Chapter II

Review of Related Literature

The researcher has made every effort to study the literature related to the problem in the game of Korfball. For this purpose, maximum possible efforts were need by spending considerable time in the major libraries presenting to the literature on physical education and sports. The researcher had access to the libraries of Pune University, Pune, Chandrashekhar Aagashe College of Physical Education, Pune. A brief review of the studies relevant to the problem has been presented in this chapter. The literature pertaining to the study has been abstracted in this chapter to provide the background material so as to evaluate the study well as to interpret its findings. The reviews were classified under the following main heads.

2.1 Studies on Skill Development in different games and Sports

Poteat\(^1\) (1985) developed a skill test to determine a racquet ball playing ability of male and female college student. 54 males and 53 females from beginning racquet ball classes were administered 2 trails of the test. 43 subjects were then-co-administered the test to determine stability re ability. All items in the skill test battery were found to have moderate to high internal consistency reliability, stability reliability and current rapidity. A panel of 3 experts on predetermined criteria evaluated 48 subjects. The ‘r’ of the individual test battery items and the corresponding score by the expert were high (r=0.75-0.84). The ‘r’ among the test battery items suggested the test test battery should contain the following items back wall forehand shot, back wall back hand shot, serve and wall rally.

Gromer\(^2\) (1987) designed a battery of tennis skill test and studies the reliability and validity. The tennis skill test battery consisted of a forehand-backhand test and a serve speed/accuracy test. Special court markings and special equipment were not necessary for test administration. The subjects were 189 male and female college students who were enrolled in combined beginner and intermediate tennis classes at the University of Texas at Arlington. Subject participated in the round-robin tennis tournament after

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6 weeks of tennis instruction. The subsequent ranking obtained from tournament served as the criterion for the validation of the test battery. The Pearson method was used to correlate test score with rank for determination of test validity. This method was also employed to compare test scores with retest scores for the reliability study. Results showed the tennis skills test battery to both reliable and valid.

**Green, East and Hensley** (1987) designed skill test battery, which components of golf and the true index of golfing ability, the score for a round of golf. An additional purpose was to provide normalize data college males and females based upon a relatively large sample size. Pre green golf test was designed to measure the basic skill component of golf; putting chipping, pitching, using middle distance irons and diving. These Five skills serve as the foundation of one’s games and thus provide the basis for accessing the achievement of golf skill. 1,000 college students of playing ability levels were enrolled. Reliability was determined for each of the test items using the interclass co-relation method described by Baugh Gartner and Jackson (1982). Pho criteria measure was based upon the sum of two 18-hole rounds and had a test-retest reliability of r=0.92. The test items entered the full validation model in the following order the full validation model in the following order; middle distance shot (R=0.66) pith shot (R2 0.72), long put (R=0.76), chip shot (R=0.77) and device (R=0.77) it is apparent, however by considering the inter mental changes for r, the deice test does not, enhance the predictability form this battery. Pho full battery of four test items adequately measures the golfing ability of college males and females. The study present the prescribe rank norms based on sex for each of the four test items retained in the complete each of the four test items retained in the complete battery. This study conclude that administration of the test items to over 1,000 students, the golf test appears to be a valid and reliable instruments for assessing golf playing ability among college males and females. It an compares the basic components required the games of golf and with proper preparation, is administratively reliable in the mass testing. Furthermore, with the use of the accompanying norms, which were based upon relatively large sample, the test becomes valuable diagram mastic tools for teaching golf.

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Han-DauYau\(^4\) (1999) designed a battery of badminton skill test. The purpose of the study was to construct criteria-referenced of the badminton test battery. The subjects were the 223 players of first and second level athletes in the badminton Association of republic of china. Pre approach of logistic regression model was used as selecting the best test battery of criterion entered test in badminton. The domestic expression education is logic \(P \approx -22.22+0.05\times \text{push shot test} + 0.03\times \text{drop test} + 0.06 \times \text{standing long jump test} + 0.02 \times \text{muscle strength test}\). The best of score (criterion ) is 0.52 empirical approaches to create validation or the phi \((\phi)\) co-efficient 0.53 and cross validation 0.80 incriterian-rentrenched measurement as well as to create it’s reliability of the agreement proportion 0.83, Cohen kappa 0.53 and mediated Kappa 0.65 in criterion entranced measurement.

Various Badminton skills, specific movement times and success in singles competition were tested by Rosentsweg\(^5\) (1966). Analysis by multiple co-relation and regression shouted that both speeds depending to a greater degree on skill than speed of movement, the miller wall rally test was the best single predator of success in singles competition and total body movement time was the best movement time predictor.

The purposes of Rodriquez’s\(^6\) (1988) study was to present an overview of development phases of the go see Run test, which represents an indirect amortize power measuring through the distance concerned in that period of time. Historical and portend details were extremely. Difference studies showed that the 40 Sec. The test is ex maxims or, with high responsibility (0.99) and internal objectivity (0.99). Validity toward an anaerobic athletic test covered from 0.70 to 0.84 toward predicted \(\text{ro}_2\) max was low among athletic and non athletic and toward blood located past- test was 0.91 and per test differences was 0.89 lord values or correlation were observed with weight and \(p\) particularly with height in school boys and girls (W2 72) from 17 to 18 years of age \((n=26)\) top athletes. Test imitations were analyzed as well as new perspectives. Among those, it was pointed out recent findings of co-relations from 0.85 to 0.92 with the Wingate test.

\(^4\) Han-DauYau, (1999). “A construction of criterion referenced for badminton test battery”, Dept of sports training sciences, national college of physical education, and sports, Tooyuon, Taiwan.

\(^5\) J.Rostenwieg (1996), Success achieved by College women engaging in badminton single competition Complete research in health physical education and recreation, 8, P. 109

Abraham\(^7\) (1986) investigated the effect of a modified task structure on success rate and learning of soccer heading skills was investigated. A secondary purpose was to develop a soccer heading skills test for children. 2 groups of boys and girls (8 per group) were randomly farmed and thought a sequence of sub skills leading to heading in soccer or the whole skill of heading on soccer. Soccer skills were evaluated during daily practiced of the frequency of current trails and the frequency on a practice trails process checklist and as skills test were used to evaluate the children’s trial heading performance. Data were analyzed in multiple discernment analysis to compare the modified and the whole tests approaches practice trail, the number of total practice trails on scores on the technique rating and soccer on the mail test between the groups thought by progressions of part skills and the groups thought by the whole skill method. The heading skill test was determined to be a valid measure of skill in heading. The number of trails with correct technique was highly related to achievement.

Michele\(^8\) (1978) explored the possibility of developing a regression equation which by football ability could be predicted. From an analysis of selected anthropometric measure, balance, standing didn’t and body weight. Subjects were 56 scholarship football players. This rating on football ability was used as the criterion measures step wise multiple regressions were utilized to farm predictive equation, by polynomial expression was test ball ability = 787.65 + 657.33 (low legs) - 143.52 (standing height) - 2.60 (tibia Tension) - 33.40 (horsepower) - 0.408 (body weights).

Liao\(^9\) (1990) studied to develop and to valid date a method of providing immediate quantities feedback information on speed and angle of release in shot putting. The achievement of maximum range in shot putting is primarily attested by the speed and angle of release of the shot. The training objective of a shot putter, therefore, is to max the speed and to optimize the angle of release of the shot. Learning to accomplish these objectives requires some form of feedback information on these 2 variables immediately after each put. No suitable method, prior to this study, was available for the provisions of this information. Formulas were derived for the purpose of this

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\(^7\) Abraham, P.C.(1986). Task modification and achievement in a soccer skill. *Complete research in health, physical education and recreation* 28, P. 21

\(^8\) Micheie, Raiph P. (Dec.s, 1978). Development of a battery of test at predicts football ability at the college level *Complete research in health physical education and recreation*, P. 19

study. The calculation request the measurement of these variables: height of release, range of put, deviation of put, and velocity component of the shot along the horizontally forward axis (x-axis). The height of release was tape measured as a constant for each subject for each put, the range and deviation values were tape measured, and the validity component along the x-axis was measured using a specially constructed timing apparatus. There quantities were input to the desired formulas for the calculation of the speed and angle of release of each shot put. The method was validating by employing high speed cinematography as the true measure of the speed and angle of release of values. A nearly perfect ‘r’ of 0.08 was found between the calculated speed of release values and these measured from him. The reliability coefficient was found to be +0.173 m/s a high ‘r’ of 0.963 was found between the calculated angle of release values and those measured from him. The reliability coefficient was found to be 0.928. The 95% confidence internal of error was found to be + 2. Based on the above result, it was concluded that the feedback system development of this study is a precise, highly valid, and reliable system.

Buyens, Coomman, Vanneste & Meirleir\textsuperscript{10} (1988) measured the blood locate concentration in 14 traithet’s who participated in a semi-triathlon. They conducted three sports specific tests two incremental tests in the laboratory (one on a treadmill and one on a cycle Ergometer) and a “two speed” swimming tests. The competition time for the swimming, cycling and running were 2112.7 sec (359.1) 97.65.4 sec (543.0) and 6401.6 sec (0.775.4) respectively mean blood factor concentration at the end of each part was 6.9 mm 01/l (swimming), 2.1 mm 0.1/l (cycling) and 3.4 mm 0.1/l (running), using a multiple regression equation they measured how the time for each part was related to parameters of the equivalent sports specific test. A multiple correlation R=0.628 for running was found with parameters of the three sports specific test, total triathlon, time could be predicted with R=0.934 and within a standard error of estimation of 758.9 sec. This study confirms that sports specific tests or useful in predicting performance but the interactions between the different parts of the triathlon has to be considered.

Tzannes, Paxinos, Callanan & Murrell\textsuperscript{11} (2000) attempted to determine the normal population range of shoulder laxity. The reliability of these tests has not been determined when performed on symptomatic patient population. 23 patients with a history suggestive of instability or impingement were referred to a shoulders specific list for treatment of their symptomatic shoulders. Four examiners examined the patients shoulder using three variation of the load and shift test the sukus sign, and the apprehension, relocation, release and argumentation tests. Intra-class correlation coefficient were then used to determine which tests shift test was found to be most reliable (rho=0.62) in the 90 degree abducted position for anterior director and in the 20 degree abducted position for the position (RHO=0.72) and inferior (rho=0.79) positions. The sulkies sigh was found to have interior examiner (rho = 0.62) for all of the provocative tests of shoulder stability apprehensions alone was found to be most reliable found to have the highest-inter examiner reliability (rho=067 and 061 (respectively). Examination of the unstable shoulder is most reliable between examiners testing for shoulder laxity. In a symptomatic patient the position of the patient has an effect on the reliability of the examination findings.

Okely and Booth\textsuperscript{12} (2000) react that the development of mastery of fundamental movement skills (fms) among children and adolescents through quality physical education is a potentially important contributor to successful and satisfying participation in sports games and activities common in the community. The study was conducted in there phrase: a preliminary study, a content validate study and a reliability and validate study were three Australian experts in fundamental movement skill. They were sent the fundamental movement skills test battery and asked to review the selection and sequence of skills and qualitative components. Participants for the reliability and validity study were 148 1-3 years students. Statistical results indicate that the test battery developed to assess children fundamental movement skill ability was valid and reliable investigation this battery will lead to a before understanding of the developmentally appropriate levels of fundamental movement


\textsuperscript{12} A.D.Okely and M.L.Booth, (2000), The development and validation of an instrument to assess children’s fundamentals movement skill ability. in book of abstract, pre Olympic international conference on sports sciences, sports medicine and physical education, Brisbane, Australia, sept.7-12 2000. P. 245
skill mastery among children in a wide range of skills that or related to popular sports and physical activates.

**Jackson, Weduwe, Schick, & Sanchez**\(^{13}\) (1996) examined the concurrent and constructs validity of the three mile (4.83 Km) run as a field test of aerobic capacity. Subjects included 109 college aged males whose three-mile run of the subjects were given a maximal treadmill run time\((M=1310.31, SD=184.48\text{sec.})\) was measured. Fifty of the subjects were given a maximal trade mile stress test, and their peak performance oxygen consumption \((\text{Vo2peak})\) \((M=54:23, \text{SD}=7.08 \text{ ml/kg/min})\) was measured. The three mill run was conducted on an outdoor 0.25 mile (0.425 km) track, and splits times were recorded each 110 yard. (100.32m) for the first and last laps and total time was recorded for laps through 11. The correlation coefficient between the run time and \text{Vo2 peak} was 0.58, indicating only moderate concurrent validity for the run as a field test for aerobic capacity. A factor analysis conducted on the split time data revealed a three factor structure of a stable pace phase, an initial sprint and a final sprint with the table pure factor according for most of the common factor variance (69\%). The three mile run time was used to discriminate successfully between two knows groups of subjects in aerobic capacity. These data provide degree of support for the construct validity of the three mile run as a field test aerobic capacity.

**Ribli, Petray and Baumgarner**\(^{14}\) (1992) examined the test retest reliability of the 1-mile, 3/4 mile, ½ mile distance run/walk tests for children in grades K-4. Fifty one physical education classes were randomly assigned to one of the three distance run conditions. A total of 1,229(621 boys, 608 girls) completed the test retest in the fall (October) with 1,050 of these students (543 boys, 507 girls) repeating the tests in the spring (May). Results indicated that one-mile run/walk distances, as recommended for young children is most national test batteries, has an exceptable interclass reliability \((0.83<R<0.90)\) for both boys and girls in grades 3 and 4 has minimal (fall) to acceptable (spring) reliability for grades 2 students \((0.70<R<0.83)\) but is not reliable for children in grade K and \((0.34<R<0.56)\) the ½ mile was the only distance meeting minimal reliability standards for an boys and girls in grade K and 1 \((0.73<R<0.82)\).


Results also indicated that reliability remained fairly stable across gender and age groups from the fail to spring testing periods with exception of the non ably improved values for grade 2 students on the 1-mile run/walk test criterion related reliability (P, Present agreement) was also estimated relative to physical best and fitness gram standard, for 5 years-old girls on the 1 mile test for both rail and spring and for 6 years old boys and girls on the 2-mile test administered in the spring. Exported reliability for boys and a girl for the tradition of and modified pull ups or above 0.01 for two trails and 0.67 for a stand single trail. However, the modified pull up has reliabilities somewhat less than the traditional pull up at each grade level as well as across grades. The results indicate that while both pull up items or generally reliable, traditional pull ups have higher reliabilities.

**Faina, Sardella, Mognoni, Dicave, & DalMonte**\(^\text{15}\) (1988) verified the validity of a test suggested by Moritent (1981) for a cycle ergometer evaluation of the anaerobic threshold (critical power). The test consist in three trail, each at a constant load but different from the other two. The co-relation between the work performed and the exhaustions time defines a line the regular coefficient of which is considered to be measurement of the anaerobic threshold. Nine good agnostic female subjects (age 13.5, height: 165.5 cm, and weight :( 6.5 kg) were tested in the specific swimming ergometer. This ergometer consists in a open pool (m7x3) in which the water is pushed by four propellers. The athlete swims in this water remaining still relatively to the outside. The subjects were subjected to three trails at different speeds and the highest of which was the average speed to their best 100m performance. The speed corresponding to the anaerobic threshold (MAT) was calculated for each athletes according to the method toady indicated above. Later each subject was sub related to a 30 minutes constant speed test during which (every 10 minutes) she was stopped for 30 second to have her blood sampled from her or to be for a lacto academia assessment. This type of test was repeated second time to decline the highest speed which the subject was able to maintain for the whole 30 minute with the highest and most constant blood lactable rate. The speed found in this was called real Anaerobic

Threshold (RAT). The average RAT and male values and the co-relation between the two parameter was high and significant at the 0.01 level it was concluded that the test applied to swimming with the specific ergo meter is valid for the measurement of the Anaerobic Threshold

Sai, Graeme, Cremades, & Rellinger\textsuperscript{16} (1995), found a valid and reliable method to evaluate racquet ball proficiency. Existing test batteries have reported low to moderate validity and reliability. The purpose of this study was to improve the reliability and validity of racquet ball skill tests through modification of the existing tests, and to develop an innovated test battery. Two trails of the modified services replacement (sv) rally (RL1) Power (PW) and kill shot (ks) tests were included with two newly develop tests, the ceiling shot and the power placement (PP) tests. A total of 67 college students (40 males and 27 females) aged 23.36+3.92 participated in this study. Subjects representing different levels of ability and experience were recruited from three beginning request ball classes at a major university. All subjects received standardized instructions for a tournament and for the skills tests Reliability was determined by the inter correlations between well the criterion scores (average scores per games from a single round robin tournament and the skills test scores.) Interclass reliability for internal consistency of the two trial of the skill tests was determined using repeated measure ANOVA procedures the results or summarized as follows.

<table>
<thead>
<tr>
<th>Skill test</th>
<th>SV</th>
<th>PK</th>
<th>KS</th>
<th>RL</th>
<th>Cs</th>
<th>PP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concurrent male</td>
<td>.623</td>
<td>.761</td>
<td>.714</td>
<td>.724</td>
<td>.628</td>
<td>.815</td>
</tr>
<tr>
<td>Reliability female</td>
<td>.639</td>
<td>.674</td>
<td>.716</td>
<td>.645</td>
<td>.586</td>
<td>.478</td>
</tr>
<tr>
<td>Interclass male</td>
<td>.864</td>
<td>.964</td>
<td>.883</td>
<td>.725</td>
<td>.868</td>
<td>.919</td>
</tr>
<tr>
<td>Reliability female</td>
<td>.879</td>
<td>.832</td>
<td>.900</td>
<td>.808</td>
<td>.781</td>
<td>.491</td>
</tr>
</tbody>
</table>

Expect for cs and pp for female, all test had modularity high validity for college male and females the pp test related the best validity for male but females indicating that a test combining power and placement was only valid for college males. Similarly, interclass, reliability was high for all tests except for the pp test for female. Test for a significance increase in R-squarely following stepwise expression analyses indicate that SV RL CS and PP were female in terms of prediction of tournament performance

where as the CS and SV were radiant for males in terms of prediction of tournament performance, there for, the test battery recommended for college females includes KS and PW while for college males. PP PW RL and KS were recommended.

**Joseph Digennor**\(^{17}(1969)\), Construction of forehand drive, back hand drives and services Tennis test. The purpose of the study was to develop a battery of tennis skills test in a manner that would serve as a model for test construction. A series of 12 procedures was out lined and followed in the construction of for-hand drives, back hand drives and drive test of accuracy in placement for Tennis player reflected to as the T.T.A. (Tennis test achievement). The planning and formulation of the T.T.A. were based on (a) knowledge of tennis authorizes including recommended drive and services teaching progression and method of practice; (b) strength and deficiencies in existing tennis skills tests; and (c) result of pilot procedures relating tennis skills; and (c) results if pilot procedures relating to the nature of tests; a circular targeted was created to provide an objective method of measuring accuracy in drive and services placement. Male volunteer (N=64) at the beginning level of the tests reliability coefficient, ascertained by the test retest method, were .80 for back hand services test. 66 for back hand service test. predictive validity co-efficient produced for the hand drive and back hand test were .48 and .60. No relation between T.T.A. performance and stroke performance during actual play over the correct of a round robin tennis tournament yielded co-efficient of .78 for the back hand drive .66 for the force and .40 for the fore hand drive.

**Dyer**\(^{18}(1935)\) had designed test to measure ability in tennis for classification purpose. It consists of rallying a tennis ball against a back board, attempting to score as many hits as possible within a thirty second time limit. The initial study contains 736 cases, from representative women’s tennis group in 19 colleges; validity of the test was determined by two method; correlating the test score with the judgment of three experts; and robin tournaments. A coffined of 0.85 was obtained in the first study and the coefficient ranking form 0.85 to 0.92 were obtained in the second validity study. Reliability of the test was determined first by correlating chance halves of the test that resulted in an r of 0.85 secondly, reliability was computed by the test retest method, which resulted in a range of co-efficient from 0.86 to 0.92


Sherman\textsuperscript{19} (1972) formed a consecutive rally test which was devised to measure the accuracy and consistency with which a player can hit consecutive rallies into the target on either the first bounce or a rally. She used 113 college women enrolled in 6 sections of a 7 were beginning tennis unit to investigated several test items she proposed a rally, a volley and serve test. The untamed consecutive rally test was found to be the best single index of tennis playing ability and could be used if time were not available to administer the full battery. The reliability with add-even and stepped-up was estimated 0.79 to 0.88 and 0.60 validity was obtained.

Hammer\textsuperscript{20} (1974) used 4 beginning tennis classes to investigate the appropriation of a “mini match” tournament as an indication women tennis with a test that stimulates actual game play the official rules of the USLTAT- out of 12 min this break were used for the mini match round robin tournament on each class in the test each student also received a rank from the average of the 4 subjective rating by the 2 judges by using spearman rule. Mini match vs. subjective rating, validity was obtained for class A-0.72, B-0.93 class c-0.92, class d-0.87 was obtained respectively and by using chi square test retest, reliability for class A-0.75, Class B-0.50, class c-0.50, class d-0.43 was obtained respectively.

Babrich\textsuperscript{21} (1972), developed a Badminton observation rating scale to measure total skill development. The total was developed using 2 classes of 67 girls enrollees in a high school bemiring badminton course. Two sections were used for evaluating individuals section I fault with skills and section II was composed of 8 items dealing with playing strategies and general knowledge. The reliability was estimated on a test retest basic using three qualities judges. Both person ‘r’ and analysis of variance technique were used to determine the reliability of the testing tool the co-efficient ranged from 0.77 to 0.87 for section P of the observational rating scale and from 0.60 to 0.83 sections II.

Nirmala\textsuperscript{22} (1985) constructed an objective skill test in hockey for higher secondary school girls. Three test items namely “Shooting accuracy, hitting and stopping accuracy” was tested on 44 girl’s students of senior secondary school aged in between

\textsuperscript{19} P.A.Sharman,(1972), A selected battery of tennis skill test. \textit{Ph.d dissertation}, University of lowa.
\textsuperscript{20} D.R.Hammer,(1975), The mini match as a measurement of the ability of beginning tennis players. \textit{Ph.D dissertation}, Indian University.
\textsuperscript{22} Nirmala A,(1985), Construction of skill test in hockey for higher secondary school girls. \textit{Unpublished thesis of masters of arts, physical education}, Pune university, Pune.
13 to 17 years. The scientific authenticity of the test was established by computing reliability, administering the test on two different occasions by the investigator herself and the co-efficient for shooting accuracy were 0.68, 0.95 and 0.86 respectively. The validity was obtained by comparing the test result with the expert’s opinion while playing situation and was found 0.92 of all three test items.

Lichtman, 23(1992) administered pickle ball test services test. The purpose of this study was to validate and compare the subseta and curitis pickle ball service tests using a total of 59 college’s players. The sebesta test required subjects to serve 15 balls into each service course while attempting to have the ball cross no higher than 2 ft. above net height. Scores from the first service were used for warm up and were not included in the analysis. Higher point values were awarded for serves which landed deep, within the corner of the backcourt and the short angle over near the junction of the nine volley zone line and the centre line. Serve travelling over the 2ft. rope were awarded half the point value. Standards procedure was used when administrating curitis test. A test retest paradigm was employed with a 7 day interval between sessions. Counter balancing for testing orders and serving court in the sebesta test were R=.78 and R=.80 for the test and retest respectively, while those for Curtis Test were R=.49 and R=.55 split half correlation comparing even with odd number trails. Alter application of the spearman Brown prophesy formula were r=.67 and r=.80 using the sebesta protocol for the test and retest respectively, while r=.43 and r=.61 were found for Curtis test. Test retest co-efficient correlation of r=.89 and r=.63 were obtained for sebesta and Curtis test respectively direction groups validation was displayed by the sebesta Past, as poorly skilled subjects scored significantly lower than highly skilled players; however, No. significant differences was shown with the Curtis test. When round robin standings were correlated with the total scores from each test at each session correlation of rho=.68 and rho=0.72 were obtained respectively, for the sebesta producers at the test and retest, while values of rho=.43 and rho=.38 were computed for Curtis test when evaluating the sebesta test should be employed rather than the Curtis test.

Loure & Chaw\textsuperscript{24}, (1992) Analyzed selected Badminton skill test battery. This study was designed to examine the factor structure of the badmintons skill in the domain of human motor performance. Subjects for the study were 105 college students including 58 males and 47 females. They were required to complete 10 different skill test which possessed acceptable reliability and validity determined by the primarily test developers and those selected test were Suggested by the concurrent tests and measurements text books in physical education. The data were investigated by various factor analysis models, including principal components analysis, unweighted least square analysis, maximum likelihood analysis and alpha factor analysis and followed by both orthogonal and oblique rotations of the 10 selected items, 7 were able to formulate 3 common factors namely, ‘Long serve’ ‘short serve’ and ‘overhead stroke’. The present result enabled to scientifically identify at least 3 important skill components in playing Badminton which may help in the development of a complete Badminton skills test battery. However, the identified components revealed that the use of all wall volley techniques in testing badminton skill was eliminated from the factor structure. Because of the modern graphical made rackets, the shuffle cocks are being stuck at a faster speed with greater power, further researcher may need to re examine the reliability and validity of using wall volley methods in testing badminton skills.

T.L.Pellett \textsuperscript{25} (1992) determined volleyball playing competence. The purpose of this study was to determine a relatively straightforward approaches for establishing a valid and reliable competency in volleyball game perform and (Pass, set-and serve) for begging college classes. Game play data was obtained from two college beginning volleyball classes (n=70) at days of game play. All students were videotaped each day and their work (contrasting group method) was utilized to develop the competency standard (Livingston,1982). Two distributions (master and non mastered) were compared and the point that best discriminated between them, as based standards (Berk 1976) Master and non master groups were manner to compare

\textsuperscript{24} L. H louie, Bic C.Chow.(1992), A facto analysis of selected badminton skill test. Supplementary Research quarterly for exercise and sports, P. 53.
\textsuperscript{25} T. L.Pellett,(1992), Determining volleyball playing competence for beginning college level classes. Supplementary Research quarterly for exercise and sports, P. 53.
differences in group formations. Test retest reliability for group relation was .94,.97 & .95 for pass, set and serve respectively. Game playing performance (proportion of correct to total trials c/g ration) was compared three different ways (1,3 and 19 day average) to determine the most imperative and least time consuming method for establishing the standards. Finding suggests the importance of measuring motor skill competence through actual game play. The greater the overlap of distribution the less powerful and interpretable the competence standard. Clearly individual skill interpretable the competency standard clearly individual well in a game and those who did not. Three day average game playing performance was found to be the most adequate and least time consuming method in determining competency standards as based on the validity contents computed for each skill the most validity co-efficient computed for each skill. The most valid and standards for be beggining college level volley ball game playing performance was determined at.43 for the pass, .63 for set, and .70 for the serve in relation to average three day C/T ration.

Broer and miller\(^{26}\) (1950) devised a test of tennis ability with college women utilizing a regulation court and fore hand and back hand strokes. The result based on small groups yielded a validity coefficient of .85 for the intermediate group and .61 for beginners with the criterion of judges rating. Reliability co-efficient of .80 were reported for both groups.

Doed\(^{27}\) (1991) investigated a factor structure of selected begining- level racquetball skills in the domain of human motor performance to identify the robust factors in that domain. A battery was administered to 230 male and female university beginning level racquetball players. Results of the study showed that there was a difference in the factor structure for male and female. It was recommended that racquetball skills tests with higher reliability be developed be used as similar study be replicated on intermediate and/ or advanced level players. Finally, it was recommended that stricter guidelines be developed to differentiate between beginning- level and experienced players.


Brandao (2000) conducted this study with a view: 1) to identify the degree of relationship between team final standings and individual skills performance, and 2) to compare, from the point of view of the individual skills, basketball players of different performance level. This second aim is related to the hypothesis that players sub-division is highly related to their technical skills. The sample comprises of 246 basketball players, 12 to 14 years old, belonging to 21 teams. They played official competitions of Proto basketball association in 1998/99 seasons. Teams were presented in 4 series of competition (A, B, C, & D) of different performance levels, according to their standings in the preview tournament. Technical skills were evaluated according to basketball test battery from AAPHERD (Kirkendall, 1987). Pearson correlation and ANOVA were used as data analysis techniques. ANOVA showed significant differences between series A, B, C, and D: pass (F=34.426, p=0.000), dribbling (F=23.986, p=0.000), shooting (F=14.753, p=0.000) and defense movement (F=6.131, p=0.000). Scheffe ‘f’ test confirmed the previous differences among the competing groups. Pearson correlation between technical indicators and team final standings were Pass (r=0.741, p=0.000, r2=55%), Dribbling (r=0.641, p=0.000, r2=41%), Shooting (r=0.722, p=0.000, r2=52%) and Defense movement (r=0.219, p=0.000, r2=4.8%). In conclusion, there is a strong relationship between offensive technical indicators (pass, dribbling, and shooting) and team final standings. The results resent important criterion-referenced values for pre selection purposes in this age group.

Gregory (1978) developed of a skill achievement test for beginning skiers on an artificial surface. 73 randomly selected beginning skiers were tested with a 16-item test battery, which was composed of suggestion form selected expert skiers. Rs between the subjects’ scores on the 16-item test battery and the total test scores resulted in the highest values. 6 items were selected from a cluster analysis as representative of the most divergent skills of the items constituted the final test battery. Test reliability was determined by test-retest of the initial Ss. Additional Ss (N=208) were evaluated with the final battery to essential norms. Test validity was determined comparing the expert evaluation of 87 Ss with final test battery score. The


X2 test indicated “a goodness of fit” between the 5 final test items and corresponding items on the preliminary test.

Relationship between selected fundamental skills and team success in intramural junior college basketball was studied by Bettencourt\(^ {30} \) (1971). Players (n=72) on 12 junior college intramural basketball teams were used as Ss. The ranking of 12 teams at the completion of league play were used as the criterion of team success. The 9 items of the AAHPERD basketball skills test was served as the independent variables. A mean score for each team on each test item was computed. The correlations for each tests item with the criterion of ranking. All correlations, with the exception of those for the under basket shot and jump and reach, were significant (p<0.05).

Won\(^ {31} \) (1988) studied the relative contribution of physical fitness and skill domain according to different skill level of handball players. Thirty three physical fitness and handball skill measures chosen from physique (6 items), muscular strength (5 items), muscular endurance (3 items), muscular power (5 items), agility (3 items), balance (3 items), flexibility (3 items), cardio respiratory (2 items), and handball skills (4 items) domain were tested on national representative (N= 21), University(N= 34), high school (N= 30) handball players. In order to investigate the relative contribution, communalities of 9 physical fitness and handball skill domains were evaluated for each different skill level group. The result indicated that degree of contribution of total variance were increasing tendency from 44.17 % to 57.08 % as the handball skill level increased. It implies that higher skill level groups are more explainable from 33 measures chosen than the lower skill level groups. In mean contribution to total variance for each 9 physical fitness and handball skill domain; physique, flexibility, cardio-respiratory endurance and handball skill domain were relatively high (11.50 % to 14.45 %), agility, muscular strength and endurance domains were moderate (10.65 % to 11.50 %), muscular power and balance domain were relatively low (8.88 % to 9.70 %). But these tendencies are not always same each different skill level group.

Cox\(^ {32} \) (1974) established the relationship between selected volleyball skill components and team performance of men’s Northwest “AA” volleyball teams.

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purposive sample of 107 games between the best “AA” men’s teams in each of 9 northwest volleyball tournaments was charted. The results of the study indicated that; consider together, the volleyball skills studied was significantly related to team performance. Further analysis of nature of the relationship revealed that the order of the volleyball skills most influential in predicting team success. 

**Gabril** (1988) examined the utility of several objective measures to predict which girls were selected for one of six junior high school basketball teams. Linear discriminate models of six coaches’ team selection were constructed from measures of basketball and athletic skills, strength, physical measures, and competition anxiety obtained during the first week of practice. These models provided greater than chance agreement with coaches’ player selection for each team (87%-93% correct classification). A cross modeling procedure revealed that the six coaches selections could be modeled in terms of one of three approaches to selection: 1) Select the aspirants who possess the best basketball skills (3 teams). 2) Select the aspirants with greatest size and strength and least competition anxiety (2 teams). 3) Select only the aspirants with both types of attributes (1 team). The results indicate that it may be difficult to identify a single set of measures to select skillful or potentially skillful basketball players, because of differences in how coaches might choose to define these terms.

**Christian** (1980) constructed and evaluated of a soccer skill test. The purpose of this study was to construct a valid, reliable, and objective test battery to measure the soccer skills of passing, shooting, and heading. Forty-five male students were administered the soccer test battery. Fifteen subjects were selected randomly from each of the following sub-groups: The Appalachian State University (A. S. U.) varsity soccer team, A. S. U. intramural divisional championship teams, and A. S. U. physical education soccer classes. The criterion measures were judge’s ratings according to subject’s performance in passing, shooting, and heading during actual games played at A. S. U. The rater agreement (R=0.85) was determined with an intra class correlation coefficient using ANOVA techniques. The reliability and objectivity coefficient, which were determined with an intra class correlation coefficient using

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ANOVA techniques ranged from 0.90 to 1.00. Construct validity for each test was established using ANOVA for the known differences among performance groups. Resulting F ratios were significant at the 0.01 level for each test performance when broken down by groups. The contrasted mean score differences obtained for the three distinct groups supports the assumed constructs of passing, shooting, and heading as logical and statistically valid measures for men’s soccer playing ability. Therefore, the score test battery appears to be a valid, reliable and objective assessment of passing shooting, and heading skills for men’s soccer.

Hensley\(^35\) (1982) studied characteristics of selected tennis skill tests. The purpose of this study was to investigate gender differences in performance on selected tennis skill tests and to identify underlying components of tennis playing ability. Fourteen tennis skill tests purporting to measure the fundamental skills required of a beginning level tennis player, were administered to 36 males and 44 females enrolled in a beginning tennis class at the collegiate level. They were then analyzed by the following factor-analytic techniques for each sex groups and for the combined sample: alpha factor analysis, canonical factor analysis, and maximum-likelihood factor analysis. It may be concluded that the tests selected in this study were measuring the same skill components and consequently, were not sex biased. However, since gender differences in mean performance were detected, it is suggested that they be separate.

Hopkins\(^36\) (1974) investigated development of a wall volley test for skilled male lacrosse players. The Ss (n=39) for this study were college varsity lacrosse players with two or more years of experience from four N. E. teams. All Ss were administered a test of stick handling ability. Each Ss score was based upon accuracy as well as the number of times the ball hit the wall. Six trials were given. The reliability of the test was 0.97, and rho was found to be 0.65. The t test was focused to be significant (p<0.01) indicating a difference in test performance between the two groups.

McDonald\(^37\) (1969) investigated the development of skill test for the badminton high clear. Test for measuring success on the high clear was established using measures of height and 7 of distance. College women (N=119) at 2 levels were tested. Test reliability for 12 methods of scoring for the whole group ranged from 0.73 to 0.83.


ratios indicated a highly significant difference between the 2 groups on all 12 variables. Scores on the test were correlated with results on a bigger tournament and ranged from 0.63 to 0.74

Chapman\textsuperscript{38} (1980) investigated the development of a basketball battery for middle school students. This study was undertaken to devise a standardized and utilitarian battery of test items that could be used as an aid in selecting players, equating teams, grading, and measuring progress or for motivational purposes. Male 9th grade students (n=58) at a SHS were tested on a battery of 8 test items and measured on certain anthropometric items, the results from which were correlated with a subjective rating by coaches of the Ss ability to play basketball in the game type situation. A 0.73 correlation between the composite 8 items battery scores and subjective rating found. Therefore 8 items test battery is used as a standardized basketball battery. Factor of age, and weight were relatively unimportant to the criteria.

Tokunosuke\textsuperscript{39} (1988) clarified the effects of the alteration of the rules on the exercise intensities, skills and tactics in the handball game. Heart rate was recorded continuously throughout the game and VO2 max was determined by means of the step wised aerometry. Distance that players ran and dribbled was pursued and recorded by the investigator. In the newly modified local rules, players must be throwing off from the goalkeeper line. Therefore, the time for the next commencement of the game was shortened. Owing to this change of the rule, it was found that the total distances that the players ran and dribbled the number of shoots and the possibility of the fast break offense were increased. The average HR of the new local rule exceeded that of the international rule through the whole game. Though the HR of the new local rule remained unchanged through the whole game, the heart rate of the first period was reduced by about ten beats / min in 2 period in the case of the international rule. We estimated the exercise intensities of the players at the 90-98% VO2 max in the new local rule and the 75-90 % VO2 max in the international rule. From these results, we concluded that the alteration of the rules in Japan was successful to facilitate the activations of the handball game, for example, the speed of the player; the offensive method and the number of shoot chance.


Maccormack\textsuperscript{40} (1977) established the relationship of selected hockey skills to success in ice hockey. A battery of selected basic skills in ice hockey was administered to 60 members of the St. Lawrence university hockey school, representing two age levels, 11-13 years and 14-16 years. Data were collected at the end of both the 1st and 2nd week the hockey school. Objective rating of the Ss on the skill test were then compared to the subjective rating made by qualified coaches as a measure of playing ability. Final multiple correlation of coefficients for the 11-13 yrs old boys ($r=0.71$) and for the 14-16 yrs old boys ($r=0.74$) were determined variables added significantly to the regression equation ($p<0.01$). It was concluded that an ice hockey skill test battery was found to be a reliable and valid measure of ice hockey playing ability.

Battles\textsuperscript{41} (1980) investigated the prediction equation for selection of intercollegiate basketball team members. Subjects for this investigation were 33 females who were participating in women’s basketball at three colleges in Florida; all were members of the FAIAW. Each subject completed a personal data form, the AMI, the Knox basketball test, Sargent jump test, and the field goal speed test. Selected anthropometric measurements were also obtained from each subject. Results of step-wise multiple regressions indicated that players ranked high by head coaches tended to score high on a combination of physical and psychological variables.

Luhtanen\textsuperscript{42} (1988) studied individual skills, understanding of the game and team skills of 138 Finnish national level junior soccer players (Age: 8-19 yrs). The terms in different age categories played six matches, which were recorded by video and coded for off-line computer software. All actions with ball were analyzed using different classified scales related to skill maneuvers. Selected technical skills, physical abilities, decision-making velocity and understanding of the rules and game were measured. The total amount of actions with ball in this study was 4800. On the average in one game with their own rules the players executed 29 passes, tried 34 recoveries of ball, executed 5 dribbling, 2 shooting for goal, tried 20 interceptions, and executed 4 dead balls. A goal keeper executed on average 13 savings. Relatively players succeeded in


\textsuperscript{41} Battles, J. (1980). Prediction equation for selection of intercollegiate basketball team members. \textit{Abstract research paper. AAPHERD convention}, P. 65.

\textsuperscript{42} Luhtanen, P. (1988). Relationships of individual skills, tactical understanding and team skills in Finnish junior soccer players. \textit{Abstracts New Horizons of Human Movement. SOSCOC, Seoul Olympic (Day 7)}, P. 84.
their attempts as follows: passing 50%, recovery of ball 69%, dribbling 38%, shooting technically 66%, scoring 8%, interceptions 59%, dead balls 58%, and goalkeepers saving 82%. The average duration of actions with the ball was only 0.9 seconds. The mean distance covered in one action (pass and dribble) was 15 meter. The correlation coefficients between total technical skill tests were as follows: bouncing the ball 0.938, combined dribbling-wall- passing-shooting 0.889, passing0.877, and heading 0.501. The age was in more significant relationship between the successful skill maneuvers and understanding of the game than the years to play and practice. A combined dribbling-wall- passing-shooting test had the highest correlation (r=0.504) to the amount of successful pass in the game. The starting velocity in sprinting and dribbling test explained most of the success in the passes and dribbling. In conclusion, it could be stated that the players with tests are starting and decision making velocity and better ball control might have more time in the game to read the game and to execute the purposeful decisions for the existing situation than the players with lower corresponding velocities and skills.

**Russell and Lange**\(^{43}\) (1910) worked with achievement tests for Junior High School Girls. They selected the repeated volleys test and the serve test from the French and Cooper battery. The volleys test was modified to involve three trials of 30 sec each at the 3 ft restraining line. The reliability computed on two trials five days apart was0.87 for the best of three trials and 0.90 for the sum of three trials. Seven judges used a four point scale from excellent to poor in the validity studies. They rated 66 players during a tournament play. The validity correlations ranged Cro'm 0.61 to 0.67, but when corrected for attenuation and random errors were 0.63 to 0.80. **Crogan\(^{44}\)**(1943) reported a repeated volleys test for high school girls. The players started behind a 6 ft restraining line but could move anywhere thereafter. The time factor was excluded. The reliability with 129 girls ranged from 0.48 to 0.52 for ten hits. The same girls were re-tested with 20 hits instead of ten; the reliability then went up to 0.83. Instead of basing the validity of the test on judges' rating as cited in other studies, Crogen based the validity on the ability to play volleyball in a competitive

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situation. It was found that teams made up of players with higher test scores won more games than those with lower test scores, thus indicating the validity of the test.

Brady (1945) constructed a repeated volleys test as a measure of general volleyball playing ability for college men. In this test, a simple target is marked on a wall. A 5’1’ feet long horizontal line, 11 feet from the floor is marked on a smooth side of a wall. Vertical lines are extended upward towards the ceiling at the ends of the horizontal line. Subject stands where he wishes and throws the ball against the wall. He then volleys it with the wall as many times as possible in one minute. Only legal volleys are counted, i.e., they must be volleys not thrown balls and must hit the wall within the boundaries of the target. In this test 522 college men and 15 Y.MCA expert players were used. A reliability coefficient of 0.93 was calculated between repeated tests by the subjects during the same testing period. For validity, a coefficient of 0.86 is repeated between the scores on the tests and the combined subjective judgment of four qualified observers.

Viohr and Haverstick (1956) evaluated 102 students for an eight-week volleyball course. They were given repeated volleys tests at 3 ft and 7 ft: restraining line. Their height was measured and they were given tests of agility, combining running and rolling and vertical jumping (Jump and Reach Test). Correlations were computed between volleys tests and other factors. From the study and a comparison of these correlations, a significant relationship was found to exist between jumping and volleying, between agility and volleying and between height and volleying. Smith (1969) formed three groups of subjects. 66 beginners, 11 varsity players, three highly skilled and experienced players and found the vertical jump correlated with the Brady test ($r = 0.35$) with the judges’ evaluation for the beginners ($r = 0.55$). The correlation between the vertical jumping ability of the varsity players and a potential playing ability ranking by their coaches was -0.36. It was concluded that the vertical jump was not an accurate predictor of volleyball playing.

Gill (1976) conducted a study on 30 students of Shri Singh Sabha Higher Secondary School, Patiala of age between 13 to 16. The skill tests included serve test,

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smash (spike) test, repeated volleys test and physical performance, tests of push ups, Squat test, straddle test and vertical jump test. He concluded that skill tests and the motor fitness tests had a significant relationship.

Edwards\(^4^8\) (1995) designed Wisconsin wall test for serve to measure the effectiveness of the serve as reflected by force and height. The serve test is reported to be reliable and to be valid logically. The time score had a reliability of 0.978 using 20 trials in 2 days determining by the analysis of variance statistics. Using only trials on 1 day, the reliability of the velocity scores was 0.942 the final score combining speed and placement values had a reliability of 0.957 using 20 trials on 2 days and 0.912 using 10 trails on 1 day the test also validated well with subjective rating.

Aloia\(^4^9\) (1975) constructed tennis service return test to measure effective placement of the return single tennis game. Two groups consisting of 8 college women varsity players 8 collegiate advanced men players were used to establish validity coefficient performance on the service return test correlated 0.86 for the varsity players and 0.99 for the advanced men players using the criterion of rank order results from round robin tournament. A different group of 10 members of an advanced tennis class was used to established reliability by the test -retest format, and coefficient was 0.90.

Dureha\(^5^0\) (1985) constructed objective skill test in hockey for senior secondary school boys. 60 boys were tested on three test items namely angular hitting and stopping for one minutes,’ ‘pass receiving’, dribbling and hitting ‘and dribbling and goal shooting’ the reliabilities of all three items were 0.92, 0.94, and 0.91 respectively. The objectivity was established by administrating the test in same manner with the help of an expert and found 0.95, 0.96, and 0.91 respectively. The validity was found by comparing the test result with the expert opinion in playing situation and was found 0.55, 0.57 respectively.

French and Stalter\(^5^1\) (1995) constructed test of footwork, wrist action and smashing ability to supplement the previously validated French test items and form a battery of skill tests in badminton to measure playing ability. A four test battery of serving,


clear, wall valley and shuttle resulted in validity to a coefficient of 0.698. Eliminating the serve three test battery with a validity of 0.678.

**French**\(^{52}\) constructed a short serve test in badminton to measure ability to serve accurately and low. A regulation badminton court was used with the specific marking. A validity coefficient of 0.66 was reported using a criterion of tournament ranking. The reliability was 0.96. Reliability will not hold up well for beginning players. A rating of the serve might be the best measure of serving skills for beginning players. This test is appropriate for intermediate players.

**Miller**\(^{53}\) (1967) constructed a wall volley test in badminton. On signal the tester puts the shuttlecock into play with a legal serve from behind the marked line and continuously volleys for 30 seconds. Three 30 seconds trails are given with at least 30 second for college girls. A validity of 0.83 with a criterion of tournament play and reliability of 0.94 are reported.

**Lokchart and McPherson**\(^{54}\) (1949) devised a volleying test for classification purposes with college women the test consist of three 30 second trail of volleying a shuttlecock against a wall area (10 feet high and 10 feet wide) from behind a 3 feet restraining line after initiating the play from 6 feet 6 inches starting line validity is reported as 0.71 with criterion of judges rating and reliability as .90.

**Hicks**\(^ {55}\) (1967) collected data from three judges rating of the subjects ability to execute the selected skill in a game situation, tournament scores; total judges evaluation of overall badminton playing ability, the performance score for each of the 20 trails on the clear test smash test, clear test, over head drop shot test and strategies test and score for each of three trials on the footwork test college women served as subjects. It was concluded that the strategy, clear and smash tests.

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\(^{53}\) F. A. Miller, (1967) The construction and evaluation of a battery of five badminton skill test. *Completed research in health, physical education and recreation*, 20, P. 153


\(^{55}\) J. V. Hicks, (1967) The construction and evaluation of a battery of five badminton skill test. *Completed research in health, physical education and recreation*, 20, P. 153
2.2 Studies on development of Test Battery on Physical Fitness

Harpeet (1988) undertook this study to formulate a specific physical fitness test. The General physical fitness test does not measure the specific physical fitness for a particular purpose. The subordinate purpose was to assess the relationship of each specific physical fitness test to hockey performance. The subjects were 50 female hockey players of Interuniversity, Indian Cambridge unique sites, state and national level. The independent variable was hockey performances, which was evaluated by a panel of experts. The independent variables were evaluated through suitable fitness tests constructed by the investigators suitable statistical procedures were adopted for computing the validity, reliability and objectivity of the test battery. Analysis of data exceeds significant relationship of hockey playing ability to the test developed by the investigator.

Safrit and Wood (1987) verified the reliability of the Health Related physical fitness test (HRPFT) since it includes four subsets, which measures components of physical fitness affecting a positive health state. The validity and reliability of each subset have been demonstrated to be adequate, as has the overall validity of the battery. However test battery reliability has not been established. The purpose of this study was to estimate the multivariate reliability of the HRPFT as a battery, using a data set obtained from middle school children. Test battery reliability was estimated using a canonical correlation analysis. Estimated were calculated for boys and girls 11-14 years of age. The HRPRT was highly reliable for all age groups and both sexes’ univariate reliabilities were also calculated and, with the exception of the distance run test these estimated were high. In conclusion, the multisite reliability of the HRPFT as a test battery is satisfactory under all conditions for these middle school children.

Dinucci, Mecum and Shows (1990) administered a modified form of the AAHPERD Health related physical Test to a sample of 200 college physical education majors. The skin fold measurer was changed from original test and the flexed arm than was added to the test battery. The validity and reliability of the test

battery have been established for middle school boys and girls. The study determined for middle School boys and girls. The study determined the multivariate reliability of the modified test battery using a canonical correlation model. The unicaeriate intra class reliability of the items ranged from 0.91 to 0.99. The total redundancy for the modified test battery was 0.87.

**Baumgartner** \(^{59}\)(1995) The purpose of this study was to estimate the objectivity and reliability of 90 degrees push up scores for college students in shoulder and griddle strength and endurance test of fitness gram. The tester was a faculty member and helped by three graduate students. They spent considerable time discussing the test directions and protecting administering the test period to collecting data. Some problems with the test directions and administrative procedure were identified here. Subjects were 84 college students in fitness classes, who were accustom to doing pushups. On one day the test was explained and subjects practiced it. Five to seven days later subjects were initially tested. Individually doing the maximum number of 90 degree pushups possible. At least two testers independent recorded the number of 90 degree pushups subject correctly executed. Objectivity estimated for a single tester and reliability estimates for a single day were calculated using and interclass ‘R’ and a one way ‘ANOVA’ model. Reliability estimates were by tester so that any difference in scoring among tested would not influence the reliability estimates. Objectivity estimates were from .16 to .91 with .48 to .91 typical Reliability estimates were .17 to .87 with values between .68 and .87 common objectivity and reliability values of .80 and higher are considered acceptable. Based on these findings score for the degree push up do not have acceptable objective and reliability for college students scored by well trained testers, it seems unlikely that scores so younger subjects and/ or score again by less capable tester will have acceptable objectivity and reliability, more research on the objectivity and reliability of the 90 degree push up seems necessary.

**Rutherford and Corbin** \(^{60}\) (1994) established criterion referenced standard test. The purpose of that study was to establish criterion referenced standard for selected tests of arm and shoulder griddle strength and endurance for college female. Several

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popular tests of arm and shoulder grilled strength and endurance were administered to
equal number of trained and untrained college females (No=92) to generate data for
the analysis. The contrasting groups method (Bark 1976, sift wood 1990) yield the
following criterion cut off scores that classified college females as trained and
untrained on the basis of the regular upper arm and shoulder griddle existence
training: pull ups: 2.5 repetitions (reps), 90° pushups=16 reps flexed arm hang=5.5,
scared chest press=24.5 kg, seated bicep curl=16.4 kg, seated lat pull (latissmus dorsi
pull down) 38.2 kg absolute strength index=86.4 kg, and relative strength index=6 kg
per of body weight. Cross-validation of the standards on an independent sample of
college females (N=112) suggested stability of the cut off scores for pull ups flexed
arm hang and relative strength.

Mcmanis & Weast61 (1994) developed a MPUT in Children in the new version of
FITNESSGRAM (1992), a modified pushups (MPU) is listed as the recommended
measure upper body strength, replacing the pull up and flexed arm hang as the
primary measures. The modified pushups test (MPUT) is included in the battery
because it does not require and special equipments it is easy to administer and most
children can perform at least one M.P.U. However, little psychometric research has
been performing on the MPUT. The primary purpose of this investigation was to
determine the stability reliability of the MPUT in elementary (RS) (3rd, 4th & 5th
grades) and high school (HS) (9th and 10th graders). Students subjects performed the
MPUT on two separate occasion prior to the testing session. The input was explained
as specified in the FITNESSGRAM manual and demonstrated by one investigator,
and then practice by the subjects. During the testing session, subjects performed a
MPU every 3’s until they could not continue or their form deteriorated. Inter class
correlation coefficient (R) was calculated from one way ANOVA’S complete data
were obtained on 45 rs subjects (20 females and 25 male age M=9.6 years) and 55 HS
subjects (23 females and 32 Male age M=15.0 years) performance data revealed the
following mean test and retest MPU scores; females rs 16.4 & 15.1 male 15.9 & 18.6,
female and male rs 16.2 & 16.3 male HS 17.9 & 15.4 and female and males were 913
and 903 respectively when Hs males and females were .913 and 903 respectively.
When rs males and females were combined, R. equaled .906 and .587, respectively
when Hs males and females were combined R equaled .750. The input appears to be

Supplementary Research quarterly for exercise and sports, P. 58.
reliable for 2 days for or males as females and females. The single day values for all of the sub-groups expect the his female were below the recommended level of .85 (safrit, 1996). This may be due to the small sample stress, Baumgartner (1987) recommends having at least 1000 subjects’ strike R can be affected when small prizes or used. The males R value for both 1 and 2 days were much lower than rs subjects and the has females R values. The rs subjects seemed to enjoy the MPUT and self successful because they were able to perform at least on eMPU. The Hs subjects were not as positive about the MPUT as the RS subjects several HS subjects remarked that the pack of the MPU (1 MPU every 3s) was to slow. A Significant difference was not found between the HS and RS mean MPUT score (both sessions) (test:+(98)=13, $P=.45$ and east: +(98) =-67, $P=.25$) it is possible the back at difference in mean scores was due to the inability of the input to discriminate among strength levels, or because the Rs subjects were strong for their age, unlike the pull up test , the MPUT can be administered to large groups of students, and the majority of the students will be able to perform at least MPU . However, the problems with maintaining proper from while performing a push up or not eliminated in the MPU more research regarding the psychometric of the MPU needs to be conducted.

Jackson et,al. 62 (1994) compared to research on field tests of cardiovascular endurance and body composition. Limited research has been conducted on field test of arm and shoulder strength and endurance. The purpose of the investigation was to examine the reliability and validity of a 1 minute push up test for young adult the sample included 40 males. (age m=24.5+4.0494, weight, M=80.5+ 10.0 kg) and 23 females (age M=24.67 I 5+0.4r) weight M=68.3 + 18.5 kg) who were enrolled in a fitness course. The subjects performed the maximum number of push up (p) in 1 minute. They started with a straight formed position with hands at shoulder width. The subject lowered the upper body until the perform and upper arm formed a 90$^0$ angle. Females had lines in contact with the floor while males maintained straight legs subject completed 4 practice trials prior to testing for reliability estimation the subjects completed 2 trails (T,T$_1$, T$_2$) separated by 1 day with 2 counters (C,C$_1$,C$_2$) for each trail. The subject completed a preparation maximum on the bench press (BP) as a test of strength and a maximum number of consecutive preparations (RP) on the bench press with a weight load of 45.5 kg for males and 22.7 kg for females as a test

of absolute endurances. The table provides the mean P and C findings. The interclass as and the fro P with BP and RP

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Portal rs, controlling body weight, of P with BP and R&P were improved to a moderate range of 0.45 to .55 (P≤.05) compared to the zero order rs for both males and females. The 1-minute P test with sufficient practice and females. The 1 minute P test with sufficient practice trials will provide a reliable test score of arm and shoulder power. Which is very reliable for mass testing. However, the scores or not highly related to measured of strength and endurance and or confounded with body weight. This observation is in agreement with past finding for pull up or modified pull up tests. Thirty-two players belonging to the national youth teams (Y: 17-18 or U: 19-20 years), age: 18.4±0.7 years, height: 188±6 cm and weight: 83.7±8.4 kg (mean±SD), were tested at least twice for physical performance in February 1997, 1998 or 1999

**Jensen, Johansen, & Liwendahl** (1999). The Danish handball team was placed 6 in the European championship in 1998, while it won the world and European championship in 1997 and 1998, respectively. Physical performance parameters of players were measured during maximal treadmill running: oxygen uptake (VO₂max), running time (Tmax), blood lactate (Blmax) and heart rate (HRmax). Furthermore, sprint time over 5 and 30 m (T₅m and T₃₀m), counter-movement jump without load and loaded with half the body weight (CMJ and CMJ½BW), shooting velocity in 3 shots: standing, after 3 steps and after a jump (SST, S₃S and SJU), and a 30 m shuttle run with increasing speeds between markers until exhaustion (30mshuttle) were performed. Strength was evaluated as one repetition maximum (1RM) in power clean, squat and bench press. No difference was seen in Body fat, VO₂max, Blmax, HRmax, T₅m, T₃₀m, CMJ, SST, S₃S or SJU (P>0.05), while body weight and fat free mass increased by 1.6 and 2.0 kg or 1.9 and 2.9%, respectively (P<0.01). Tmax, and

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63 Jensen, K., Johansen, L and Larsson, B. (1999). Physical performance in Danish elite team handball players. *5th IOC World Congress on Sport Sciences with the Annual Conference of Science and Medicine in Sport, Sydney, Australia.*
30m shuttle increased 22 sec and 354 m or 4.9 and 8.6%, respectively (P<0.05). CMJ½BW increased by 1.4 cm or 9.9% (P<0.001). 1RM increased by 8, 14 and 7 kg or 11, 14 and 9% in power clean, squat and bench press, respectively (P<0.001). Accordingly, after one year of training the players increase body weight and fat free mass and variables related to strength such as CMJ½BW and 1RM in strength exercises. Time to exhaustion in a maximal treadmill run and distance covered during shuttle run also increase. However, no changes are seen in functional exercises as 30 m sprint and different shots. Aerobic work capacity per kg body weight is maintained although body weight increases. It is concluded that successful players competing at international level in team handball is depending more on changes in variables alluding to strength properties rather than on variables related to aerobic capacity.

Singh64 (1997) assessed the performance and fitness of 11-14 year old swimmers according to German standards. Data was collected on 160 swimmers (80 boys and 80 girls) by conducting a battery of tests (50m freestyle, 50m backstroke, 50m breaststroke, 50m butterfly, 60 sec chin up, 60 sec sit up, 30 sec jumping sideways over the bench, 60 sec push up, 60 sec upper body lift, 60 m dash, and 2000 m run) used in Germany. The results revealed that Indian swimmers are much inferior to their German counterparts and swimming performance of Indian girls is very poor. On the whole the study indicates that the training and competition system for young swimmers needs comprehensive revaluation and change.

The purpose of the present study Stanley65 (1999) was to profile competitive junior female tennis players and determine if differences in fitness exist between state (n = 13, age=16.23 yrs) and district (n = 10, age = 17.10 yrs) standard female tennis players. The fitness components measured included: maximal aerobic capacity (graded treadmill test to volitional exhaustion with direct oxygen analysis), strength (grip strength), power (vertical jump), speed (20 yard dash), muscular endurance (60 second sit-up), agility (spider test), flexibility (sit and reach) and body composition (restricted anthropometric profile). A questionnaire was also administered to determine fitness training habits and attitudes to fitness. A series of unpaired t-tests found no significant differences between the groups on any of the body composition

65 Stanley, M. (1999). Fitness profiling and comparisons between different standards of competitive junior female tennis players. 5th IOC World Congress on Sport Sciences with the Annual Conference of Science and Medicine in Sport, Sydney, Australia.
or fitness variables. The only significant difference occurred with the subjects playing age where the state group had been playing tennis for a significantly longer time (8.46 yrs) than the district group (6.55 yrs). The results of the present study showed that the fitness level of the girls was sub-standard. This may partly explain the current lull in the performance of Australia’s female tennis players. Questionnaire results showed that most girls were spending considerable time doing fitness training each week however, the questionnaire also showed that most of the girls did not have a fitness program to follow and would like a program written for them. To succeed at the highest level the tennis player must be proficient in all three areas of skill, psychology and fitness.

Kinanthropometer profile (weight, stature, sum of six skin folds, muscularity & vertical jump) of Brazilian (BCN Osaco female) volleyball athletes (age: 13 to 22 years) in 3 age groups: A-(13 to 14 yrs old), B-(15 to 17 yrs old), C- (>17 yrs old) with different training experience Gr.1 (0 to 2 yrs) Gr.2 (2 to 4 yrs) and Gr.3 (>5 yrs) was studied by Silva (2000). One-way ANOVA and post hoc (Tukey) tests were used for statistical analysis. Significant differences were observed for most of the variables studied among the age groups and between the shorter (Gr.1) and longer (Gr.3) trained groups.

Uppal and Datta (1988) identified motor fitness components, which can help in prediction of performance in hockey. Male hockey players (n=74) studying in different universities of India was exposed to motor fitness components: Speed (50-yard dash), strength (right and left hand grip), Power (standing broad jump), Agility (dodge run), Dynamic balance (Johnson modification of Bass test), Flexibility (trunk and shoulder) and kinesthetic perception (a test of horizontal distance). The criterion measures were playing ability in hockey, which was based on the Strait field hockey rating scale. The analysis of data using zero order and multiple correlations revealed that playing ability in hockey is significantly related to speed (r=-0.29), right grip strength (r=0.29), left grip strength (r=0.47), agility (r=0.30), balance (r=0.27), and kinesthetic perception (r=0.29). Playing ability in hockey is not found to be significantly related to power (r=-0.19), flexibility (r=-0.10), and shoulder flexibility


The analysis of data further revealed that the combined contribution of left grip strength, balance and speed to playing ability in hockey is significant at 0.05 level of confidence. Conclusion: 1) the motor components, namely speed, grip strength, agility, balance, and kinesthetic perception contribute to playing ability in hockey where as power and flexibility do not underlie performance in this game. 2) Speed, left grip strength and balance taken together, contribute most to the playing ability in hockey. 3) It is possible to predict playing ability in hockey based on performance in selected motor fitness components.

**Shergill** (1992) established the importance of a set of specific physical fitness components as contributors in hockey playing ability. On the basis of available literature, 22 relevant test items were selected to measure fitness components. The sample consisted of 100 female hockey players, from 4 universities of Punjab. The age of player’s ranged between 18 to 24 years. The stepwise regression was applied to assess the importance of different variables in predicting hockey playing ability. The result of ‘t’ ratio suggested that endurance run test, standing broad jump, grip strength (LH), vertical jump, wrist flexion, age, height, and weight were significantly important in evaluating the hockey performance. Also, the results failed to find support for speed as an important predictor of hockey playing ability. The result of this analysis again stresses the positive role of physical fitness components in hockey playing ability.

**Calderia and Mastudo** (1988) analyze the changes on the physical fitness variables in elite volleyball players. The athletes from the 1987 national Brazilian team were submitted to a battery of tests. Data from each athlete included: weight, height, skin fold thickness, arm and calf circumference, predicted VO2 maxi l (min)-1 and ml. (kg min)-1 (ml), 40 sec run test, 50 m run test, vertical jump with and without the help of arms, long jump and shuttle run. Data were compared to the national volleyball team who had participated in the 1980 Olympic Games in Moscow. The results showed a better situation of the 1984 Brazilian Olympic team in muscle mass; velocity (50m); aerobic (VO2) and anaerobic (40 sec) power.

**References**


The Canadian association of health, physical education and recreation youth fitness programmed\(^70\) (1996) was started in 1964. The battery consists of the following items for boys and girls in the age group 7 to 17.

- One minute speed sit up
- Standing broad jump
- Shuttle run
- The flexed arm hang
- 50 yard run, and
- 300 yard run

An international programmed for the standardization of physical fitness tests was undertaken by the international council of health, physical education and recreation (ICHPER) (Larson, 1967)\(^71\). A committee on the standardization of physical fitness test ICHPER was appointed to set up standards and to construct instruments for the measurement of physical fitness in 1964 at Tokyo. A survey was conducted and a report on the tentative standard was distributed to all members of the committee for review. The comments and recommendations received were discussed at the meeting held in maaglingen, Switzerland in August, 1967. Te performance tests were developed in two Parts. The basic combination of tests items includes endurance run (800 meters run walk), 50 meters. Sprints, pull ups (pull ups and the flexed arm hang), standing broad jump and grip strength. The following additional items for application under special circumstances are also involved: 50 meter sprint (2 mins), sit ups (25-20), repetition bench press (15 kg press) one minute trunk curl, vertical jump, 50 meter shuttle run, back strength, leg strength with belt arm flexion strength.

Zuti and Corbin\(^72\) (1977) conducted a research on physical fitness norms for college freshman. They took of Kansas state university within the age of 17.6 to 19.5 years. The tests were conducted for strength test, flexibility, body composition and cardiovascular fitness. The results appear to indicate that the college freshmen at

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\(^{71}\) L. A. Larson, (1967) An American research programme for the standardization of physical fitness Tests. (Canada : ICHPER, 10th International Congress), P. 52.

Kansas state university were average and the standards were appropriate for their use at national level.

**Glassow and Krause**\(^{73}\) (1960) conducted a study on motor performance of girls age 6 to 14 years. Here group achievement scores for elementary school girls for the 30 yards run, standing broad jump and over arm throw were presented to add to the limited information now available on children in the first 3 grades, 1through 8 and 6 through 14 years. Reliabilities of written day scores were reported. Correlation of year-to-year scores and of the first grade scores with those grades 3 through 5, showed that individuals tend to remain in the same relative position within the group during the elementary school years. This paper added to present knowledge of motor performance of elementary schools children by reporting observation derived from achievements scores of girls during a five-year period.

**Busch**\(^{74}\) (1970) conducted a normative study on the AAHPER youth fitness test for girls in grade 7 through 10 in the state of South Dakota. One school was selected to represent each region or section of the South Dakota high school activities association. The number selected from each school was in proportion to school enrollment. The AAHPER youth fitness test was administered to 1000 South Dakota girls’ grades 7 through 10. Norms were established by computing every fifth percentile. The scores of South Dakota girls were compared with those of national girls, using age only. The medians of South Dakota girls then compared with the medians of the national girls each test item. 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 score for national girls tended to level off or drop.

**Alston**\(^{75}\) (1965) conducted a study on the physical performance of high girls on physical tests. The Virginia physical fitness test, AAHPER youth fitness test and north Carolina physical fitness test were administered to 60 girls in grades 9,10 and 11. The correlation between the Virginia and the AAPHER tests was 0.8, between the

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\(^{75}\) J. D. Alston,(1965), The physical performance of high school girls on 3 physical tests, *Completed Research in Health, Physical Education and Recreation Including International Sources*, 7, P. 74.
AAPHER test and the North Carolina 0.79 and between the two state tests 0.80. The 
mean difference of the three tests in standards scores terms were not significant at the 
0.01 level. The 3 tests gave essentially equivalent results for assessing the physical 
fitness of high school girls.

**Ball** (1967) compared the 4 methods of developing physical fitness in junior high 
school girls by matching girls in searcy junior high school, searcy, Arkansas, into 4 
groups on the basis of motor fitness tests for high school girls by Evangelina and 
Cereton. The 4 methods compared were calisthenics, isometric exercise, rope jumping 
and regular physical education program. After three months the motor fitness rests 
was repeated. All groups gained significantly at the 0.05 level with greatest 
 improvement resulting from the calisthenics programme.

**Barman** (1960) studied the AAPHER youth fitness test Battery and administered 
the test to 78 girls in grade Vill at Mitchell junior high school. The girls were 
classified by the nelson cozens classification index and compared with national 
 norms. The girls were above the average in the sit-ups, standing broad jump, 600 
yards run and walk, 50 yard dash and shuttle run, below in the softball throw and 
modified pull ups. The differences were attributed to their physical education 
program.

**The AAPHER youth fitness test** (1962) project represented the first attempt by the 
physical education profession to established norms. The test battery was originally 
developed in 1957 by a special committee of the AAPHER council.

The youth fitness tests consist of the following:

- Pull-ups (modified pull ups for girls)
- Sit-ups
- Shuttle run
- Standing broad jump
- 50 yard run
- 60 football throw and
- 600 yards run walk

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76 F. J. Ball, (1967) A comparison of 4 methods of developing physical fitness in junior high 
school girls, *Completed Research in Health, Physical Education and Recreation*, 9, P. 
42.
77 B. K. Barnam, (1960), A study of youth fitness of English grade junior high school girls of 
Mitchell as measured by AAHPER youth fitness test, *Research Quarterly*, 31, 1, P. 67
78 American Association Of Health, Physical Education And Recreation, *Youth fitness test 
The norms were revised to update and make it more scientific after comparing the achievement of the youth of Great Britain, Japan etc. with the American norms. Devi (1984) established norms using the AAPHER fitness test for girls in secondary schools. Her subjects were eighty girls’ students of VIIIth and XIth standards studying in Kendriya Vidyalaya Gwalior. Although the number of subjects was less, the norms were found reliable and valid.

In order to arouse consciousness towards physical fitness, national physical Efficiency drive was launched in the country in 1959-60 by the Union Ministry of Education (1969). The scheme is to award recognition by awarding star pins and certificates to those who score in all the item of the test battery. The prescribed minimum for any of three levels of achievements envisaged, namely one-star, two-star, three-stars. Twenty national awards are also made to those who are adjudged the top twenty in the national physical efficiency test or national award competition each year.

The ‘A’ battery of the test consists of the following items:

- 100 meter run
- 800 meter run (men and women)
- 200 meter run (women)
- Long jump
- High jump
- Putting the shot

In the “B” battery some of the athletic field items are replaced by items like Dand, Baithakas, Carrying weights, etc. After organizing it for two years on an experimental basis, the scheme has been continuously evaluated every year by organizing a seminar for state liaison offices in the national physical efficiency drive (NPED). The norms have been changed a number of times as a result of the deliberation at those seminars.

However, the ‘A’ battery consisting of purely athletic items has been more or less constant and the adhoc norms prescribed for three levels of recognition remains unchanged. Attempts to evolve norms on scientific basis have not yet borne fruit. The

80 Government of India, ministry of education and youth services, National Physical Efficiency Drive(1969) (NPED), P. 5
NPED is intended to promote skills in track and field events well. Hence these items are in the “A” battery.

**Box** (1967) prepared percentile norms tables for a selected measure of strength, power, agility, flexibility, and body composition, cardiovascular and muscular endurance from data collected in five schools of the unity Christian’s school systems Hudsonville.

**Elizabeth** (1960) prepared percentile norms for girls in the age group of 12, 13, 14, and 15 on the North Carolina AAPHER tests. The norms were prepared for each of the five test items: 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 squat thrust test resulted in effective discrimination in the center of the range for all age groups. The standing broad jump test provided the greater ranges and the best differentiation of the score 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.

**Brown** (1963) gave four item motor fitness tests to Washington state university freshman men for two years and was validated against the Rogers physical fitness index, the strength index and subjective rating of the development (sub-fit) class students by their instructions. No significant difference between means and standard deviations were found for the two sets of data and norm based on them were statistically sound.

**Beckford** (1976) conducted a study to evaluate the physical fitness level of Navajo girls 14 to 16 years old. AAPHER youth fitness test was administered on the subject selected from seven schools of the region to measure the physical fitness level. Also norms were established on basis of source obtained from test results from these schools. These norms were compared to national norms found in the manual

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81 D. L. Box, (1967). Physical ability testing of male students in grades four through twelve, *Completed Research In Health, Physical Education and Recreation*, 9, P. 77.


83 F. D. Brown (1963). The determination of the validity of four selected motor fitness items and the construction of norms for Washington State University men, *Completed Research In Health, Physical Education And Recreation*, 5, P. 84.

84 P. A. Beckford, (1976). A normative study of the physical fitness of 14, 15 and 16 year old Navajo girls using AAHPER youth fitness test, *Completed Research In Health Physical Education And Recreation*, 14, P. 159.
accompanying the AAPHER youth fitness test. The result of the study gave an indication of the overall fitness level of 14, 15 and 16 years old Navajo girls on the seven test items the Navajo norms were below national norms on 5 test items and above on softball throw and 600 yards run and walk.

Singh\textsuperscript{85} (1988) undertook a normative study of the physical fitness of male teenagers of the state of Jammu and Kashmir in the age 13 through 19 years. The variables considered were, pull-ups (arm and shoulder griddle strength), bent knee sit ups (abdominal strength), standing broad jump (explosive strength), 50 meter dash (speed), shuttle run (agility), and 600 meter run/walk (cardiovascular endurance). He concluded that the subjects belonging to age group 16 through 19 years showed better performance in all variables over the other age group of 13 through 15 years.

Das\textsuperscript{86} (1980) prepared norms for evaluating performances in physical fitness for classes 9\textsuperscript{th}, 10\textsuperscript{th}, & 11\textsuperscript{th} in the government higher secondary schools of the union territory in the Delhi. Twenty percent of the schools in rural and urban areas in the same population were taken up for this study. In each school ten percent of students were tested on the items of AAPHER youth fitness test and NPFP battery ‘A’. The items of NPFP were the same as included in the syllabus of central board of secondary education (CBSE). Norms were prepared for the boys 9\textsuperscript{th}, 10\textsuperscript{th} and 11\textsuperscript{th} classes and was statistically analyzed. It was concluded that a comparison of the obtained data with the data of American students show that the Indian students of classes 9\textsuperscript{th}, 10\textsuperscript{th}, and 11\textsuperscript{th} seem to be very poor in abdominal strength. The performance of students of class 9\textsuperscript{th} in all items of youth fitness tests was poor and there was a remarkable spurt of performance in X and XI though still lower than that of students in the United states of America except in pull-ups measuring shoulder griddle strength.

Colgan\textsuperscript{87} (1978) compared the AAPHER youth fitness test and a proposed fitness test to determine whether the tests measured the same fitness components. Girls and boys (N=326) from st. John’s English school in waterloo, Belgium (grade 5-12) were

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\textsuperscript{87} S.M. Colgan, (1978). A comparative study of the AAHPER youth fitness and a proposed fitness test,” Completed Research in Health, Physical Education and Recreation, 21, P. 244.
evaluated in both tests. The fitness items used were the 6 item of the AAPHER youth fitness and 3 items recommended by ARAPCS committees viz., mile run, skin measurement and sit ups. Both tests when statistically treated revealed that the AAPHER youth fitness and the proposed test were measuring different components of fitness. It was concluded that AAPHER youth fitness measures “fatness” and “endurance”. AAPHER youth fitness measures the same components for males and females, but age interacts with performance to a great extent in females. Alexander (1985) administered an overall test of fitness to 387 female volunteers between the ages of 14 and 76 years. The best battery included a test for cardiovascular endurance (12 minutes bicycle test) muscular endurance (1 minutes speed sit ups, flexed arm hang), muscular strength (grip strength, 30 seconds speed push-ups), flexibility (sit and reach, back extension) and percent body fat (skin fold measurement). Height, weight and resting blood pressure were also recorded for each of the participants. The subjects were divided into five age groups and the test results were compared between groups to determine the trends in fitness test scores. The following trends were identified from the test results from the youngest to oldest age groups: an increase in body weight, percent body fat, systolic and disystolic blood pressure; and decrease in maximum oxygen uptake, maximum exercise heart rate sub maximal exercise heart rate, muscular endurance, muscular strength, flexibility and standing height. The relative fitness level of females in distance age groupings was examined. The results indicate that there was a progressive decline in all fitness components with age. The decrease in fitness was seen to be the most marked in dynamic strength and muscular endurance components, while flexibility and isometric strength were relatively well maintained. Progressive decline in cardio respiratory endurance over various age groups and increase in both, systolic and diastolic blood pressure.

Singh (1986) prepared physical fitness norms for high school boys of Punjab state. Data were collected on 5000 subjects from various schools in the state. The test that was administered consisted of eight items, viz., standing broad jump, sit and reach test, agility run, sit-ups bent knee, 50 betters dash, push-ups (chairs), Cricket Ball throw and 600 meters run and walk. The percentile

norms for physical fitness tests were found to be valid and suitable to assess the physical fitness level of the high school boys in the age group of 12 through 15 years.

Humphrey\(^{90}\) (1983) conducted a study to investigate the physical fitness level of third grade pupils taught by specialists and non-specialists. 100 specialists and 100 non-specialists were randomly selected from 20 schools in Greenly, Colorado. The AAHPER youth fitness test was administered consisting of following items:

- Sit-ups,
- Sit and reach,
- Skin fold measurement
- One mile run and walk.

Comparison was made with the test results, between all subjects taught by specialists and those taught by non-specialists and between females taught by specialists and non-specialists. The two group 't' test was used to make the comparison. Analysis revealed that the specialist group had significantly higher scores. The specialist males scored significantly higher on sit-ups, sit and reach, skin-fold measurement and one mile run and walk when compared with non-specialists. The specialist females scored significantly higher on the skin-fold measurement than the non-specialist females.

Robson et. al.,\(^{91}\) (1978) and his colleagues conducted a study on a simple physical fitness test battery for elementary school children. They conducted the test on 152 boys and 150 girls of Kendriya Vidyalaya, Gwalior. The test battery was practicable, simpler than the existing physical fitness tests and measured most of the essential motor qualities of elementary school children. Norms were prepared for classifying school children into ability group by assessing their physical fitness.

\(^{90}\) M. A. Humphrey,(1983). A comparison of fitness level in elementary children as taught by specialists and as taught by non-specialists, *Dissertation Abstracts International*, P. 44.

Uppal\textsuperscript{92} (1983) studied the effect of eight weeks participation in physical education and conditioning program on flexibility of women students and found that the flexibility of the hip, trunk, shoulder and spine improved effectively, as measured by the sit and reach test.

Romsussen\textsuperscript{93} (1970) found that the median scores of South Dakota boys at all ages were higher than those of the National sample in all items except pull-ups and shuttle run.

Sittmann\textsuperscript{94} (1981) conducted a study to develop norms for North East Missouri state University students enrolled in the health and physical fitness concept classes. 372 male and 648 female subjects were tested for 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. Means standard deviations and range for all variables were calculated. Classification was based on sex. Percentiles in increments of 5 were constructed for each variable in each classification.

Mathews\textsuperscript{95} (1973) constructed the motor fitness test, using a twelve-item standard involving at least two measures each of strength, velocity, motor ability and endurance.

The following four indices have been developed and validated for high school and college age men:

- **Motor Fitness Index I** - \( \text{Chin + push-ups} \) \\
  \( \text{vertical jump} \)

- **Motor Fitness Index II** - \( \text{Chin + push-ups} \) \\
  \( \text{standing broad jump} \)

- **Motor Fitness Index III** - \( \text{straddle chins + push-ups} \) \\
  \( \text{vertical jump} \)


Motor Fitness Index IV - (straddle chins + push-ups)

(standing broad jump)

The validities of the above index with a twelve items criterion are as follows:

Index I  0.859
Index II  0.818
Index III  0.841
Index IV  0.812

As these coefficients of validity are of appropriate size, the instructor may select the index most applicable to his program and facilities. Indices III and I are preferable because of their higher validity coefficients.

Herman (1976) administered the AAHPER youth fitness test to 100 rural and 100 urban boys. The urban boys were superior to rural boys and the difference was significant at the 0.01 level. The two samples were weaker on the same components of physical fitness.

Berger (1963) concluded that the groups in his study that trained dynamically, improved significantly more in vertical jump than did the groups that trained statistically or trained strictly by jumping vertically.

Knuttgen (1961) compared the physical fitness of Danish School children with that of American School children, by administering the AAHPER youth fitness test. He concluded that the scores of the 70 percent of the boys and 80 percent of the Danish girls exceeded American mean scores.

Patrick (1972) has constructed a motor fitness test battery for girls in lower elementary grades. The items included in this test were Clarks strength composite, McCloy's endurance ratio, leg extension and flexion, Well's sit and reach, Dodging run, bass length wire stick balance and vertical jump. It measured the essential components of motor fitness, such as muscular strength, muscular endurance, cardiovascular endurance, flexibility, agility, balance and power.

96 B. Herman, (1976). A comparison of physical fitness level of urban and rural boys, Completed Research in Health, Physical Education And Recreation, 10, P. 86.
Ikeda\textsuperscript{100} (1962) undertook a comparative study of physical fitness of children in Iowa (USA) and Tokyo (Japan). A physical fitness test battery including sit-ups, standing broad jump, shuttle run, forward bend, dash, grass hoper and bent-arm hand for girls and pull-ups for boys was administered to 172 girls and 178 boys in Iowa and 221 girls and 174 boys in Tokyo, ranging from 9 to 12 years. Height, weight, finger length and leg length were recorded. Subjects were drawn from various sized towns and situations as similar as possible. A two-factor (race and age) analysis of variance was used. The two samples were homogenous in age except for 9 year old boys and girls. The Iowa boys and girls were taller, heavier and had longer legs than the Japanese. Except for sit-ups, the Japanese groups exceeded the Iowa groups in all fitness tests. Age seemed to have no effect on performance in the bent arm and sit-ups for girls, the forward bend for boys and the grasshopper for both sexes. Negative correlations were found between forward bend and finger-knee length, forward bend and leg length, bent-arm hand and weight, pull-ups and weight and the weight/height ratio and sit-ups. Dash and leg length and weight/height ratio and forward bend were positively correlated. The correlation between these items was not absolutely consistent, but the 2 groups showed similar pattern of growth and performance. A check list showed that the Japanese children had more chances for activity in physical education classes although the classes were larger and the facilities less desirable.

Babcock\textsuperscript{101} (1964) studied the physical fitness of Delaware boys and girls in grades five through twelve. Age, height, weight and AAHPER physical fitness scores were obtained from 6,761 boys and girls 10 to 17 years of age. Except for shuttle runs by boys and girls, the Delaware norms between the 25th and 75th percentiles were equal to or higher than the national norms on the basis of either age or classification index. The Delaware norms also tended to be higher at the 50th and 100th percentiles. Differences between small, medium and large schools were too scattered to indicate consistent trends.

\textsuperscript{100} N. Ikeda, (1962). A comparison of physical fitness of children in Iowa, USA and Tokyo, Japan, \textit{Completed Research In Health, Physical Education And Recreation}, 4, P. 44.

\textsuperscript{101} C. F. Babcock, (1964). Physical fitness of Delaware boys and girls in grades five through twelve, \textit{Completed Research In Health, Physical Education And Recreation}, 6, P. 60.
Meeks\textsuperscript{102} (1966) made a comparison of physically fit and physically unfit junior high school girls. The AAHPER youth fitness test was administered to 264 girls at Hdman Junior High School, St. Ann, Missouri. The 27 girls who scored highest on the test were designated as the "fit group" and the 27 girls who scored lowest were designed as the "unfit group". These groups were compared in academic achievements by grade point average, personality by the California test of personality and social acceptance among their peer group by a sociometric design. The physical fitness students had better personalities, made better grades and were more socially accepted by their peers than the physically unfit students.

Rieger\textsuperscript{103} (1961) made a study of the effect of participation in three recreational activities on the physical fitness of the ninth and tenth grade girls. The AAHPER youth fitness test battery was administered to 112 girls in grades IX and X. Then the subjects were divided into a badminton, bowling, dance and control group by modified random selection. The activity group had 18 periods of instruction and the control group went to study hall before re-testing. Mean differences within groups were tested. Comparisons in the mean change made in the 7 test items by the experimental groups with that of the control groups, showed the Badminton group had four, bowling group had one and the dance group had two significant improvements.

Beltrao\textsuperscript{104} (1961) conducted a comparative study of the physical fitness of Brazilian girls and the United States standards for girls of the same age groups. The AAHPER national youth fitness test was administered to 232 Brazilian High School girls. The results were compared with the standards for girls in the United States. The comparison of median scores within each age group showed that the Brazilian girls had consistently better results in the standing broad jump and the 600 yard run and walk than the girls represented by the standard. The United States girls had a higher median score in the soft


ball throw in every age group. No consistent differences were found in the other test events.

**Lincoln**\(^1\)\(^0\)\(^5\) (1965) conducted a study of the relationship between physical fitness and grade point averages of tenth grade boys at Sammamish High School. The Washington state physical fitness test battery for junior - senior high school boys was administered to 173 boys in grade 10. Their mean physical fitness scores and grade point averages correlated positively and significantly at the 0.05 level. The high and low grade point average groups differed significantly at the 0.05 level in physical fitness. The mean physical fitness of the total group matched that of the middle grade point average group.

**Beulah**\(^1\)\(^0\)\(^6\) (1960) administered a test to compare selected tests of fitness for elementary children, the case objectivity of administration, discriminatory power and preference of the children. There were 58 children in 1\(^{\text{st}}\) grade, 48 in IIIrd grade and 52 in 5\(^{\text{th}}\) grade. Results indicated that one minute sit-ups were superior to two minutes sit-ups. The endurance run and squat side step were not satisfactory tests for this age. The dash and obstacle race were highly correlated. Interest in the test appeared to be inversely related to grade level and experience in fitness testing.

**Rosenstein and Frost**\(^1\)\(^0\)\(^7\) (1964) administered the New York physical fitness test in October and May to pupils of 13 senior high schools whose physical education programme was rated high. The laborite score card was utilized to validate these ratings. Each pupil recorded the amount of physical activity outside of class and the effect was analyzed. Pupils participating in good programmes improved significantly more in physical fitness than participants in poor programmes. The greatest improvement was in strength with some gain in agility, balance and endurance.

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A study has been reported on the motivational techniques. Singh\textsuperscript{108}, studied the effects of two motivational techniques on the performance of girls in selected items of AAPHER physical fitness tests. He found that these were not superiority of medal or verbal motivation on the composite score. Verbal motivation did seem to have a positive effect over verbal command. A number of studies evolving norms for various states in the USA and comparison of such norms with national norms are available.

Mequi\textsuperscript{109} (1966) compared the physical fitness level of the Filipino students with Japanese and American students. He found that the Filipino students generally lower performance in the pull-ups, softball throw and sit-ups.

Watson\textsuperscript{110} (1978) conducted a study to evolve norms for Nebraska boys and girls. The test items for the Neb Ele physical fitness test were standing long jump or vertical jump, 50 yard dash, sit-ups, stick jump and 300 yards distance run. The items for secondary test were pull-ups or flexed arm hang, 50 yard dash, standing long jump, sit-ups, side step and mile or 9 minute run or 12 minute run. A random sample of schools in Neb (1%) was selected to participate in the establishment of these norms. The norms were established for each test item for girls, boys and groups according to chronological age. Percentile tables were prepared. Based on the results of the study, following recommendations were suggested: 1) There should be a test item included in the ELE test, grade 1-6, to evaluate shoulder girdle strength. 2) Norms need to be established for 1 1/2 mile or 12 minute run. 3) The secondary girls need to establish norms for the girls chin-ups.

Number of studies on improvement of physical and sports performance, reveal significant inter-relationships. The literature, in fact, helped the investigators about the identification of various dimensions for test constructions. The literature also indicates that, ones development in skill is also important in exhibiting overall game performance. The studies provide adequate information about the selection of test


\textsuperscript{109} A. Mequi, (1966). Comparison of performance in the AAHPER youth fitness test between university of the Philippines entering freshmen students and American and Japanese boys, \textit{Completed Research In Health, Physical Education And Recreation}, 8, P. 78.

\textsuperscript{110} R. E. Watson, (1978). The establishment of norms for Nebraska fitness test, \textit{Completed Research In Health, Physical Education And Recreation}, 19, P. 103.
items of various skills. Available literature on the development of test battery supports that very few studies are reported so far regarding the game “Korfball”. Moreover, study regarding a tool for searching sports talents in Korfball is not available. In fact, standardization of Korfball skill test is a new to the literature in world sports. It was, therefore, thought desirable to undertake the present study and presented in chapter III.