: The score is the total number of dips performed in 60 seconds.
Figure 3.19(a): Illustration of Dips

Figure 3.19(b): Illustration of Dips
Test No. 40

MEDICINE BALL ROLL:

Purpose: To develop strength and power.

Equipment Required: Several 6-pound medicine balls, marking tape, and measuring tape.

Description: The researcher asked the subject to remain in standing position between two restraining lines 15 feet apart (throwing area). Grasp the 6 pound medicine ball with both hands while standing on the restraining line, and on the command “Go” the subject rolled the medicine ball along the ground, towards the target line. If the subject stepped over the line, the score for the test was not counted. The subject must, however, complete at least one successful roll. Three successive trials were given.

Scoring Procedure: The best score of the successful trials was recorded to the nearest foot.

Test No. 41

PULL-UPS:

Purpose: To measure upper body muscle strength and endurance.

Equipment Required: Horizontal overhead bar and wooden box.

Description: The researcher asked the subject to grasp the overhead bar. The researcher instructed them to use an overhand grip (palms facing away from body) with the arms fully extended. On command “Start” the subject started pull-ups in the manner: raises the body until the chin clears the top of the bar, then lowers again to a position with the arms fully extended. The pull-ups should be done in a smooth motion. Jerky motion, swinging the body and kicking or bending the legs were not permitted. As many full pull-ups as possible are performed.

Scoring Procedure: The number of correctly completed pull-ups was recorded as the score.
Figure 3.20(a): Illustration of Pull-Ups

Figure 3.20(b): Illustration of Pull-Ups
Test No. 42

LATERAL MOVEMENT

Purpose: - To measured agility.

Equipment required: - Two platforms (45 cm x 45cm), measuring tape and stopwatch.

Description: - Having two platforms of 45 cm x 45 cm each, positioned 25 cm apart. The subject stepped on right platform picked up the platform to the left using both hands, and placed it on the right side. The subject stepped on this platform and picked up the left platform, and so on subjects were asked to do this as quickly as possible.

Scoring Procedure: - The total time was recorded in 30 seconds. Score consisted of shifts of the platform and shifts of the body within a 20 second interval. The first point was awarded when the platform touched the floor at the right side of the body. The second point was awarded when the player had stepped on the next platform with both feet. A third point is given when the platform was placed on the right, and so on.

Test No. 43

HAND REACTION TEST:

Purpose: - To measure reaction time, hand-eye quickness and attentiveness.

Equipment required: - Ruler (15 inches in length), chairs and table.

Description: - The subject sat on the chair near to a table, with the elbow and lower arm resting on the table. The heel of the hand rested on the table so that only the fingers and thumb extend beyond the edge of the table. The researcher held the ruler from the very top, allowing the lower end of the ruler at the one-inch mark to dangle between the thumb and forefinger of the subject. The subject was instructed to concentrate on the ruler. The test researcher signaled, “Ready”. Then the researcher had up to 10 seconds to release the ruler. Once the ruler is dropped, the subject grasped the ruler with the help of thumb and forefinger together as quickly as possible. Three trials were given.

Scoring Procedures: - The point at which the top of the forefinger and thumb crosses the ruler was the initial value. One inch was subtracted from this reading on the ruler, since the starting position was at the one inch line. The subject’s score was the sum of best of one out of three trials.
Figure 3.21(a): Illustration of Hand Reaction

Figure 3.21(b): Illustration of Hand Reaction
Test No. 44

KRAUS-WEBER FLOOR TOUCH

Purpose: To evaluate physical strength and which will help checking the true relationship between strength, performance and your condition.

Equipment Required: Exercise mats.

Description: The subject assumed a standing position with feet together. Shoes were put off. Arms were hanging comfortably by the sides. Using static movement and not flexing the leg at the knee, the player bended forward and down, attempting to touch the floor with the tips of the fingers and to hold this position for three counts.

Scoring Procedures: If the floor-touch position was held for the full three seconds, the player received 10 points. If the floor was not touched, 1 point was subtracted for every inch between the floor and the players outstretched fingers.

Test No. 45

600 METERS RUN/WALK

Purpose: The purpose of these distance runs is to measure maximal function and endurance of the cardio-respiratory system.

Equipment Required: Athletics field or any smooth flat area safe for running on which distance could be accurately measured; Fluorescent boundary cones and stopwatch.

Description: Players were instructed to run the required distance in the fastest possible time. A signal, “Ready, Go,” or a whistle was used to begin the test. Test participants, or their parents/guardians were informed of the total elapsed time as the participants crossed the finish line. Players were encouraged to keep moving (running, logging, or walking) throughout the test.

Scoring Procedures: The run was scored to the nearest minutes & second.
Figure 3.22(a): Illustration of 600 Mtr Run/Walk

Figure 3.22(b): Illustration of 600 Mtr Run/Walk
Test No. 46

SQUAT THRUST

Purpose: To measure how rapidly body position can be accurately changed in a calisthenics activity.

Equipment Required: Stop watch or other timing device.

Description: The player assumed a standing position. On the signal to start, the player moved to a squat position, then to a front learning rest position, then moved to a squat position, and then returned to the starting position. This movement was repeated as rapidly as possible until the signal to stop was given.

Scoring Procedures: Each movement was considered a part. For example, the squat position was counted as one, moving to the front leaving rest position was two, and so on. The number of successfully executed movements completed in 30 seconds was recorded as the player's score.

Test No. 47

BASS STICK TEST (LENGTHWISE)

Purpose: To measure the ability to jump accurately and maintain balance during and after movement.

Equipment Required: Tape, yardstick, stop watch.

Description: The player was instructed to place the ball of the dominant foot lengthwise on a 1”x1”x12” stick. On the signal “Go”, the player lifted the other foot off the ground and holding his balance as long as possible to a maximum of 60 seconds. The stopwatch was stopped when the opposite foot or any part of the support or foot touched the floor. The test was completed three times on each leg for a total of six trials.

Scoring Procedure: The sum of the three best trials was recorded (in seconds) as the player score.
Figure 3.23(a,b,c,d): Illustration of Squat Thrust
Test No. 48

BASS STICK TEST (BREADTH WISE)

Purpose: To measure the ability to jump accurately and maintain balance during and after movement.

Equipment Required: Stopwatch, tape on other adhesive material to secure stick to floor, 1”x1”x12” stick.

Descriptions: The player was instructed to place the ball of the dominant foot breadth wise on a 1”x1”x12” stick. On the signal “Go”, the player lifted the other foot off the ground and holding his balance as long as possible to a maximum of 60 seconds. The stopwatch was stopped when the opposite foot or any part of the support foot touched the floor. The test was completed three times on each leg for a total of six trials.

Scoring Procedure: The sum of the three best trials was recorded (in seconds) as the players.

3.10 Statistical Techniques:

The design of the study is to construct specific physical fitness test and development of norms for North-Zone university level cricket players.

The results have been obtained through the Statistical Package for Social Sciences (SPSS) Version 17.0. The Pearson Product Moment formula has been utilized for correlation of variables and then Matrix of inter-correlation among the 24 variables was obtained.

The data was then subjected to Factor Analysis. The principal component analysis was used to extract factors. Varimax Rotation (Kaiser’s Normalization) was used to generate rotated factor matrix. The rotated factor matrix was used to the selected for interpretation.

Considering the Eigen value, rotated factor loadings, communality, a Specific Physical Fitness Test Battery of five test items for intervarsity level cricket players was developed. The percentile norm was developed from total data.
Figure 3.24: Illustration of Bass Stick Test (Length Wise)

Figure 3.25: Illustration of Bass Stick Test (Breadth Wise)
Chapter 4

Analysis and Interpretation of Data
CHAPTER IV

ANALYSIS AND INTERPRETATION OF DATA

The present study was planned to construct, standardize and develop norms of Specific Physical Fitness Test battery for cricketers of North zone intervarsity level players. The dependability and generalizability of the findings of any research study, to a large extent, are determined by the techniques used for analysis and interpretation of the data. In the present study too, the data collected were subjected to advance statistical techniques i.e., Factor Analysis which has been used to decipher the behavior of numerical data concerning attributes to Specific Physical Fitness Test. The results have been obtained through the Statistical Package for Social Sciences (SPSS), version 17.0. The Pearson-product Moment Technique was used to intercorrelate the score from the 24 test items. The resulting co-relation matrix was used to Factor Analyze using the principle axis method with the Varimax Criterion for rotation. The factor analysis yielded five factors with Eigen values above 1.022. Through face validity, five test variables were considered as dependent variables with the cumulative percentage of 84.084.

In context of the analytic methods that employed – factor analyses by Gorsuch, 1983 made a related observation that, “Factors that appear under a wide variety of conditions are obviously more desirable than factors that appear only under specialized conditions” example, only when certain samples or certain factor extraction or rotation methods are used. Similarly, Gorsuch, 1983 noted that “A prime use of factor analysis has been in the development of both the operational constructs for an area and the operational representatives for the theoretical constructs”. In short, factor analysis is intimately involved with questions for validity. Factor analysis is at the heart of the measurement of psychological constructs (Nunnally, 1978). In the present study both first-order and second order factor analysis and principal components analysis for the factor extractions have been employed. Many researchers acknowledge the prominent role that factor analysis can play in efforts to establish construct validity. For example: Nunnally, 1978, noted that historically construct validity has been spoken of both trait validity and factorial validity.
Analysis differs quite heatedly over the utility of principal component as compared to common or principal factor analysis. The difference between the two approaches involves the entry used on the diagonal of the correlation matrix that was analyzed; principal component analysis uses one on the diagonal while common factor analysis uses estimates of reliability, usually estimated through an interactive process. The two methods yield increasingly more equivalent results as either (a) the factor variables are more reliable or (b) the number of variables being factored is increased. Snook and Gorsuch, 1989 explain this second point noting that “As the number of variables decrease, the ratio of diagonal to offer-diagonal elements also decreases, and therefore, the value of the communality has an increasing effect on the analysis”. Gorsuch, 1983, suggests that with 30 or more variables the differences between solutions from the two methods are likely to be small and lead to similar interpretations.

Methodology: Information from the data sheets was entered into Microsoft Excel, analyzed and descriptive statistics computed using an SPSS statistical package (version 17.0) to factor analyze the physical test items and to determine the mean and standard deviation for each variables.

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<th>Mean</th>
<th>S.D</th>
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<td>Test item-2</td>
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*Mean and S.D (Standard Deviation) are rounded to three decimals.*

*Catalogue of variables for further reference*

### 4.1 Objectivity, Validity and Reliability

Cohan (1988) considers trial stability to be an important factor in assessing an impartial estimate of test reliability. She also argues that “the choice of a stable measurement schedule in research and measurement involving the investigated physical fitness tests requires more trials, pre-test administration than are recommended in test and measurement books.” Keeping this in view, sufficient pre-test practice and greater number of trials were given to the players while estimating the objectivity and reliability to trace identified test variables. Best of 3-5 trials was considered in calculating objectivity and reliability of the test variables. Correlation coefficient was obtained by using the product moment method. The researcher observed during the administration of the tests that some players were not confident enough to perform some tests and that there was a lot of inconsistency in the scorer, even after sufficient practice had been ascertained.

**Objectivity:** Objectivity means the degree of uniformity with which no disagreement occurs among competent persons in scoring any given subject while using the same test even after sufficient practice had been ascertained (Willgose, 1961). Objectivity and reliability of the 24 tests are presented in the Table 2.

**Validity:** Factor analysis has revealed validity co-efficient ranging from 0.95 to 0.58 with the mean of 0.77. Content validity was established by expert judgment.

**Reliability:** Synonyms for reliability include consistency, repeatability, and precision. A systematic observation system should possess reliability so confidence can be placed in the collected data.

**Test–Retest Reliability:** The test–retest reliability procedure is exactly what the name applies. By administering the test first set of data is produced. After an appropriate period of time, the test is administered again in as much the same
conditions as possible to produce the second set of data. These two sets of data are correlated to determine the reliability coefficient. Since the tricky part of this part of the test is to determine the reliability coefficient, various scholars opine that some physical performance tests learning may take place during the first trial that would cause improvement in the second trial. If “learning effect” is possible, then the test retest may not be effective for estimating reliability (Afrit, 1976; Baumgartner, Jackson, Mahar & Rowe, 1987).

Table -2: Objectivity and Reliability of Correlation of Coefficient

<table>
<thead>
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<th>S.N.</th>
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<th>Reliability</th>
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<td>2</td>
<td>Standing broad jump</td>
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<td>Criss- cross</td>
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<td>0.63</td>
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<td>10 yard backward run</td>
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<td>600 mts run/walk</td>
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4.2 Correlation Matrix

Multiple correlations of 24 variables were obtained and correlation matrix of variables is presented in Table 3.

The positive correlation value range from 0.001 to 0.983 and negative correlation value range from -0.988 to -0.003 was established.
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</table>

1: Standing Broad Jump; T1: 3-20 mts Hopping; T14: Coin-Cross Test; T15: Zig-Zag Running; T16: 10-yrd Backward running; T17: Shuttle-Run; T18: 100 yd Sprints; T19: Overhead Hopping; T20: 60-mts Run/ Walk.
4.3 Factor Analysis

The purpose of factor analysis is to "explore the underlying variance structure of a set of correlation coefficient. Thus, factor analysis is useful for exploring and verifying patterns in a set of correlation coefficient" (Brown, 2001).

Factor analysis for the raw data set of 24 variables suggested five factors that account of the total variables in the data set. Kaiser's criteria were used to generate the factors. The factors which have eigen value of more than one were considered. The rest of the 19 present of variance mounted ‘n’ number of factors. These factors are insignificant because of low eigen value and low percent of variance in the data set of 24 variables. The considered factors individually possess 61.832, 7.879, 5.695, 4.421 and 4.258 of variance. Thus factors represent the sub systems of components of a major system called specific physical fitness test. The Kaiser’s Varimax rotated factor matrix along with eigen value, percentage of variance, cumulative percentage of variance and commutative (h²) of variables are presented in table 4 and Rotated factor Matrix in table 5 respectively.

The connotations of the test variables are interpreted as seen through rotated loadings. Factor solutions can best be interpreted with respect to the pertinent field of research as also the researching insight with the subject. Subjective interpretations are essential in order to come to meaningful conclusions, which may often lead to new thoughts in the concerned field.

Kim and Mueller (1978) have suggested that we should look for subjects rather than looking for merely numerical values. Keeping this in view the tests with bi-polar loading of 0.44 and above were considered to be significant to each factor. The theory of redundancy is followed which considered in one factor is not considered in another factor; however, the interpretation is conducted with respect to the relevance of a test with another factor, if there is a significant loading.
<table>
<thead>
<tr>
<th>Test Variables</th>
<th>Communalities</th>
<th>Factor</th>
<th>Total</th>
<th>Percent of variance</th>
<th>Cumulative Percent ($h^2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standing vertical jump</td>
<td>0.866</td>
<td>1</td>
<td>14.840</td>
<td>61.832</td>
<td>61.832</td>
</tr>
<tr>
<td>Standing broad run</td>
<td>0.564</td>
<td>2</td>
<td>1.891</td>
<td>7.879</td>
<td>69.711</td>
</tr>
<tr>
<td>Hopping</td>
<td>0.894</td>
<td>3</td>
<td>1.367</td>
<td>5.695</td>
<td>75.405</td>
</tr>
<tr>
<td>Criss- cross</td>
<td>0.755</td>
<td>4</td>
<td>1.061</td>
<td>4.421</td>
<td>79.826</td>
</tr>
<tr>
<td>Zig-zag run</td>
<td>0.658</td>
<td>5</td>
<td>1.022</td>
<td>4.258</td>
<td>84.084</td>
</tr>
<tr>
<td>10 yard backward run</td>
<td>0.515</td>
<td>6</td>
<td>0.940</td>
<td>3.915</td>
<td>87.999</td>
</tr>
<tr>
<td>Shuttle run</td>
<td>0.978</td>
<td>7</td>
<td>0.755</td>
<td>3.146</td>
<td>91.145</td>
</tr>
<tr>
<td>50 yard dash</td>
<td>0.236</td>
<td>8</td>
<td>0.614</td>
<td>2.558</td>
<td>93.703</td>
</tr>
<tr>
<td>Side -stepping</td>
<td>0.975</td>
<td>9</td>
<td>0.574</td>
<td>2.390</td>
<td>96.093</td>
</tr>
<tr>
<td>Sit-ups</td>
<td>0.782</td>
<td>10</td>
<td>0.262</td>
<td>1.090</td>
<td>97.183</td>
</tr>
<tr>
<td>Squat thrust</td>
<td>0.881</td>
<td>11</td>
<td>0.150</td>
<td>0.624</td>
<td>97.807</td>
</tr>
<tr>
<td>Overarm hang</td>
<td>0.960</td>
<td>12</td>
<td>0.106</td>
<td>0.442</td>
<td>98.250</td>
</tr>
<tr>
<td>No of dips</td>
<td>0.961</td>
<td>13</td>
<td>0.089</td>
<td>0.370</td>
<td>98.620</td>
</tr>
<tr>
<td>Pull- ups</td>
<td>0.950</td>
<td>14</td>
<td>0.065</td>
<td>0.271</td>
<td>98.891</td>
</tr>
<tr>
<td>Full- squat</td>
<td>0.764</td>
<td>15</td>
<td>0.053</td>
<td>0.223</td>
<td>99.114</td>
</tr>
<tr>
<td>Cricket Ball throw</td>
<td>0.955</td>
<td>16</td>
<td>0.042</td>
<td>0.176</td>
<td>99.290</td>
</tr>
<tr>
<td>Skipping</td>
<td>0.874</td>
<td>17</td>
<td>0.041</td>
<td>0.169</td>
<td>99.459</td>
</tr>
<tr>
<td>Strock -stand</td>
<td>0.922</td>
<td>18</td>
<td>0.031</td>
<td>0.130</td>
<td>99.589</td>
</tr>
<tr>
<td>Hand reaction</td>
<td>0.974</td>
<td>19</td>
<td>0.029</td>
<td>0.119</td>
<td>99.708</td>
</tr>
<tr>
<td>Bass stick test</td>
<td>0.887</td>
<td>20</td>
<td>0.024</td>
<td>0.102</td>
<td>99.810</td>
</tr>
<tr>
<td>Single squat</td>
<td>0.917</td>
<td>21</td>
<td>0.018</td>
<td>0.074</td>
<td>99.885</td>
</tr>
<tr>
<td>Trunk lift</td>
<td>0.991</td>
<td>22</td>
<td>0.014</td>
<td>0.057</td>
<td>99.942</td>
</tr>
<tr>
<td>Sit and reach</td>
<td>0.956</td>
<td>23</td>
<td>0.009</td>
<td>0.038</td>
<td>99.980</td>
</tr>
<tr>
<td>600mts run/walk</td>
<td>0.965</td>
<td>24</td>
<td>0.005</td>
<td>0.020</td>
<td>100.000</td>
</tr>
</tbody>
</table>

*Analysis number- 1, Extraction Method, Principal Component analysis.*
*Percentage Variance of Rotated Factor loading (Varimax solutions)*
Table-5: Rotated Factor Loadings (Verimax solution)

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Test variables</th>
<th>Factor I</th>
<th>Factor II</th>
<th>Factor III</th>
<th>Factor IV</th>
<th>Factor V</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Standing vertical jump</td>
<td>0.034</td>
<td>-0.209</td>
<td>0.904</td>
<td>0.067</td>
<td>-0.010</td>
</tr>
<tr>
<td>2.</td>
<td>Standing broad jump</td>
<td>0.519</td>
<td>-0.350</td>
<td>0.147</td>
<td>0.358</td>
<td>0.149</td>
</tr>
<tr>
<td>3.</td>
<td>Hopping</td>
<td>-0.938</td>
<td>0.052</td>
<td>-0.110</td>
<td>-0.001</td>
<td>0.007</td>
</tr>
<tr>
<td>4.</td>
<td>Criss- cross</td>
<td>0.302</td>
<td>0.812</td>
<td>0.020</td>
<td>0.009</td>
<td>0.066</td>
</tr>
<tr>
<td>5.</td>
<td>Zig-zag running</td>
<td>-0.356</td>
<td>0.220</td>
<td>-0.052</td>
<td>0.327</td>
<td>0.611</td>
</tr>
<tr>
<td>6.</td>
<td>10yard backward running</td>
<td>-0.296</td>
<td>-0.609</td>
<td>0.015</td>
<td>0.138</td>
<td>0.192</td>
</tr>
<tr>
<td>7.</td>
<td>Shuttle run</td>
<td>-0.966</td>
<td>-0.173</td>
<td>0.103</td>
<td>0.040</td>
<td>0.051</td>
</tr>
<tr>
<td>8.</td>
<td>50 yard dash</td>
<td>-0.369</td>
<td>-0.233</td>
<td>0.065</td>
<td>-0.203</td>
<td>-0.028</td>
</tr>
<tr>
<td>9.</td>
<td>Side -stepping</td>
<td>0.975</td>
<td>0.150</td>
<td>0.036</td>
<td>-0.039</td>
<td>-0.004</td>
</tr>
<tr>
<td>10.</td>
<td>Sit- ups</td>
<td>-0.099</td>
<td>-0.091</td>
<td>0.096</td>
<td>0.865</td>
<td>-0.079</td>
</tr>
<tr>
<td>11.</td>
<td>Squat thrust</td>
<td>0.074</td>
<td>0.184</td>
<td>0.915</td>
<td>0.042</td>
<td>0.051</td>
</tr>
<tr>
<td>12.</td>
<td>Overarm hanging</td>
<td>0.972</td>
<td>0.116</td>
<td>-0.001</td>
<td>-0.029</td>
<td>-0.007</td>
</tr>
<tr>
<td>13.</td>
<td>No of dips</td>
<td>0.960</td>
<td>0.170</td>
<td>0.082</td>
<td>-0.036</td>
<td>-0.040</td>
</tr>
<tr>
<td>14.</td>
<td>Pull- ups</td>
<td>0.964</td>
<td>0.115</td>
<td>-0.057</td>
<td>-0.044</td>
<td>-0.049</td>
</tr>
<tr>
<td>15.</td>
<td>Full- squat</td>
<td>0.134</td>
<td>-0.246</td>
<td>0.079</td>
<td>-0.251</td>
<td>0.785</td>
</tr>
<tr>
<td>16.</td>
<td>Cricket ball throw</td>
<td>0.964</td>
<td>0.138</td>
<td>0.038</td>
<td>-0.059</td>
<td>-0.042</td>
</tr>
<tr>
<td>17.</td>
<td>skipping</td>
<td>0.926</td>
<td>-0.084</td>
<td>0.027</td>
<td>-0.054</td>
<td>-0.081</td>
</tr>
<tr>
<td>18.</td>
<td>Strock -stand</td>
<td>0.944</td>
<td>0.160</td>
<td>0.068</td>
<td>0.027</td>
<td>0.027</td>
</tr>
<tr>
<td>19.</td>
<td>Hand reaction</td>
<td>-0.956</td>
<td>-0.211</td>
<td>-0.118</td>
<td>0.029</td>
<td>0.033</td>
</tr>
<tr>
<td>20.</td>
<td>Bass stick test</td>
<td>0.929</td>
<td>0.142</td>
<td>0.049</td>
<td>-0.009</td>
<td>0.025</td>
</tr>
<tr>
<td>21.</td>
<td>Single squat</td>
<td>0.935</td>
<td>0.200</td>
<td>0.021</td>
<td>-0.031</td>
<td>-0.034</td>
</tr>
<tr>
<td>22.</td>
<td>Trunk lift</td>
<td>-0.980</td>
<td>-0.166</td>
<td>-0.035</td>
<td>0.020</td>
<td>0.037</td>
</tr>
<tr>
<td>23.</td>
<td>Sit and reach</td>
<td>0.946</td>
<td>0.241</td>
<td>0.048</td>
<td>-0.014</td>
<td>-0.033</td>
</tr>
<tr>
<td>24.</td>
<td>600mmts run/walk</td>
<td>-0.971</td>
<td>-0.128</td>
<td>-0.056</td>
<td>0.040</td>
<td>0.032</td>
</tr>
</tbody>
</table>

As it is mentioned earlier in this chapter that the factor analysis yielded five factors which is as follows:

**Factor-1** Appears to be primarily a speed, agility and coordination. The factor loading are as follows,
Table-6: Factor-I Factor Loadings

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Test Variables</th>
<th>Catalogue</th>
<th>Factor loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Standing broad jump</td>
<td>Test Item-2</td>
<td>0.519</td>
</tr>
<tr>
<td>2</td>
<td>Side-stepping</td>
<td>Test Item-9</td>
<td>0.975</td>
</tr>
<tr>
<td>3</td>
<td>Overarm hanging</td>
<td>Test Item-12</td>
<td>0.972</td>
</tr>
<tr>
<td>4</td>
<td>No of dips</td>
<td>Test Item-13</td>
<td>0.960</td>
</tr>
<tr>
<td>5</td>
<td>Pull-ups</td>
<td>Test Item-14</td>
<td>0.964</td>
</tr>
<tr>
<td>6</td>
<td>Cricket ball throw</td>
<td>Test Item-16</td>
<td>0.964</td>
</tr>
<tr>
<td>7</td>
<td>skipping</td>
<td>Test Item-17</td>
<td>0.926</td>
</tr>
<tr>
<td>8</td>
<td>Strock-stand (static balance)</td>
<td>Test Item-18</td>
<td>0.944</td>
</tr>
<tr>
<td>9</td>
<td>Bass stick test(dynamic balance)</td>
<td>Test Item-20</td>
<td>0.929</td>
</tr>
<tr>
<td>10</td>
<td>Single squat</td>
<td>Test Item-21</td>
<td>0.935</td>
</tr>
<tr>
<td>11</td>
<td>Sit and reach</td>
<td>Test Item-23</td>
<td>0.946</td>
</tr>
</tbody>
</table>

**Factor-I:** High factor loading variable the factor loading of 0.975 for side stepping is used to determine lateral speed, agility, and coordination. Speed the rate of change of successive movements of same pattern. Standing broad jump identified/ emphasized on the ability to exert maximum explosive energy on maximum effort. However over arm hanging, pull ups and dips are used to measure shoulder, upper arms strength and upper body endurance. Sit and reach measure flexibility of the lower back and hamstring muscles. Strock stand measures body balance which is bass stick test emphasize on the dynamic balance. The balance in term of static or dynamic act as slow movements or with change of direction and position. Cricket ball throw: this factor measures the ability to exert maximum explosive or energy in minimum effort or act. Single squat also measures leg strength and balance. It is true in context of specific physical fitness test battery for cricketers. The cricket ball throw, wherein strong shoulder strength and the whole body coordination in necessary to perform this test. Over arm hanging measures upper body strength and endurance while the performance with cricket ball throw has shown near about same significant loading as this factor. When logically analyzed it reveals only the importance of mostly the shoulder muscles explosive with respect to the whole body explosive strength. This may be cause of the fact that two individuals of equal explosiveness to perform such activity, than the one who could sustain the activity for longer duration would decline higher physical fitness.
Factor II: Two items were identified with power, speed and coordination factors of physical fitness.

**Table-7: Factor-II Factor Loadings**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Test Variables</th>
<th>Catalogue</th>
<th>Factor loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Hopping</td>
<td>Test Item-3</td>
<td>0.052</td>
</tr>
<tr>
<td>2.</td>
<td>Criss-cross</td>
<td>Test Item-4</td>
<td>0.812</td>
</tr>
</tbody>
</table>

Factor II: The items identified are criss-cross and hopping, where the first exhibit high significance loading. Whereas hopping has low significant loading. This factor identifies the characters of the factors determined as power, speed, balance and coordination. The horizontal and vertical power of the legs and balance and coordination of the body are very important factors for cricket players.
Graph-2: Factor-II Factor Loadings

Factor Loading

Factor-III: Appears to be primarily a explosive strength and speed with the highest loading variables were as follows,

Table-8: Factor-III Factor Loadings

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Test Variables</th>
<th>Catalogue</th>
<th>Factor loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Standing vertical jump</td>
<td>Test Item-1</td>
<td>0.904</td>
</tr>
<tr>
<td>2.</td>
<td>Shuttle run</td>
<td>Test Item-7</td>
<td>0.103</td>
</tr>
<tr>
<td>3.</td>
<td>50 yard dash</td>
<td>Test Item-8</td>
<td>0.065</td>
</tr>
<tr>
<td>4.</td>
<td>Squat thrust</td>
<td>Test Item-11</td>
<td>0.915</td>
</tr>
</tbody>
</table>

Standing vertical jump determines explosive strength. Explosive strength plays an important role in the fielding to jump and to throw over heads cricket ball.

The shuttle run and 50 yard dash have positive significance loading. Speed the rate of change of successive movement of the same pattern. Fast movements of the body (arms and legs) with a minimum numbers effort were designed in the test of the factors. Sprint 50 yard dash and shuttle run, which exhibit significance loading. The squat thrust shown the above table is highest factor loading is 0.915. This test item which is describes the quality and has a great importance for improving fitness level of cricket players. It is a true full body workout.
Factor-IV

Appears to be primarily a strength endurance factor where both the factors extracted has similar low characters.

Table-9: Factor-IV Factor Loadings

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Test Variables</th>
<th>Catalogue</th>
<th>Factor loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Sit-ups</td>
<td>Test Item-10</td>
<td>0.865</td>
</tr>
<tr>
<td>2.</td>
<td>600mts run/walk</td>
<td>Test Item-24</td>
<td>0.040</td>
</tr>
</tbody>
</table>

Many physical fitness factors contribute to excellence in physical fitness test including strength, speed power, endurance flexibility, agility etc. but the entire factor affect in the physical fitness. Which is 600 meter run/walk to determine measure of cardiovascular fitness which is very important factor for cricketers. The highest factor loading sit-ups identified to determine abdominal strength endurance this physical test have shown the maximum explosiveness and endurance to sustained the explosive for a substantiate duration. The abdominal area is the only body part which is not supported with skeletal frame, the part which links the upper and lower body segments.
Graph-4: Factor-IV Factor Loadings

![Factor Loading](image)

Table-10: Factor V- Factor Loadings

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Test Variables</th>
<th>Catalogue</th>
<th>Factor loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Zig-zag run</td>
<td>Test Item-5</td>
<td>0.611</td>
</tr>
<tr>
<td>2.</td>
<td>10yard backward run</td>
<td>Test Item-6</td>
<td>0.192</td>
</tr>
<tr>
<td>3.</td>
<td>Full- squat</td>
<td>Test Item-15</td>
<td>0.785</td>
</tr>
<tr>
<td>4.</td>
<td>Hand reaction</td>
<td>Test Item-19</td>
<td>0.033</td>
</tr>
<tr>
<td>5.</td>
<td>Trunk lift</td>
<td>Test Item-22</td>
<td>0.037</td>
</tr>
</tbody>
</table>

Factor -V

Zig-zag running appears to be primarily a reaction ability and measure of coordination movement and speed. Full squat develops the athlete's legs strength. It is true with respect in context to specific physical fitness test battery for cricketers. Full squat shown the highest factor loading is 0.785. This factor emphasis is developed the athlete's legs strength, squat also help maintain stablity and creat a good base for cricket plyers. Backward running which is also helpfull for cricketers during receiving the high catch. Like other batting sports, cricket requires exceptional hand-eye coordination. Running in cricket is quite complex and not just running straight or walking, jogging, running at controlled speed, and jogging backward is an important components of cricket, fielding is an also important part of cricket. The role of fielders including saving runs particularly is the shorter format. Backward running gives a fabulous cardiovascular workout for cricket players. Backward running is
recommended for the rehabilitation of overuse injuries and knee joints problems, because it increases the strength and power of the quadriceps muscles while reducing compressive force at the knee joint, preventing over stretching of the anterior cruciate ligament (ACL) and decrease force absorptions. Hand reaction test is the true representative of this factor, this factor emphasis on the ability to react faster and faster which is very important for cricket players. The flexibility is the factor that same extent determines the agility.

**Graph-5: Factor-V Factor Loadings**

![Factor Loading Graph](image)

### 4.4 Development of the Specific Physical Fitness Test Battery

The bringing together of several tests, which turn out to measure the same factor, is not very efficient. According to Fleishman, (1963), “Inefficient test batteries are those with too many tests on one factor and none from one or more of the other factors identified”. Furthermore, “the addition of more than one test per factor adds relatively little new information about a subjects abilities relative to the addition of the test from separate factor”. The coaches or trainers have countles test to choose from. The problem is to choose those tests which gives the best coverage to the most important Specific Physical Fitness factors.

Here, the test items were selected to be included in the test on the basis of the results obtained from the factor analysis to serve as the criteria to measure the Specific Physical Fitness Test of cricketers of north zone level interversity players. In this
connection, the size of the test’s factor loading was examined on its primary factor loadings as well as on how pure the test was measuring the factor indicated by near zero loadings on the factors covered better by the other factors. If two test were approximately equal in meeting these demands, the test having a higher degree of correlation with the criteria was chosen.

Out of the 24 variables subjected to stastitical analysis, five variables have been shortlisted for constructing a Specific Physical Fitness Test battery for North-zone interversity level cricketers. The criteria considered for the developing the test were as mention below:

1. Objectivity and reliability co-efficient of the selected test items.
2. Rotated factor loadings of variables.
3. Communality of the variables.
4. Identified component of specific physical fitness with respect to the selected test items.

Considering the administrative feasibility, logistic and practical application following Specific Physical Fitness Test is recommended for cricketers of North-zone level of interversity players.

1. Side Stepping
2. Criss-Cross Test
3. Squat Thrust
4. Sit-ups
5. Full-squat

Finally, these tests need no sophisticated or specific equipments to be used. It is very easy to conduct with high reliability, with no need for any specific training to teachers, coaches and trainers.

**Table-11: Constructed & Validated Specific Physical Fitness Test Battery for North-Zone Intervarsity Level Cricket Players.**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Factors</th>
<th>Test items</th>
<th>Factor loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Factor-I</td>
<td>Side Stepping</td>
<td>0.975</td>
</tr>
<tr>
<td>2</td>
<td>Factor-II</td>
<td>Criss-Cross Test</td>
<td>0.812</td>
</tr>
<tr>
<td>3</td>
<td>Factor-III</td>
<td>Squat Thrust</td>
<td>0.915</td>
</tr>
<tr>
<td>4</td>
<td>Factor-IV</td>
<td>Sit-ups</td>
<td>0.865</td>
</tr>
<tr>
<td>5</td>
<td>Factor-V</td>
<td>Full-squat</td>
<td>0.785</td>
</tr>
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</table>
Above Test battery would consist of the most valid measure of the five factors identified.

Graph-6: Percentage Variance of Rotated Factor Loadings

Preceding test battery is easy to administer with high reliability and need no complicated equipment to use. All the tests in the battery are easy to understand both by administrators as well as players.

4.5 Development of Norms

Without norms no test is Applicable. The development of norms was one of the objectives of the study. A test that has accompanying norms is definitely preferred to one that does not. They provide information to the students and the teachers. They may be useful to them to interpret the subject scores in relation to the scores made by other individuals in the same population. Like the Specific Physical Fitness Test the norms are usually based on specific specialized group, levels of participation, level of achievements, sex, age, and various combinations of these.

In the present study norms have been developed for Male Cricketers of North-zone Intervarsity Level Players of the age group between 18 to 25 years. The norms have been developed through percentile rank only as it is found easier for all teachers, coaches, trainers, researchers and testers to compare the results (Barnett and Peters,
Moreover percentile rank provides a quick comparison with all other scores in the group (Chow and Henderson, 2003).

**Table-12: Percentile Norms of Specific Physical Fitness Test Battery For North-Zone Intervarsity Cricket Players**

<table>
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<tr>
<th></th>
<th>Side stepping</th>
<th>Criss-Cross Test</th>
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Chapter-5

Summary, Conclusions and Recommendations
CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Physical fitness abilities are perhaps one of the most controversial aspects of one's personality. It is the most elusive quality and has been frequently defined in rather abstract terms. Physical fitness abilities are the state which characterizes the degree to which the person is able to function. According to some health and fitness experts, (Ljach and Starosta, 2001; Malina, 2004) the way each human being lives will be a major determining factor for the health and fitness of that individual. "Quality of Life" has become one of the major aims of contemporary societies. Society is constantly changing and this is mirrored within the profession of physical education and exercise sciences. One of the most important goals of the physical educationist, coaches, etc. is to develop physical fitness program and improve the quality of human beings.

The concept and importance of Physical fitness is one of the facts of a person’s all round harmonious development. Physical fitness is the cultural phenomenon of great complexity and magnitude, which is historically, preconditioned level of health and comprehensive development of a person. Physical fitness adds grace to the young, wealth to the poor, and ornament to rich and acts as a consoling factor to the old. The place of physical fitness in any society reflects something of that society’s characteristics. Today almost every country in the world gives importance to development of sports in order to improve the nation's health and for the well being of the future generation. Throughout the history of mankind physical fitness has been considered an essential element of everyday life. The ancient people were mainly dependent upon their individual strength, vigor and vitality for physical survival. This involved mastery of some basic skill like strength, speed, endurance, agility for running, jumping, climbing and other skills employed in hunting for their livings. Over the past four decades, there has been an increase in the prevalence of overweight and physical fitness deterioration in adult across all genders, ages and racial/ethnic groups (Ichinohe, mita & Saito, 2004). Basically, Physical fitness is fundamental to public health. This has an influence on the risks of morbidity and mortality, and therefore can reduce these risks. Disease prevention and health promotion should be implemented as early as possible both in childhood and adolescence. Previous studies
have focused on specific health behavior (Yen, 1997; Chen, 2003). Low levels of physical activity and cardio-respiratory fitness are both associated with higher risk of all cause and disease specific mortality (Thune, Njolstad, Lochen, & Forde, 1998). The negative effects of degraded physical fitness on both the individual and society are serious and multi-dimensional. It can cause many risk factors to health including coronary heart disease, certain forms of cancer, diabetes, depression, hypertension, stroke, gall bladder diseases, osteoarthritis, respiratory problems, and gout and is associated with increases in all-cause mortality (Cataldo, 1986). Bucher (1983) opinions, physical fitness includes more than muscular strength. He further enunciates that physical fitness implies soundness of the body organs such as heart and lungs, a human mechanism that perform efficiently under exercise or work conditions, and reasonable measure of performance in selected physical activities. Uppal, (1992) defines physical fitness as the capacity to carry out reasonably well various forms of physical activities without being unduly tired and includes qualities important to the individuals health and wellbeing. Troester Jr. (1957) stated that the physical fitness includes those qualities which will permit an individual to perform life activities involving speed, strength, agility, power and endurance and to engage in various kind of physical activities required of modern-day living including sports and to be able to maintain optimum amount of fitness for the individual involved.

Although heredity plays a part to a large degree, but these abilities are acquired characteristics (Dollman, 1999; Bruininks and Bruininks, 2005). This clearly indicates that present way of living in an automotive society, switch button style of living where advertising woes, medical quackery, fake short-cut and other temptations, embraces human being on all sides (Okely, Booth, & Patterson, 2001). It is of great concern to every individual in general and physical educationist in particular to take stock of all these situations and feel concerned about the fitness of the nation (Gheysen, Loots, & Waelvelde 2008). The first and foremost duty of the physical educators is to devise testing protocols for the measurement and evaluations of general fitness and specific fitness of all the individuals of the nation and then suggest specific programs for the improvement. Developing general norms of general fitness and specific fitness is a great challenge for an individual. However, this task can be accomplished by dividing the Indian Territory and specific groups on the basis of specialized groups into smaller parts and develop some fitness norms to evaluate
conditions of each part separately. Assessment as measurement of individual performance is needed to determine status of physical fitness in general and specific physical fitness, precisely to activities which meet the unique needs of the developing the individual, and the evaluation will help to understand the present levels of their performance in specificity.

The importance of specific fitness involves focusing the fitness goals of an athlete to meet the specific needs of an activity. Specific physical requirements of that sport and then target exercises that will increase their fitness in those areas. An awareness of specific fitness can help athletes excel in their chosen sports because it directly connects their workouts to their performance in their sport. The primary benefit of this sport-specific fitness technique is that the athlete wastes little energy building fitness levels in areas that are not directly beneficial to his or her sport. As useful as sport-specific fitness can be in maximizing an athlete's performance at a given task, there can be some negative consequences if an athlete does not maintain an awareness of his or her overall fitness. It also is important for athletes to remember that achieving their specific fitness goals usually will require some degree of overall fitness. Cricket fitness training is a form of sport-specific training designed for cricket players. The top cricket players in the world use fitness plans to developed and customized for their needs by their coaches. Basically cricket is a physically demanding sport. Players need to be capable of high intensity bursts of energy, but they also need the endurance to make it all the way through a match. Coordination, flexibility, and agility are also important as cricket players move around all over the ground during fielding. People who play cricket professionally and who want to develop their amateur games need fitness training to be able to take their performance to the next level. A number of well known sports scientist researchers, coaches, trainers and physical educationist have advocated the doctrine of specificity in sports training that is training for fitness related to that sport. Loarance and Gross (1977) stated that “if your main objective is sports, it is better to play that sport”. This phenomenon in physiology is called “specificity”. It means, if you want to train for any event, you practice that event in a manner that stimulates the requirement.

In sports you must be specific. “Specificity” means adaptation to the imposed demands. The body responds to the way demands are placed on it. If you function in certain way your body begins to take that shape. The fitness of cricketers which is
specific to that game has no utility for the fitness of other games. Here the concern of
researcher is specific fitness, particularly for the game of cricket. Sodhi and Sindhu
(1984) define specific fitness of a sports- man as “The fitness that serves as a pre-
condition required for particular sports. Fitness involves focusing the fitness goals of
an athlete to meet the specific need of an activity. The term is most common when
referring to athletes who play a particular sport; the athletes identify the specific
physical requirements of that sport and then target exercises that will increase their
fitness in those areas. Tewarson (1983) remarks that “This era has become an age of
specialization but of super -specialization as well as micro specialization”. Henry,
(1958) who is pioneer in the field of specificity, says that “there is a degree of
generality and specificity in the performance of motor tasks. In connection with the
development of general motor abilities, tests were supposed to measure the degree of
generality in the performance of physical task and vice versa.”

The data and information collected for the study was rich, both in content and
magnitude. The findings presented in the preceding chapters, therefore, cover only
those crucial aspects which were in accordance with the scope and objectives of the
study.

Due consideration has been given to the diverse characteristics of the sports
undertaken, batting, bowling, fielding, wicket keeping, (fast and spinners) etc. in
order to select the subject as true representative of north-zone cricket intervarsity
players only. The players from 18 to 25 years of chronological age have been taken in
the study. The study is delimited to 80 percent of university level player’s for the
development of norms. To justify, every member of the team was considered as
subject for the study from the randomly selected North-zone level cricket players. The
universities give serious consideration to all the sections, batting, bowling, etc. in
forming a team to represent them. Thus the subjects selected were justified for the
study.

By reviewing the standard general and specific test batteries available, the most
prominent test variables which have been used by well known physical fitness test
batteries, 48 test variables, which were predicted to measure the different components
of specific physical fitness of North-zone intervarsity level players, were selected
from a wide variety of components of test items. The subjects of this study were
cricket players between 18 to 25 years of chronological age. All the players were randomly obtained from different universities who were participating either or had participated earlier. Before construction of specific physical fitness test battery, with the help of pilot study the researcher has found to explore sample for the ‘construction phase’ of 50 players, and they were exposed to 48 different motor skills tests. The pilot study develops the preliminary test battery and a protocol for each of the test items that were representative of the task performed by North-zone level cricketers. In order to develop the test battery information was obtained through review of related literature, including a task analysis, and physical data of cricketers.

Furthermore, the final sample for construction of specific physical test battery and protocol for each test items was developed. Sample population of 120 players was exposed to 24 different motor skills for construction of test battery. And the researcher brings out the Objectivity, reliability and Validity of the test items. The data collected was subjected to factor analysis in (SPSS), version 17.0. Since factor analysis starts with the correlation matrix was initially obtained. Then Principal Components Analysis method was used to extract factors, which generated five factors. Then the factor matrix was extracted to have rotated factor loadings. By considering the administrative feasibility, logistic interpretation with respect to the pertinent field of application, rotated factor loadings and communality a test battery of five items was developed to measure the specific physical fitness for North-Zone intervarsity level cricket players. The test items for the Specific Physical Fitness Batteries are as follows:

1) Side-stepping
2) Criss-cross test
3) Squat thrust
4) Sit-ups
5) Full Squat

Further these tests have been administered to those selected North-Zone level University Players and the norms have been developed.

Within the constraints of this study followings were deduced.
base strength of the players. It is very useful and beneficial to enhance the performance of the modern cricket players. Squats are the fastest way to build strength in the legs strength and more power with less injury. It is a powerful way to improve mobility in the hips. It is fact that the squat is powerful and flexible exercise that is adaptable to your needs as a cricketer. Therefore, the requirement of keepers are to be a hard as other players have unique fitness need compared to the rest. The frequent squatting down require a lower body strength and core stability. So the purpose of specific test battery accomplished, because the full squat test is fulfilling our aim which is important component for wicket keeper.

The test developed stands the criteria of a statistical significant authenticity, administration feasibility, practical orientation and educational application in the field and physical education, sports sciences and training, and will help in assessing the specific physical fitness of cricketers.

Conclusion:

Based on the findings of the statistical analysis, critiques and experts deliberations in the light of critical literature and scientific information on the performance demands of specific fitness of cricketers. Existing knowledge could be complemented by obtaining the considered opinions and insights of coaches and players. This information would also provide a framework for the development of design of batting, bowling, wicket keeping and fielding a specific assessment, focused on training, conditioning and coaching protocols. This should enhance all type performance and contribute to the ultimate goal of winning matches. A systematic research programme covering all components of all game formats would be beneficial. In this chapter all the five test items drawn on the basis of factor loadings correlates significantly with cricketers required specific fitness attributes. In the light of facts the following conclusions were drawn.

1. Factor Analysis, Rotated Varimax solution significantly and appropriately identified the test items for the Specific Physical Fitness Test for North-zone level cricketers.
2. Every sports explicitly differs the demand of the physical fitness ability and the specific physical fitness ability varies from one to another. The test variables showed a significant realness to on ground pragmatics.

3. A cricketer, batsman, bowler, fielder, and wicket-keeper differs in quality and quantity of fitness components, like, balance, co-ordination, reaction ability (sharp movement/ability to change hands or foot), etc. The test items derived indisputably represent the specific physical fitness components of cricketers as a whole.

4. The first test items obtained by constructed and validated design test battery is side stepping (also known as side step dodging, spot dodging, ground dodging or simply one step sequence). This test items aims to measure the sprinting speed as well as endurance of the cricketers.

5. The second test item obtained by constructed and validated design test battery is Criss -Cross. This test items aims to measure the whole body co-ordination and foot work ability of the cricketers.

6. The third test item obtained by constructed and validated design test battery is Squat Thrust. This test item describes the quality and has a great importance for improving fitness level of cricket players. It is a true full body workout. Holding yourself in the right body position will engage your arms, chest and core muscles.

7. The fourth test item obtained by constructed and validated design test battery is Sit-up (60 second). Sit-ups test primarily measures the abdominal and hip-flexor muscles, strength and endurance.

8. The fifth and last physical test item obtained by design test battery of specific physical fitness is Full Squat. Full squat is one of the best test which measures the maximum strength in the cricket players.

9. The Percentile rank based norms of each test items were appropriately developed considering all the standard procedures.

In the light of above mention discussion researcher reached the conclusion that these test items are highly specific in measuring the specific physical fitness for cricket players which is very demanding now-a day’s cricket.
Recommendations:

In the light of conclusions drawn, following recommendations worthy of consideration are made,

1. Due to constrain of the time framed for this study only major components of specific physical fitness ability and rather smaller numbers of test variables were included. Therefore, it is recommended that a same study be conducted considering all the motor, general physical and specific fitness components and a large number of variables and test items.

2. The same study may be conducted in regard to female players.

3. Similar study may be conducted in regards to players of both sexes, belonging to below and above level players.

4. A study may be taken up considering the players of all levels and other sports. Further, the study may be conducted in particular to sports so that the comparison may be done among the sports and level of participation.

5. The study may also be taken up in other state and geographical contest.

6. The area which has not been covered may be taken up in further study.

7. In order to bring improvement in specialized area (batting, bowling, wicket keeping and fielding, etc) of cricket more similar studies may be conducted, which will enable the physical educationists, teachers, coaches, trainers, other associates with much wide vision to judge and place players in correct program.

8. In this study, the norm has been prepared as a whole for cricketers and not of specialized areas (i.e.: batsman, bowlers, etc); hence, similar norm(s) may be developed considering each specialization separately.

9. The present study should be replicated and expanded. Data bank should be expanded and norms for other states should be developed.

10. Further researches should be conducted taking into consideration of special peoples.

11. More research is needed in order to substantiate the results of this study.

12. Future studies may be taken to develop ‘Criterion-Referenced Standard’ for the same proposed test.
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Appendices
### Raw Data of 24 Test Items

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Introduction

Sports and games unite individuals, societies and nations. A competitive sport is a universal passion and usually seen as an alternative to the smiles which remove barriers. Sports have now achieved a significant position in the culture of the society and this culture is measured through its achievement in sports. Test and measurement in the field of physical education are relatively recent outgrowth of the general testing movements. Beginning late in the 19th century as strength test, test of track and field and anthropometric measurement, they have increased in number and completeness with amazing rapidity. During most of the skills on abilities measured, the development of test in physical education had avoided many of the pitfalls that have been encountered by test builders in the mental discipline (Fieg et and Kolobe 2002).

Hence, there is a need to pay attention specific fitness to a great extent. On the basis of different findings by researchers and sports scientists, that fitness has been analyzed as the degree of a person to function effectively, and the aim to fill his potential. Many researchers, scientists and physical educationists have written much about the "principles of specificity". But very few have defined a specific fitness. As Singh (1984) has stated that each sport activity demands different types and levels of different motor abilities and when a sports man possesses these, he is said to have specific fitness. The concept of specific physical fitness test requires that the test avoid as much as possible highly specialized skills (Haywood and Getchell, 2005). In considering the construction of a physical fitness test battery for players of any chronological age, growth, and maturational characteristics of the subjects.

Moreover, administrative feasibility; available of economy of time, tools and the practice of testing a maximum number of subjects should be considered in developing an effective physical fitness test battery (Bravo, 1994). Though a small number of scientifically constructed physical test battery for players of different games is available (Girard, 2006). No
specific physical fitness test battery is existing for the batsman cricketers of any age. Sport-specific tests are increasingly popular in modern sports and are mostly developed to replicate characteristic sport performances, with the main idea of them being similar to real-life sport situations. It is generally accepted that these tests are more appropriate than standard tests (General Fitness Tests) for assessing athletes' capacities that are challenged during a real competition (Meckel, 2009), the appropriate variables for sport-specific selection and orientation (Sattler, 2012), and the physical qualities that are useful for discriminating between different positions in team sports (Kondrie, 2012; Mechlin, 2009).

Therefore, the fitness of a cricketer which is specific to the game has no utility for the fitness of other game. Cricket occupies a significant place among all other games and sports. In some respects it is unique as a sport. Cricket requires specific physical fitness characteristics to be on top gear to take all the qualities in the match. In some respects it is unique as a sport. It is an ideal sport and is a giving enjoyment and pleasure and demanding fitness and dedication. Even though cricket is one of the oldest organized sports, there are very few studies on the physical demands of the game (Woolmer and Noakes, 2008; Christie and King, 2008; Christie, 2008). Batting is intermittent in nature with the demands placed on the players being dictated by the type of match being played. Due to this stop-start nature of cricket, accurate assessments are often difficult and as such, research is sparse (Bartlett, 2003).

Here the concern of researcher is construction of specific physical fitness, particularly for the batsman game of cricket. Cricket batsman fitness training is a form of sport-specific training designed for batsman cricket players. During an innings two members of the batting side are on the pitch at any time: the one facing the current delivery from the bowler is denoted the striker, while the other is the non-striker. Batting tactics and strategy vary depending on the type of match being played as well as the current state of play. The main concerns for the batsman are not to lose their wicket and to score as many runs as quickly as possible. The top cricket players in the world use fitness plans to developed and customized for their needs by their coaches. And other people can consult with personal trainers and cricket coaches to get advice on creating a cricket fitness training program, provide information and assistance with fitness training, including recommended workout schedules that people can use as a base for the program. Cricket is a physically demanding sport. Players need to be capable of high intensity bursts of energy, but they also need the endurance to make it all the way through a match. Brute muscular power is not a liability to this position, but reaction time, batting technique, and balance in the crease are of basic importance. A batsman may be required to maintain his position for a number of hours. The cricket batting stroke relies upon core strength, particularly in the abdominal and oblique muscle groups, the glutest muscles, and the upper arms and shoulders.

Therefore argue that only the best physically prepared cricketers will perform better, more consistently and with fewer injuries and, in turn, will enjoy longer and more illustrious careers. Thus, understanding the specific fitness placed on players and in particular batsmen respectively. It is important to recognize fitness level, skills and mental aptitude needed to succeed for a good batsman in the game of cricket (Woolkes and Durandi, 2000) Specific Physical Fitness of the game enhancing and bringing the game forward, even though, scientific and systematic, approach of training and research in the field of cricket contributes to improved performance.

**MATERIALS AND METHOD**

**Subjects**

This subjects for the study were 30 intervarsity cricket players specialized in batting. The chronological age of the players was between 18 to 25 years. They were recruited randomly from various universities participated in North-zone Intervarsity Cricket tournament held at Allgarh Muslim University, Allgarh. No grouping of players was made during this phase. The sample for the construction phase was 50 players exposed to sixteen different fitness items. Then after taking data, all the skills were raised through factorial analysis.

**Variable and Test Items**

In order to select the broad component of test, the available literature of physical fitness were critically reviewed and opinions of experts regarding these tests obtained. Also existing literature on the appropriate component of physical fitness in Indian geographical condition/situation were considered. All the components of the physical fitness were considered. On the basis of these the following components for the specific physical fitness test for cricketer are considered. The physical fitness components are: Strength, Endurance, Agility, Flexibility, Coordination and Balance.

During the process of selection of the components of specific fitness test, the test items for each components were also identified along with and 16 test items were considered as: Standing vertical jur;-, Sit - ups, Dips, Pull - ups, Zigzag, Shuttle run, 50 yard dash, Side - stepping, Squat Thurst, 600mns run/walk, Coss-cross, Skipping, Stroke Stand, Trunk Lift, Sit and reach, and Head Reaction.

**Method of Execution**

Each experimental test items administration was adhered strictly administration procedure outline and protocol.

**Statistical Analysis**

The results have been obtained through the statistical package social sciences SPSS version, 17.0. The Pearson product formula has been utilizing for correlation of variables and the matrix of inter correlation among the sixteen variables was obtained. The data was then being factor analysis. The principal component analysis was used to extract factors. Varimax rotation (Kaiser’s normalization) was used to generate rotated factor matrix. After that the rotated factor matrix was used to the selected factor for analysis of data.
RESULTS AND DISCUSSION

In this study Considering the Eigen value, rotated factor loadings, communality, a construction of specific fitness test for the batsman in the sports of cricket. The obtained data was analyzed by the statistical procedure of Factorial analysis. The factor analysis was done by SPSS version 17.0.

Table-1 : Descriptive analysis of 16 fitness test items.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Test Variables</th>
<th>Catalogue</th>
<th>Mean</th>
<th>S.D.</th>
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<td>Standing vertical Jump</td>
<td>Test item-1</td>
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<td>4.</td>
<td>Pull- ups</td>
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</tr>
<tr>
<td>11.</td>
<td>Criss-cross</td>
<td>Test item-11</td>
<td>10.914</td>
<td>2.490</td>
</tr>
<tr>
<td>12.</td>
<td>Skipping</td>
<td>Test item-12</td>
<td>56.371</td>
<td>7.818</td>
</tr>
<tr>
<td>13.</td>
<td>Stroke Stand</td>
<td>Test item-13</td>
<td>14.435</td>
<td>2.221</td>
</tr>
<tr>
<td>14.</td>
<td>Trunk lift</td>
<td>Test item-14</td>
<td>32.447</td>
<td>3.392</td>
</tr>
<tr>
<td>15.</td>
<td>Sit and reach</td>
<td>Test item-15</td>
<td>9.759</td>
<td>4.485</td>
</tr>
<tr>
<td>16.</td>
<td>Head Reaction</td>
<td>Test item-16</td>
<td>29.200</td>
<td>9.483</td>
</tr>
</tbody>
</table>

In this study Table 1 displays the descriptive statistics analysis and of mean and SD of the selected sixteen experimental test items which were administered on the batsman who played as subject in this study for obtaining the data. The mean of standing vertical jump in item number-1 is 40.829 and SD is 2.844. The mean of sit-ups in item number-2 is 45.057 and SD is 8.095. The mean of dips in item number-3 is 32.429 and SD is 12.675. The mean of pull-ups in item number-4 is 11.429 and SD is 4.189. The mean of zig-zag in item number-5 is 9.195 and SD is 0.893. The mean of Shuttle run in item number-6 is 10.187 and SD is 0.393. The mean of 50 yard dash in item number-7 is 6.306 and SD is 0.487. The mean of Side-stepping in item number-8 is 17.000 and SD is 2.195. The mean of Squat Thrust in item number-9 is 9.714 and SD is 1.808. The mean of 600mths run/walk in item number-10 is 1.417 and SD is 0.083. The mean of Criss-cross in item number-11 is 10.914 and SD is 2.490. The mean of Skipping in item number-12 is 56.371 and SD is 7.818. The mean of Stroke Stand in item number-13 is 14.435 and SD is 2.221. The mean of Trunk lift in item number-14 is 32.447 and SD is 3.392. The mean of Sit and reach in item number-15 is 9.759 and SD is 4.485. The mean of Head Reaction in item number-16 is 29.200 and SD is 9.483.

Factor Analysis: The purpose of factor analysis is to explore the under lying variance structure of a set of correlation coefficient. Thus, factor analysis useful for exploring and verifying patterns in a set of correlation coefficient” (Brown, 2001).

Table-2 : Representing Factor Loading of factor I.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Test Variables</th>
<th>Catalogue</th>
<th>Factor Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Dips</td>
<td>Test item-3</td>
<td>0.974</td>
</tr>
<tr>
<td>2.</td>
<td>Pull- ups</td>
<td>Test item-4</td>
<td>0.978</td>
</tr>
<tr>
<td>3.</td>
<td>Side stepping</td>
<td>Test item-8</td>
<td>0.977</td>
</tr>
<tr>
<td>4.</td>
<td>Skipping</td>
<td>Test item-12</td>
<td>0.918</td>
</tr>
<tr>
<td>5.</td>
<td>Stroke stand</td>
<td>Test item-13</td>
<td>0.950</td>
</tr>
<tr>
<td>6.</td>
<td>Sit and reach</td>
<td>Test item-15</td>
<td>0.968</td>
</tr>
</tbody>
</table>

Construction of Specific Physical Fitness Test for Batsman
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Ahsan Ahmad, Ikram Hussain and Fuzail Ahmad

Factor I: The highest factor loading test variables the factor loadings 0.978 to pull-ups is used to determine to measure shoulder, upper strength and upper body endurance. Followed by side stepping is used to lateral speed, agility, and body control. However sit and reach to measure flexibility of the lower back and hamstring muscles. Stock stand measure body balance. The balance act as show the movement or with change of direction and position. When logically analyzed it reveals only the importance of mostly the shoulder muscles with respect to the Strength.

Fig. 1: Representing the highest factor loading of Factor I

![Factor Loading Diagram](image)

Table-3: Representing Factor Loading of factor II.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Test Variables</th>
<th>Catalogue</th>
<th>Factor Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Standing vertical jump</td>
<td>Test item-1</td>
<td>0.925</td>
</tr>
<tr>
<td>2.</td>
<td>Sit-ups</td>
<td>Test item-2</td>
<td>-0.006</td>
</tr>
<tr>
<td>3.</td>
<td>Shuttle run</td>
<td>Test item-6</td>
<td>0.086</td>
</tr>
<tr>
<td>4.</td>
<td>Squat thrust</td>
<td>Test item-9</td>
<td>-0.915</td>
</tr>
</tbody>
</table>

Factor II: These four test items were identified in four different components of physical fitness i.e. standing vertical jump to determine explosive strength. The shuttle run and 50 yard dash have significance positive loading. Speed the rate of change of successive movement of the same pattern. The squat thrust shown the above table is highest factor loading is 0.915 this test item describing the quality and has a great importance for improving fitness level of crackers.

Fig. 2: Representing the highest factor loading of Factor II

![Factor Loading Diagram](image)
Table-4: Representing Factor Loading of factor III.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Test Variables</th>
<th>Catalogue</th>
<th>Factor loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Zig-zag running</td>
<td>Test item-5</td>
<td>0.478</td>
</tr>
<tr>
<td>2.</td>
<td>Criss-cross</td>
<td>Test item-11</td>
<td>0.723</td>
</tr>
</tbody>
</table>

Factor III: Zig-zag running appear to be primarily reaction ability and measure of coordination movement and speed. Criss-cross shown the highest factor loading is 0.723 this factor emphasis the development of athletes improve agility for rapid and accurate directional change in play, it improve body awareness and eye, and foot coordination.

Fig. 3: Representing the highest factor loading of Factor III

Table-5: Representing Factor Loading of factor IV.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Test Variables</th>
<th>Catalogue</th>
<th>Factor loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>60 yard Dash</td>
<td>Test item-7</td>
<td>0.958</td>
</tr>
<tr>
<td>2.</td>
<td>600 mts run/walk</td>
<td>Test item-10</td>
<td>0.138</td>
</tr>
<tr>
<td>3.</td>
<td>Trunk lift</td>
<td>Test item-14</td>
<td>0.050</td>
</tr>
<tr>
<td>4.</td>
<td>Hand reaction</td>
<td>Test item-16</td>
<td>0.021</td>
</tr>
</tbody>
</table>

Factor IV: Many physical fitness factor contribute to excellence in physical fitness test including strength, power, endurance flexibility, agility etc. But the entire factor affect in the physical fitness. Which are 600 meters run/walk determine measure of cardio-respiratory fitness. In this table 50 yard dash shown the highest factor loading is 0.958, speed as the rate of motion or velocity. Hand reaction this factor emphasis react faster. However, Trunk lifts has shown the flexibility in this factor.

Fig. 4: Representing the highest factor loading of Factor IV

CONCLUSION

Based on the findings and statistical analysis, critiques and experts deliberation in the light of critical literature and scientific information on the performance demands of construction of specific physical fitness test for batsmen, cricketers. Existing knowledge could be completed by obtaining the considered opinions and insides of coaches and players. This information would also provide a framework for the development of design of batting a specific assessment, focused on systematic training, conditioning and coaching protocols.

In the light of facts the following conclusions were drawn.

1. Factor analysis Rotated Varimax solution significantly and appropriately identified the test items for the

Construction of Specific Physical Fitness Test for Batsman
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35
construction a specific physical fitness test for batsman for North - Zone level cricket players.

2. Every sport differs from one to another and the demand of specific physical fitness ability in various games/jobs.

3. A batsman differs from bowlers, fields etc in a quality and quantity of fitness components like balance, reaction ability (sharp movement ability to change position immediately). The test items derived indisputably represent the specific physical fitness components for batsman.

Table-6: Constructed specific physical test battery for batsman (cricket).

<table>
<thead>
<tr>
<th>Factor</th>
<th>Test Item</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pull-ups</td>
<td>0.978</td>
</tr>
<tr>
<td>2</td>
<td>Standing Vertical Jump</td>
<td>0.925</td>
</tr>
<tr>
<td>3</td>
<td>Criss-cross</td>
<td>0.723</td>
</tr>
<tr>
<td>4</td>
<td>50 yard dash</td>
<td>0.558</td>
</tr>
</tbody>
</table>

Factor-1 is Pull-up which is the first test item obtained during the construction of test battery. Pull-ups used to measure shoulder, upper arm strength and upper body endurance. It's very important test items for batsman in cricket, because for playing full stroke is to be needed shoulder and upper body strength.

Factor-2 is standing vertical jump the second test items obtained by constructed design test battery. Vertical bat shots can be played either off the front foot or the back foot depending upon the predictable height of the ball at the moment. It reaches the batsman, the characteristic position of the bat is a vertical alignment at point of contact. Vertical bat shots are typically practiced to accurately judge the line of the ball. The batsman should have explosive power for quick movement and immediate acceleration or pickup the run during matches.

The third factor is Criss-Cross, physical fitness test can improve agility for rapid and accurate directional change in play. It improves body awareness and eye, hand and foot coordination. It helps to develop explosive start speeds and footwork for running events; develops upper-body momentum, and anaerobic fitness. Criss-cross is more beneficial for testing overall fitness and physical efficiency for batsman needed in cricket.

The last and fourth factor is 50 yard dash have positive significance loading. Speed is the rate of change of successive movement of the same pattern. Fast movements of the body (arms and legs) with a minimum numbers effort were designed in the test of the factors. 50 yard dash sprinting is to be needed to run between the wickets.

In the light of above mentioned discussion researcher reached the conclusion that these test items are highly specific in measuring the specific physical fitness test for batsman in the game of cricket.

All authors declared there is not any potential conflict of interests regarding this article.

REFERENCES


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