CHAPTER-II

REVIEW OF RELATED LITERATURE

Review of related literature gives valuable insight to the investigator regarding the problem to be solved. The review of literature can be extremely helpful to the investigator in identifying the methods that have been successfully used to solve the particular types of problems. Valuable elements from other studies may include the characteristics of the subjects, data collecting, testing procedure, statistical designs and analysis etcetera. An analysis of the literature is a part of all types of researches and it will creatively help the investigator to know deeply about the chosen study and related studies already done.

The literature in any field forms the foundation upon which all future frameworks will be built. Hence a study of relevant literature is an essential step to get detailed information, insight and a good comprehension of what has
been done earlier with regard to the present problem under investigation.

In order to get a thorough knowledge about the proposed area of study, the investigator searched available research references, periodicals, journals, books and already conducted similar studies. The collected references have been presented in a logical order.

**Hetzler, RK. et.al., (2010)** examined a modification of the Margaria-Kalamen test for football players. The football stair climb test (FST) protocol used in this study increased the vertical displacement (20 steps, 3.12 m) so that the mean best time for the test was $2.048 \pm 0.267$ seconds. Fifty-eight Division I-A football players volunteered to participate (mean $\pm$ SD age=$20.2 \pm 1.8$ yr, height =$184.1 \pm 7.7$ cm, weight =$102.5 \pm 19.4$ kg). Subjects performed 25 trials with 30 to 40 seconds of rest between trials. Test-retest reliability was determined using 34 subjects by way of intra class correlation coefficients with a value of $0.73$ for peak power and SEM of $105.4$ W, indicating an acceptable level of
reliability. Subjects were divided into 3 groups by position: linemen (Line), skill, and linebackers (LB). Peak power was $1674.5 \pm 300.8$, $1712.6 \pm 251.5$, and $1388.6 \pm 210.4$ W for the LB, Line, and Skill groups, respectively. Groups were significantly different ($P<0.0001$), with the LB and Line found to be more powerful than the Skill group. Peak power continued to increase throughout the 25 trials in the Skill and LB group but plateaued after approximately 17 trials in the Line group. It was concluded that the FST was a reliable test for measuring peak anaerobic power in collegiate football players, which, theoretically, should provide more accurate measures of peak power caused by increased vertical displacement and longer duration, resulting in a decreased influence of cheating strategies during test administration. To achieve maximal power in stair climbing tasks, coaches may need to incorporate a greater number of trials or a more intense warm-up than has been previously reported.

Keane, A. et. al., (2010) identified the fitness items that characterize top performers in the game. Altogether, 83 women aged 18–29 participated in the study and completed a
series of tests consisting of 8 items in the Eurofit Test Battery. The profiles of the 2 groups were subjected to logistic regression analysis. Four of the test items contributed to group discrimination (endurance, flexibility, trunk strength, and limb speed). Based on percentage difference, the most prominent discriminator was the estimated \( \text{VO}_2\text{max} \) (mean 49.9 ± 4.2 vs. 39.7 ± 6.3 ml·kg\(^{-1}\)·min\(^{-1}\)). Grip strength and agility were also significantly superior in the Gaelic Football players (P<0.05), who had significantly lower body fat values (23.3 ± 2.3%) than the reference group (27.2 ± 3.6%). The use of the Eurofit Test battery in games players was confirmed as were the multifactorial requirements of fitness for women playing this sport. It was concluded that elite Gaelic Football at top level is characterized mainly by high aerobic fitness, but a holistic training program is needed to cover the multiple fitness requirements of the game. Practical applications include the use of this game for health-related purposes.

Lo´pez-Min´arro, PA and Rodr´ıguez-Garc´ıa, PL (2010) analyzed the influence of hamstring muscle
extensibility on the hamstring criterion-related validity of the sit-and-reach (SR) and toe-touch (TT) tests. Two hundred forty young adults (mean age: 22.9 ± 3.6 years) participated in this study. Three trials of straight leg raise (SLR) (left and right), SR, and TT tests were performed in a random order. The subjects were dichotomized into group A (subjects with an SLR angle, 75°) or group B (subjects with an SLR angle $>75°$). The correlation values between SLR angle and SR and TT scores were calculated and compared between both groups. Group B elicited higher mean SR and TT scores than group A (P<0.001). Group A showed low associations between SLR with respect to the SR ($r = 0.31–0.41$) and TT ($r=0.28–0.40$) tests. Group B showed moderate values for both SR ($r=0.55$) and TT ($r=0.60–0.61$) tests. The hamstring criterion-related validity of the SR and TT tests is influenced by hamstring muscle extensibility. From the results of this investigation, it is found that the SR and TT tests are not valid measures of hamstring extensibility for subjects with reduced hamstring muscle extensibility.
Reiman, MP. et. al., (2010) determined if a modified (MOD) testing method for previously established trunk endurance testing for flexion and extension is a reliable alternative. Fifty subjects were tested with the standard (ST) testing procedure and an MOD testing procedure on separate testing occasions 1 week apart. The testing procedure order and method of assessments were randomly selected and implemented. The MOD testing procedure used a clinician to provide stabilization as opposed to the ST method of belt stabilization. Inter-rater reliability for MOD procedures was 0.97 for extension and 0.93 for flexion. Correlation of the MOD procedure to the ST procedure was found to be 0.90 and 0.84 for extension and flexion, respectively. From this testing, it can be concluded in a sample of normal college-aged subjects that an MOD testing method for trunk flexion and extension endurance can reliably be used as compared with the previously accepted ST testing methods. From a practical application standpoint, this allows the use of an MOD testing procedure to be implemented in athletic training rooms and weight rooms that may not have appropriate
tables for the ST testing and the fact that the MOD testing procedure will most likely require less time commitment and greater efficiency with testing of large groups of subjects.

Shimon, JM. et. al., (2010) assessed the initial reliability of the prototype instrument and its validity by comparing obtained values from a Cybex Testing and Rehabilitation System. Flexibility of the left leg was assessed on 53 college-aged participants (women, n=28; men, n=25) using the Lift-and-Raise test by 2 independent testers to determine initial reliability measures. The Cybex Testing and Rehabilitation System was compared with the Lift-and-Raise test when assessing the left hamstring of 39 college aged students (women, n=23; men, n=16) to establish initial validity. A high intra-class correlation coefficient emerged between the 2 testers (r=0.944) on the Lift-and-Raise instrument and between the Lift-and-Raise test and the Cybex testing protocol (r=0.891). Based on initial results, the Lift-and-Raise test seems to be a reliable and valid test to measure hamstring flexibility.
Souhail, H. et. al., (2010) examined the possible association between Yo-Yo intermittent recovery test level 1 performance (distance covered, Yo-Yo IR1) and match activities (direct validity) in young male team handball players. Eighteen young male players (age 14.3 ± 0.5 years, body mass 64 ± 28.7 kg, height 174 ± 6 cm, body fat 11.2 ± 3.9%) took part in this study. Players’ match activities were videotaped during an experimental tournament (6 games/player) and analyzed using a computerized system. Games and Yo-Yo IR1 heart rates (HRs) (short-range telemetry, HR) and blood lactate concentrations ([la]b) were assessed throughout and at selected times of the games, respectively. Peak Yo-Yo IR1 HR was assumed as representative of individual maximal HR (HRmax). Mean and peak game HRs were 174 ± 3 and 198 ± 2 b_min21, which corresponded to 87 and 99% of HRmax, respectively. Yo-Yo IR1 performance (1,831 ± 373 m) was significantly related (r=0.88, p<0.01) to total game distance (1,921±325 m). Post-game (9.2±2.3 mmol_L21) and Yo-Yo IR1 (8.8±1.6 mmol_L21) [la]b were significantly related (r=0.51, p<0.05). These findings
demonstrated the direct validity of Yo-Yo IR1. Consequently, Yo-Yo IR1 test may be considered as a team handball test relevant for the assessment of intermittent high-intensity endurance in young male team handball players.

**Sporis, G.et. al., (2010)** evaluated the reliability and factorial validity of agility tests used in soccer. One hundred fifty (n=150), elite, male, junior soccer players, members of the First Junior League Team, volunteered to participate in the study. The slalom test (ST) sprint 4 3 5 m (S4 3 5) and sprint 9-3-6-3-6-9 m with 180_ turns (S180 _) tests had a greater reliability coefficient (r=0.992, 0.979, and 0.976), whereas the within-subject variation ranged between 2.9 and 5.6%. The mentioned 6 agility tests resulted in the extraction of 2 significant components. The S4 3 5 test had the lowest correlation coefficient with the first component (r=0.38), whereas the correlation coefficients of the other 5 agility tests were higher than 0.63. The T-test (TT) showed statistically significant differences between the defenders and midfielders (p<0.05) and between the defenders and attackers (p<0.05). Statistical significant differences were determined between
the attackers and defenders in the sprint 9-3-6-3-9 m with backward and forward running (SBF) and p<0.05. It can be concluded that of the 6 agility tests used in this study, the SBF, TT, and S180_ are the most reliable and valid tests for estimating the agility of soccer players. According to the results of the study, the TT proved to be the most appropriate for estimating the agility of defenders, the SBF, and S180_ for estimating the agility of midfielders, whereas the S4 3 5 test can be used for estimating the agility of attackers.

Wilson, K.et. al., (2010) developed and assessed the reliability of a repeated anaerobic power cycling test designed to mimic the repeated sprinting nature of the sport of ice hockey. Nineteen female varsity ice hockey players (Mean age, height and body mass=21.62 yr, 166.66 cm and 62.36 Kg) completed 3 trials of a repeated anaerobic power test on a Monark cycle ergometer on different days. The test consisted of “all-out” cycling for 5 seconds separated by 10 seconds of low-intensity cycling, repeated 4 times. The relative load factor used for the resistance setting was equal to 0.095 kg per kilogram body mass. There was no significant difference
between the peak 5-second power output (PO), mean PO, or the fatigue index (%) among the 3 different trials. The intraclass correlation coefficient for peak 5-second, mean PO, and fatigue index was 0.82, 0.86, and 0.82, respectively. This study reported the methodology of a repeated anaerobic power cycling test that was reliable for the measurement of PO and calculated fatigue index in varsity women ice hockey players and can be used as a laboratory-based assessment of repeated anaerobic fitness.

**Stockbrugger and Haennel (2009)** evaluated the validity and reliability of a medicine ball throw test to assess explosive power. Twenty competitive sand volleyball players (10 male players, 10 female players) performed a medicine ball throw and a standard countermovement vertical jump. The subjects attended 2 sessions; at each session, 3 attempts of each test were completed. The movement pattern for the medicine ball throw was a backward overhead toss. To standardize for body weight, a power index was calculated for the countermovement vertical jump using the Lewis formula. Validity was assessed using the best score for both the throw
and the jump, and reliability was assessed using the best score from each session. There was a strong correlation between the distance of the medicine ball throw and the power index for the countermovement vertical jump ($r=0.906$, $p<0.01$). For the countermovement vertical jump, the test-retest reliability was 0.993 ($p<0.01$), and for the medicine ball throw, the test retest reliability was 0.996 ($p<0.01$). These findings suggested that the medicine ball throw test is a valid and reliable test for assessing explosive power for an analogous total-body movement pattern and general athletic ability.

**Bullock, et. al., (2009)** conducted a study to transfer talent, rapidly develop, and qualify an Australian female athlete in the skeleton event at the 2006 Torino Winter Olympic Games and quantify the volume of skeleton-specific training and competition that would enable this to be achieved. Initially, 26 athletes were recruited through a talent identification programme based on their 30-m sprint time. After attending a selection camp, 10 athletes were invited to undertake an intensified skeleton training
programme. Four of these athletes were then selected to compete for Australia on the World Cup circuit. All completed runs and simulated push starts were documented over a 14-month period. The athlete who eventually represented Australia at the Torino Winter Olympic Games did so following approximately 300 start simulations and about 220 training/competition runs over a period of 14 months. Using a deliberate programming model, these findings provide a guide to the minimum exposure required for a novice skeleton athlete to reach Olympic representative standard following intensified sport-specific training. The findings of this study are discussed in the context of the deliberate practice theory and offer the term "deliberate programming" as an alternative way of incorporating all aspects of expert development.

Castagna, C. et. al., (2009) analysed the effects of intermittent-endurance fitness on match performance in young male soccer players. Twenty-one young, male soccer players (age 14.1 ± 0.2 years) were involved in the study. Players were observed during international championship
games of corresponding age categories and completed the Yo-Yo IR1 on a separate occasion. Physical (distance coverage) and physiological match demands were assessed using Global Positioning System technology and heart rate (HR) short-range telemetry, respectively. During the match (two 30-minutes halves), players covered 6,204±731 m, of which 985±362 m (16%) were performed at high intensities (speed .13 km_h21, HIA). A significant decrement (3.8%, p=0.003) in match coverage was evident during the second half. No significant (p<0.07) difference between halves was observed for HIA (p=0.56) and sprint (speed .18 km_h21, SPR) distances. During the first and second halves, players attained the 86±5.5 and 85±6.0% of HRmax (p<0.17), respectively. Peak HR during the first and second halves were 100±4 and 99.4±4.7% of HRmax, respectively. Yo-Yo IR1 performance (842±352 m) was significantly related to match HIA (r=0.77, p<0.001) and total distance (r=0.65, p<0.002). The result of the study showed that specific endurance, as determined by Yo-Yo IR1 performance, positively affects physical match performance in male young soccer players.
Consequently, the Yo-Yo IR1 test may be regarded as a valid test to assess game readiness and guide training prescription in male youth soccer players.

Hadavi, F and A. Zarifi (2009) designed a model for talent identification and development in Iranian athletes. This project aimed at addressing the problem of coaches to find the best children and youth for track and field by a multi-factorial modeling. This model can be utilized to explain the present status of the talent identification process and provide suitable suggestions to improve the results of athletic fields in international competitions. In terms of methodology, a descriptive-analytical and field study was used to randomly select expert coaches (n=38) in Iran. A research-made questionnaire was used to collect the data and the experts confirmed its content validity as well as reliability in a pilot study. The data were collected via six factors: motor ability, physiological, anthropometrical, psychological, sociological and cultural. The results of this research lead to a special model of Iranian track and field. This model has three phases (initial selection, general tests...
and special tests) with specific aims such as determining unsuitable children for athletic fields, determining the abilities of the youth for track and field and improving the special abilities required of athletes. Also, each phase has a special “input entrance” such as the main input, classical input, games input, free input and championship input. This model determined the age and time span of each phase and also emphasized those in charge of each phase.

**Kinser, AM; WA. Sands and MH. Stone (2009)** tested the reliability and construct validity of an algometer (1000-Hz sampling rate) by manually applying pressure on a force plate (500-Hz sampling rate): 10 sets of 5 applications to 80 N and 1 set of 5 applications to each force level: 20, 30, 40, 50, 60, 70, 80, 90, 100, and 110 N. The investigator had previously become familiar with and practised with the algometer. The handheld algometer had a 1-cm2 round rubber application surface, and the maximum force reading was compared with maximum force readings by the force plate using SEM and t-tests. Force-time curves were analyzed for average slope representing rate of force
application. Average Pearson (r) correlations between the maximum force reading of the algometer and force plate were excellent in both trials to 80N (r=0.990) and the incremental trials (r=0.999). The application of force was reasonably constant, with slopes averaging $6.8 \pm 0.932$ N/s. The SEE was 0.323 N. In conclusion, with previous familiarization and practice, an investigator may have high reliability in the rate of force application. The device itself was also highly correlated with readings from a force plate and, therefore, may be considered valid.

**Sassi, RH. et. al., (2009)** evaluated the reliability of a modified agility T-test (MAT) and to examine its relationship to the free countermovement jump (FCMJ) and the 10-m straight sprint (10mSS). In this new version, the same nature of displacement of the T-test was preserved but the total distance coverage was reduced. A total of 86 subjects (34 women: age=$22.6 \pm 1.4$ years; weight=$63.7 \pm 10.2$ kg; height=$1.65 \pm 0.05$m; body mass index=$23.3 \pm 3.3$ kg.m$^2$) and 52 men: age=$22.4 \pm 1.5$ years; weight=$68.7 \pm 8.0$ kg; height=$1.77 \pm 0.06$ m; body mass index=$22.0 \pm 2.0$ kg.m$^2$)
performed MAT, T-test, FCMJ, and 10mSS. The results showed no difference between test–retest MAT scores. Intraclass reliability of the MAT was greater than 0.90 across the trials (0.92 and 0.95 for women and men, respectively). The mean difference (bias) ± the 95% limits of agreement was 0.03±0.37 seconds for women and 0.03±0.33 seconds for men. MAT was correlated to the T-test (r=0.79, p<0.001 and r=0.75, p<0.001 for women and men, respectively). Significant correlations were found between both MAT and FCMJ, and MAT and 10mSS for women (r=0.47, p<0.01 and r=0.34, p<0.05, respectively). No significant correlations were found between MAT and all other tests for men. These results indicate that MAT is a reliable test to assess agility. The weak relationship between MAT and strength and straight speed suggests that agility requires other determinants of performance as coordination. Considering that field sports generally include sprints with change direction over short distance, MAT seems to be more specific than the T-test when assessing agility.
determined the validity and reliability of a 90-minute soccer performance test: Ballsport Endurance and Sprint Test (BEAST90). Fifteen healthy male amateur soccer players participated and attended 5 testing sessions over a 10-day period to perform physiologic and soccer-specific assessments. This included familiarization sessions and 2 full trials of the BEAST90, separated by 7 days. The total 90-minute distance, mean percent peak heart rate (HRpeak), and estimated percent peak oxygen uptake of the BEAST90 were $8,097 \pm 458$ m, $85 \pm 5\%$ and $82 \pm 14\%$, respectively. Measures obtained from trial 1 and trial 2 were not significantly different (p<0.05). Reliability of measures over 90 minutes ranged from 0.9–25.5\% (% typical error). The BEAST90 protocol replicated soccer match play in terms of time, movement patterns, physical demands (volume and intensity), distances, and mean and HRpeak values, as well as having an aerobic load similar to that observed during a soccer match. Reproducibility of key physical measures during the BEAST90 were mostly high, suggesting good
reliability. The BEAST90 could be used in studies that wish to determine the effects of training or nutritional interventions on prolonged intermittent physical performance.

Zagatto, AM; WR. Beck and CA. Gobatto (2009) investigated the reliability and validity of the running anaerobic sprint test (RAST) in anaerobic assessment and predicting short-distance performance. Forty members of the armed forces were recruited for this study (age 19.78±1.18 years; body mass 70.34±8.10 kg; height 1.76±0.53 m; body fat 15.30±5.65 %). The RAST test was applied to six 35-meter maximal running performances with a 10-second recovery between each run; the peak power, mean power, and the fatigue index were measured. In the first stage of the study the researchers investigated the reliability of the RAST using a test-retest method; the second stage aimed to evaluate the validity of the RAST comparing the results with the Wingate test and running performances of 35, 50, 100, 200, and 400 m. There were not significant differences between test-retest scores in the first stage of the study.
(p<0.05) and were found significant correlations between these variables (intraclass correlation coefficient=0.88). The RAST had significant correlations with the Wingate test (peak power $r=0.46$; mean power $r=0.53$; fatigue index $r=0.63$) and 35, 50, 100, 200, and 400 m performances scores (p<0.05). The advantage of using the RAST for measuring anaerobic power is that it allows for the execution of movements more specific to sporting events that use running as the principal style of locomotion, is easily applied and low cost, and due to its simplicity can easily be incorporated into routine training. It is concluded that this procedure is reliable and valid, and can be used to measure running anaerobic power and predict short-distance performances.

Penry, Jason.T (2008) examined the validity and reliability evidence of two field tests of aerobic fitness: Cooper’s 12-minute run (12MR) and the multistage shuttle run (MSR). Sixty participants (mean age=21.8±3.6y), completed three trials (occasion) of each field test (instrument) for a total of six test trials. To estimate overall reliability and evaluate possible sources of error in the field
tests, a psychometric statistical tool called generalizability study (G-study) was employed. This analysis utilized a two-random facet design (occasion and instrument) in a completely crossed ANOVA. In addition, criterion VO$_2$max was assessed in a subgroup of volunteers (n=21) via an incremental treadmill run and expired gas analysis (TR). Each participant completed the study within a six-week period. G-study analysis of the two field tests returned a high reliability coefficient ($\varphi=0.96$), with the largest amount of systematic error variance (4.3%) attributable to an interaction between participants and test occasions. This mild interaction suggests certain test participants demonstrated larger error variability across test occasions than other participants. The MSR predicted VO$_2$max values lower than those measured in the laboratory setting ($p<0.01$; paired t-tests), while 12MR and TR scores were not different ($p>0.05$). The 12MR underestimated VO$_2$max values at lower aerobic fitness levels and overestimated VO$_2$max values in individuals demonstrating greater aerobic fitness, which was not observed in the MSR data. These results suggested high
reliability for VO\textsubscript{2}max field tests in young, healthy individuals.

**Baldari, et. al., (2008)** investigated leaping ability and morphological characteristics in rhythmic gymnastics, in order to verify which parameters are useful indicators for the talent identification. Twenty-five national gymnasts of international level (age 14.7±2.2 years) underwent three testing sessions: anthropometric measurements, vertical jumps (counter movement jump and hopping test), and three technical split leaps with stretched legs (SL), with ring (RG) and with back bend of the trunk (BBT). By multiple regression analysis, among anthropometric and vertical jump variables, the hopping ground contact time was the strongest predictor of ground contact time of the three technical leaps (SL, RG, BBT) accounting for 26-37% of variance. Some anthropometric measurements are good indicators for the better performance in rhythmic gymnastics. Level of muscle compliance (stiffness) evaluated by hopping test is a good parameter for athletes selection and for monitoring leaps training.
Bandyopadhyay (2008) undertook a study to assess the suitability for application of Queen’s College Step Test as an Alternative of Harvard Step Test in Young Indian Women. One hundred and fifty five sedentary females of 19-24 years were selected for the study from Institute of Dental Sciences, UP, India to evaluate the applicability of QCT as an alternative of HST. They were divided into study group (n=100) and confirmatory group (n=55). All subjects performed QCT comfortably but 35 (20 from study group and 15 from confirmatory group) of them could not properly perform the HST due to premature fatigue in their legs and therefore these 35 subjects were discarded from the study. Existence of significant correlation (r=-0.90, P<0.001) between PFI and QCT heart rate depicted the following prediction norm for PFI from QCT heart rate : Y=195.06 – 3.09 X (SEE = 3.09). Prediction of PFI by this norm in the confirmatory group showed insignificant variation with the directly measured value from the HST. Bland and Altman’s analysis also indicated that QCT norm predicts the PFI with 95% confidence interval. Moreover, QCT is easy to perform
and the derived norm from QCT predicted the PFI score with substantially small standard error of estimate. Therefore, QCT is recommended as a valid and authentic test for evaluating PFI in young sedentary females of Uttar Pradesh, India.

Clemons, J and M. Harrison (2008) examined the validity and reliability of a new stair sprinting power (SSP) test and, in addition, develop norms for college-age students. Two hundred twenty-seven college-age volunteers participated in the study (ages: males, Mean=21.66 years; females, Mean=22.36 years). The majority (n=192) were tested with stopwatches, and 35 were tested using Speedtrap II. Participants began with their back to a wall 1.87 m from the first step of a 2.04-m high staircase of which they sprinted 2 steps per stride to the top. Excellent test-retest reliability (intra-class R) was demonstrated: overall, F(1,226)=0.420, p=0.518, R=0.986; stopwatch: males, F(1,118)=0.045, p=0.833, R=0.970; and females, F(1, 72) = 0.000, p=0.998, R=0.977; and the Speedtrap II: males, F(1, 15)=2.599, p=0.128, R=0.982; and females, F(1, 18)=0.010,
p=0.921, R=0.980. In addition, vertical jumping distance (VJD) was acquired on 25 of the Speedtrap II participants. Using Pearson product moment correlation, relationships were determined between SSP, vertical jumping distance (VJD), and vertical jumping power (VJP): VJP=(W)=51.93 countermovement VJD (cm)+48.9_ body mass (kg) 2 2007. Overall, the correlation between SSP and VJD was strong, r=0.692, p=0.000; however, correlations by sex were neither significant nor meaningful. Significantly strong correlations were found between SSP and VJP. overall, r=0.943, p=0.000; males, r=0.903, p=0.000; and females, r=0.835, p=0.000. It was concluded that the new test was safe, quick, easy to administer, inexpensive, reliable, and valid both logically and concurrently when used with college-age males and females.

**Davis, KL. et. al., (2008)** established validity and reliability evidence for the medicine ball throw test for kindergarten students. The subjects were 105 students, 5–7 years old, BMI 17.44±3.17 kg_m2, 43% female and 57% male. Intraclass correlation coefficients (ICCs) were used to examine reliability, and Pearson correlation coefficients and a
paired t-test were used to examine validity. To accomplish this, the kindergarten students completed the medicine ball throw test on two different days and the modified pull-up test, the “criterion” measure, on another day. For the medicine ball throw, each student sat on the floor before throwing the medicine ball forward like a chest pass three times. The medicine ball throw was highly reliable both within 1 day (ICCs=0.93 and 0.94 for day 1 and day 2, respectively) and across 2 days (ICC=0.88), with all reliability estimates over the acceptable level of 0.80. The medicine ball throw scores were positively related with height (r=0.34) and weight (r=0.34), and there was a significant difference between the 5-year-old group (mean 6 SD; 111.78±34.93) and the 6-year-old group (135.60±39.77), t=23.23, p<0.002, which supports correlational and known-difference evidence of validity for the medicine ball throw test. Even though no correlation was found between the medicine ball throw test and the modified pull-up test, r=0.04, other forms of validity evidence (i.e., known difference and correlational) were apparent. In conclusion, the medicine ball throw test seems
to be a valid and reliable measure of upper-body strength for kindergarten children.

**Delextrat, A and D. Cohen (2008)** examined whether the changes in the rules of the game instituted in 2000 have modified the physiological factors of success in basketball. The performances of 8 elite male players and 8 average-level players were compared in order to identify which components of fitness among agility, speed, anaerobic power, anaerobic capacity, and upper body strength were key determinants of performance in modern basketball. Each subject performed 7 tests, including vertical jump (VJ), 20-m sprint, agility T test, suicide sprint, 30-second Wingate anaerobic test (WAnT), isokinetic testing of the knee extensors, and 1 repetition maximum (1RM) bench press test. The statistical difference in the anaerobic performances was assessed by Student’s t test. The main results showed that, compared to average-level players, elite level players achieved significantly better performances in the agility T test (+6.2%), VJ test (+8.8%), peak torques developed by knee extensors (+20.2%), and 1RM bench press (+18.6%, p<0.05).
In contrast, no significant difference between groups was observed on 20-m sprint, suicide run, and parameters of the WAnT (p<0.05). These results emphasized the importance of anaerobic power in modern basketball, whereas anaerobic capacity does not seem to be a key aspect to consider. In this context, coaches are advised to avoid using exercises lasting 30 seconds in their physical fitness programs, but instead to focus on short and intense tests such as VJ, agility T test, and sprints over very short distances (5 or 10 m).

Mirkov, DM. et. al., (2008) evaluated the soccer-specific field tests that are popular among coaches due to their simplicity, validity, and minimal use of equipment. However there is a general lack of data about their reliability, particularly regarding the tests of anaerobic performance. Twenty professional male soccer players performed 3 consecutive trials of the tests of throwing-in and standing-kick performance (the distance measured) as well as on timed 10-m sprint, flying 20-m sprint, running 10 3 5 m, zigzag running with and without the ball, and the skill index (i.e., the ratio of the zig-zag running without and with the
With the exception of the throwing-in and standing kick, the evaluated tests revealed high intra-class correlation coefficients (r=0.80), small within-individual variations (coefficient of variation, 4%), and sample sizes for detecting a 2% change in the tested performance that are either close to or below the standard size of a professional soccer squad. In addition to simplicity and face validity, most of the evaluated tests revealed high reliability. Therefore, the evaluated tests are recommended for sport-specific profiling and early selection of young athletes as well as for routine testing procedures that could detect effects of various intervention procedures. Regarding the throwing-in and standing-kick tests, direct measurement of the ball velocity (e.g., with a standard radar gun) is recommended.

**Ortega, et.al., (2008)** examined the reliability of a set of health-related physical fitness tests used in the European Union-funded Healthy Lifestyle in Europe by Nutrition in Adolescence (HELENA) study on lifestyle and nutrition among adolescents. A set of physical fitness tests was performed twice in a study sample, 2 weeks apart, by the
same researchers. A total of 123 adolescents (69 males and 54 females, aged 13.6±0.8 years) from 10 European cities participated in the study. Flexibility, muscular fitness, speed / agility and aerobic capacity were tested using the back-saver sit and reach, handgrip, standing broad jump, Bosco jumps (squat jump, counter movement jump and Abalakoy jump), bent arm hang, 4x10m shuttle run and 20m shuttle run tests. The ANOVA analysis showed that neither systematic bias nor sex differences were found for any of the studied tests, except for the back-saver sit and reach test, in which a borderline significant sex difference was observed (p=0.044). The Bland-Altman plots graphically showed the reliability patterns, in terms of systematic errors (bias) and random error (95% limits of agreement), of the physical fitness tests studied. The observed systematic error for all the fitness assessment tests was nearly 0. Neither a learning nor a fatigue effect was found for any of the physical fitness tests when repeated. The results also suggest that reliability did not differ between male and female adolescents. Collectively, it can be stated that the reliability of the set of physical
fitness tests examined in this study is acceptable. The data provided contribute to a better understanding of physical fitness assessment in young people.

Vaeyens, et.al., (2008) threw light on talent identification and development programmes that have gained popularity in recent decades. There remains a lack of consensus in relation to how talent should be defined or identified and there is no uniformly accepted theoretical framework to guide current practice. The success rates of talent identification and development programmes have rarely been assessed and the validity of the models applied remains highly debated. This study provides an overview of current knowledge in this area with special focus on problems associated with the identification of gifted adolescents. There is a growing agreement that traditional cross-sectional talent identification models are likely to exclude many, especially late maturing, 'promising' children from development programmes due to the dynamic and multidimensional nature of sport talent. It is advocated that talent identification and development programmes should be
dynamic and interconnected taking into consideration maturity status and the potential to develop rather than to exclude children at an early age. Finally, more representative real-world tasks should be developed and employed in a multidimensional design to increase the efficacy of talent identification and development programmes.

**Barfield, JP. et. al., (2007)** examined the reliability (test-retest, inter-rater), validity (criterion-related, construct related), and practice effect of the PIE among men and women college basketball players. Test-retest estimates were moderate for men (intra-class correlation coefficient [ICC]_0.79) and poor for women (ICC_0.35), but inter-rater reliability was high (ICC_0.95). Criterion-related validity evidence (i.e., relationship between PIE and playing time) was weak, but construct- related evidence was acceptable (i.e., college players had higher scores than high school players). A practice effect was also demonstrated among men. In conclusion, reliability of the battery should be improved before its use is recommended among college basketball players. Additionally, the battery does not appear to be a
predictor of performance but does appear to distinguish between skill levels.

Hol, AT. et al., (2007) designed a sub maximal arm ergometry test (six-minute arm test [6-MAT]), for persons with spinal cord injury (SCI) and to determine the test-retest reliability and concurrent validity of this test. To determine test-retest reliability, subjects completed the 6-MAT on 2 days, separated by 1 week. Validity was determined by comparing 6-MAT results with peak oxygen consumption (VO₂peak). Thirty subjects with SCI (mean age, 36.3y; 83% male) participated in this study. Subjects were evaluated on the 6-MAT and a VO₂peak test. All subjects were able to complete the 6-MAT. Test-retest reliability of steady-state oxygen consumption (V’O₂) and heart rate during the 6-MAT were excellent (intra-class correlation coefficient [ICC], 0.81; 95% confidence interval [CI], 0.58–0.92; ICC_0.90; 95% CI, 0.75–0.96, respectively). The correlation between VO₂ peak and 6-MAT V’O₂ was excellent (r_0.92) and the correlations between VO₂ peak, 6-MAT heart rate (r_0.63), VO₂peak and 6-MAT power output (r_0.73) were good. This study showed
that the 6-MAT has acceptable values for test-retest reliability and validity. The 6-MAT should be further tested for responsiveness to enhance its use as a clinical tool.

**Beets and Pitetti (2006)** examined the Healthy Fitness Zone (pass / fail) criterion referenced reliability (CRR) and equivalency (CRE) of the 1-mile run/walk (MRW) and Progressive Aerobic Cardiovascular Endurance Run (PACER) in adolescents (13 to 18 years). Seventy-six girls and 165 boys were randomly assigned to complete 2 trials of each test. CRR for the boys on the MRW (Pa=77%, $K_q=0.53$) was lower than on the PACER (Pa=81%, $K_q=0.63$); girls were classified more similarly on the MRW (Pa=83%, $K_q=0.67$) than on the PACER (Pa=79%, $K_q=0.58$). The CRE between the MRW and PACER indicated boys (Pa=77%, $K_q=0.55$) were classified more consistently on both tests than girls (Pa=73%, $K_q=0.46$). No test provided greater consistency. Practitioners may consider other features, such as case of administration, environmental conditions and comparative use in the literature.
Pearson, Naughton, and Torode (2006) were of the opinion that entrepreneurial marketing of sport increases demands on sport development officers to identify talented individuals for specialist development at the youngest possible age. Talent identification results in the streamlining of resources to produce optimal returns from a sports investment. However, the process of talent identification for team sports is complex and success prediction is imperfect. The aim of this review is to describe existing practices in physiological tests used for talent identification in team sports and discuss the impact of maturity-related differences on the long term outcomes particularly for male participants. Maturation is a major confounding variable in talent identification during adolescence. A myriad of hormonal changes during puberty results in physical and physiological characteristics important for sporting performance. Significant changes during puberty make the prediction of adult performance difficult from adolescent data. Furthermore, for talent identification programs to succeed, valid and reliable testing procedures must be accepted and
implemented in a range of performance-related categories. Limited success in scientifically based talent identification is evident in a range of team sports. Genetic advances challenge the ethics of talent identification in adolescent sport. However, the environment remains a significant component of success prediction in sport. Considerations for supporting talented young male athletes are discussed.

**Lidor, et.al., (2005)** identified motor, physical, and skill variables that could provide coaches with relevant information in the selection process of young team handball players. In total, 405 players (12-13 years of age at the beginning of the testing period) were recommended by their coaches to undergo a battery of tests prior to selection to the Junior National Team. This number is the sum of all players participating in the different phases of the program. However, not all of them took part in each testing phase. The battery included physical measurements (height and weight), a 4x10m running test, explosive power tests (medicine ball throw and standing long jump), speed tests (a 20-m sprint from a standing position and a 20-m sprint with a flying
start), and a slalom dribbling test. Comparisons between those players eventually selected to the Junior National Team 2-3 years later with those not selected demonstrated that only the skill test served as a good indicator. In all other measurements, a wide overlap could be seen between the results of the selected and non-selected players. It is suggested that future studies investigate the usefulness of tests reflecting more specific physical ability and cognitive characteristics. The need for assessing sports skills had been felt on every stage of the development of every game and the review clearly unfolds studies on construction and evaluation of skill tests in all games. The investigator was able to gain a thorough knowledge of the studies already done relating to the present problem.

Markovic, G. et.al., (2004) determined reliability and factorial validity of squat (SJ) and countermovement jump (CMJ) tests, and compared 3 popular methods for the estimation of vertical jumping height. Physical education students \((n=593)\) performed 7 explosive power tests, 5 different vertical jumps (Sargent jump, Abalakow’s jump with
arm swing and without arm swing, SJ, and CMJ) and 2 horizontal jumps (standing long jump and standing triple jump). The greatest reliability among all jumping tests \((r=0.97 \text{ and } 0.98)\) had SJ and CMJ. The reliability coefficients for other jumps were also high and varied between 0.93 and 0.96. Within-subject variation (CV) in jumping tests ranged between 2.4 and 4.6\%, the values being lowest in both horizontal jumps and CMJ. Factor analysis resulted in the extraction of only 1 significant principal component, which explained 66.43\% of the variance of all 7 jumping tests. Since all jumping tests had high correlation coefficients with the principal component \((r=0.76 \text{ – } 0.87)\), it was interpreted as the explosive power factor. The CMJ test showed the highest relationship with the explosive power factor \((r=0.87)\), that is, the greatest factorial validity. Other jumping tests had lower but relatively homogeneous correlation with the explosive power factor extracted. Based on the results of this study, it can be concluded that CMJ and SJ, measured by means of contact mat and digital timer, are the most reliable and valid
field tests for the estimation of explosive power of the lower limbs in physically active men.

**Baskaran (2001)** constructed a Volleyball skill test and computed the norms for school boys of different age groups in Pondicherry state. One thousand five hundred and five (1505) male School students in the age group of 13 to 15 years were selected as subjects. All the subjects were selected from 7th, 8th, 9th and 10th classes in each school. For the construction of new skill tests, the investigator selected pass and service skills. The criterion tests were the Brumbach forearm (under arm) pass Volley test, Glady’s Scot and Easther Frenche’s service placement test. Two new skill tests were designed with suitable court markings for the new service skill test and for the underhand skill test. The reliability, validity and objectivity of the new skill tests were established. Thereafter norms were compiled for the newly constructed tests for each skill and for each age group. To construct norms, Hull Scale statistical technique was employed. It was found out that the newly constructed service skill tests were good and consistent. As per the
qualitative grading in the pass skill out of 1505 subjects, 73 fell in failing category, 194 were below average, 554 were average, 483 were above average, 180 were good and 21 were outstanding. In the service skill, as per the qualitative grading it was found out that out of 1505 subjects, 86 fell in failing category, 170 were below average, 543 were average, 522 were above average, 138 were good and 46 were outstanding.

**Pauole, et.al., (2000)** examined the reliability and validity of the T-test as a measure of leg power, leg speed, and agility. A total of 304 college-aged men (n=152) and women (n=152), selected from varying levels of sport participation, performed 4 tests of sport skill ability: (a) 40-yd dash (leg speed), (b) countermovement vertical jump (leg power), (c) hexagon test (agility), and (d) T-test. For both men and women, significant differences (p<0.05) in mean scores were found among groups for the T-test. The intraclass reliability of the T-test was 0.98 across 3 trials. For men, the Pearson product moment correlations between the T-test and the 40-yd dash, vertical jump, and hexagon test were
r=0.53, r=0.49, and r=0.42, respectively (p<0.05). For women, the corresponding correlations were r=0.73, r=0.55, and r=0.48 (p<0.05). Regression analyses showed that for men 48% of the variability and for women 62% of the variability of the T-test scores can be predicted from measures of leg power, leg speed, and agility (p<0.05). Computing partial correlations assessed the criterion validity of the T-test as a measure of agility, leg power, and leg speed. The T-test appears to be highly reliable and measures a combination of components, including leg speed, leg power, and agility, and may be used to differentiate between those of low and high levels of sports participation.

Aragón-Vargas (2000) evaluated and compared four different methods commonly used to measure vertical jump performance with 52 physically active men each performed 5 maximal vertical jumps. Kinetic and kinematic data were used to analyze each trial using the 4 methods: a criterion test based on body center of mass displacement (VJPT), 2 methods based on vertical takeoff velocity as calculated from the force platform, and 1 method based on time in the air
All 4 methods showed excellent reliability ($R>0.97$). Using VJPT as the criterion, the other 3 methods showed excellent coefficients of validity ($R>0.95$) but poor accuracy. The obtained vertical jump height scores were statistically different among all methods ($p<.01$). JUMPAIR is considered a relatively simple and inexpensive method to obtain valid and reliable measures of vertical jump performance without an arm swing, provided the appropriate adjustments are made to the jump results.

Varghese (2000) constructed the norms for the predicted skills, physical and anthropometrical variables for College men Soccer players in Kerala. The data were collected from one hundred soccer players in the age group of 18 to 25 years on the chosen nine variables, viz, dribbling, ball control, kicking, speed, power, endurance, height, leg strength and thigh girth. For the prediction, Wherry Do Litte method of variable selection was employed. From the nine chosen variables, ball control power, dribbling and endurance were predicted in the order of importance. After the prediction data were collected for 2000 subjects on the
predicted variables. To construct norms, Hull Scale was employed. As per the qualitative grading, it was found that 317 subjects fell in failing group, 873 subjects fell in below average, 748 above average and 137 were good in ball control. In power, 18 subjects were failing group, 260 were below average, 829 were average, 609 were above average and 93 were outstanding. In dribbling, 158 were in failing category, 126 were below average, 744 were in average, 773 were above average, 238 were good and 36 were outstanding. In endurance, 101 subjects were in the failing category, 90 were below average, 767 were average, 813 were above average, 276 were good and 28 were outstanding.

Williams (2000) reviewed the key components of perceptual skill in soccer, and highlighted the implications for talent identification and development. Skilled soccer players can recall and recognize patterns of play more effectively than their less skilled counterparts. This ability to encode, retrieve and recognize sport-specific information is due to complex and discriminating long-term memory structures and is crucial to anticipation in soccer. Similarly,
experts use their knowledge of situational probabilities (i.e. expectations) to anticipate future events. They have a better than average idea of what is likely to happen given a particular set of circumstances. Also, proficiency-related differences in visual search strategy are observed. Skilled players use their superior knowledge to control the eye movement patterns necessary for seeking and picking up important sources of information. The nature of the task plays an important role in constraining the type of search used. Skilled soccer players use different search strategies when viewing the whole field (i.e. 11 vs 11 situations) compared with micro-states of the game (i.e. 1 vs 1, 3 vs 3 situations). Visual search behaviour also differs between defensive and offensive plays. These observations have implications for the development of perceptual training programmes and the identification of potential elite soccer players.

**Pichaiappa (1999)** conducted a study to construct norms for the predicted fundamental volleyball skills for school boys in Tamil Nadu in the age groups of 16,17 and 18
years. Initially 100 volleyball players in each age group, who participated in the inter school competition, were selected as the subjects for prediction. The following variables namely underhand pass, overhead pass, spiking, serving, setting, blocking and playing ability were chosen as the variables. Wherry Do Litte method of variable selection and multiple correlation were used for selection of variables and prediction. Data from 2000 volleyball players were collected in each group for the construction of norms on the predicted skills. Mean, standard deviation and hull scale were the statistical techniques used. The following results were obtained. Among all the skill variables analyzed, service and underhand pass were found to be significantly related to volleyball playing ability for all these 16, 17 and 18 years of age groups. Spiking was found significantly related to volleyball playing ability for 16 and 17 years age groups. Setting was found significantly related to volleyball playing ability for 16 and 18 years age groups. Overhead pass and blocking were found to be significantly related to volleyball playing ability for only age groups of 17 and 18 respectively.
On the basis of hull scale quantitative grading for the different age groups was computed.

**Yilla and Sherrill (1998)** validated the Beck battery of quad rugby skill tests. The purpose was to develop a valid and reliable battery of quad rugby skill tests. Participants were 65 adult male quad rugby athletes. Construct validity was established in two modified Delphi rounds by a panel of international experts. For Concurrent validity, Spearman rho correlation between coaches’ rankings of players’ skills and scores ranged from 0.63 to 0.98 for the total battery. Inter-class reliability co-efficient ranged from 0.94 to 0.99. The battery includes five tests, maneuverability with the ball, pass for accuracy, picking, sprinting and pass for distance.

**Chandrasekaran (1997)** constructed a basketball skill test battery for Tamil Nadu School boys of fourteen to sixteen years. 156 male basketball players who represented their division were the subjects. The preliminary test package included eighteen test items under the five fundamental skills. The playing ability of each subject was determined by
subjective ratings during the competition. The prime intention of the researcher was to construct a comprehensive module with limited number of test items and greater level of dependability. The tests such as Different spot shot, Pace dribble, Star defensive movement, Zig-zag lay-up shot and Moving pass were found to be highly reliable and fully valid final test battery, which yielded a high level validity score of 0.972.

**Helina (1997)** constructed the norms for the AAHPERD youth fitness test variables for the Physical Education professional College men and women students in Tamil Nadu. A total of 1064 men students and 460 women students studying in seven Physical Education Colleges in Tamil Nadu were selected as subjects for this study. AAHPERD youth fitness test variables namely, shoulder strength, abdominal strength, agility, power, speed and endurance were selected for norm construction separately for men and women. Mean, Standard Deviation and Hull Scale were used as the statistical techniques to construct the norms.
Kirubakaran (1996) constructed a battery of objective skill test in Hockey for Madras University students. Thirty two (32) men college students belonging to the age group of 19 to 25 years were selected and they had enough experience in the game as players representing the college or the university. The researcher conducted the following tests such as Speed, Dribble test, Ball carrying, dodging, passing ability test and target hitting test. The scientific authenticity of the battery of skill tests was established by computing the correlation co-efficient. The battery of skill tests constructed by the investigator measures the offensive Hockey playing ability of the Madras University students. It is found that the battery of objective skill tests satisfied the criterion of scientific authenticity in reliability, objectivity, validity and administrative feasibility. Further they had a significant correlation between the total scores of the test battery and the hockey playing ability assessed by the experts.

Vairamani (1996) constructed a objective test and computed the norms for the measurement of agility. Four thousand eight hundred forty eight (4848) boys were selected
from all the Kendriya Vidyalaya School of Tamil Nadu State. The test scores were correlated using Pearson’s Product moment correlation and intraclass correlation method. The results of the study revealed a reliability coefficient of different groups and tested population varying from 0.75 to 0.99 which was highly significant. The validity coefficient ranged from 0.85 to 0.93 which showed a high validity. Further, a norm scale using Hull Scale was also computed for agility.

**Hui, et.al., (1995)** conducted a study to improve the reliability and validity of racquetball skills tests through modification of the existing tests, and to develop an innovated test battery. Two trials of the modified service placement (SV), rally (RL), power (PW) and kill shot (KS) tests were included with two newly developed tests, ceiling shot (CS) and the power placement (PP) tests. A total of 67 college students (40 males and 27 females) were the subjects representing different levels ability and experience recruited from three beginning racquetball classes at major university. Intra-class reliability for internal consistency of the two trials
of the skills tests was determined using repeated measures ANOVA procedures (Reliability ranges from 0.725 to 0.964 for male and 0.491 to 0.900 for female). The concurrent validity of the skills tests was determined by the inter correlations between the criterion scores (average scores per game) from a single round robin tournament and the skills tests scores (concurrent validity ranges from 0.623 to 0.815 for male and 0.478 to 0.716 for female). Tests for a significant increase in R-squared following stepwise regression analysis indicated that SV, RL, CS and PP were redundant for females in terms of prediction of tournament performance, whereas the CS and SV were redundant for males in terms in terms of prediction of tournament performance. Therefore the test battery recommended for college females includes KS and PW, while for college males PP, PW, RL and KS are recommended.

Johari and Siai (1995) estimated the reliability of 7 subtests in the National Sports Council physical fitness test battery. The test battery was administered to a sample class of 25 students (mean age 14.2 years ± 0.5) on
2 occasions, three days apart, to estimate the intraclass R using ANOVA procedures. The F-test for independence of trials detected a dependency for the 1500 m run and the sit and reach test. High values of intraclass reliability coefficient were obtained 0.97 (1500 m run), 0.95 (agility run), 0.94 (flexed-arm hand, and sargent jump) and 0.86 (sit-up).

**Montgomery, DL; G. Reid and LP. Koziris (1992)** examined the reliability and validity of cardiovascular fitness tests. Ten untrained controls and 18 adults with mental handicaps (experimental group) completed five trials on each of four exercise protocols. VO$_2$ max results (M±SD) averaged across trials were as follows: Maximal treadmill test, 27.2 ± 6.2 for the experimental group (E) and 45.5 ± 8.1 for the control group (C); Maximal shuttle run test, 19.7 ± 3.4 (E) and 42.1 ± 6.2 (C); Submax step test, 33.0 ± 7.6 (E) and 44.5 ± 7.6 (C); and Submax cycle ergometer test, 36.4 ± 13.1 (E) and 42.0 ± 7.1 (C). The four modes had similar VO$_2$ max values across trials with intra-class correlations ranging from $r = 0.90$ to 0.97. To examine validity, the predictive tests were
compared with the treadmill VO$_2$ max test. Both the step and shuttle run tests correlated significantly with the treadmill test. The duration of the shuttle run test was not related to the exercise intensity. The stepping test is recommended over both the maximum shuttle run test and the submaximum cycling test when measuring the aerobic fitness of adults with mental handicaps.

**Sabharwal (1991)** established a criterion for the selection of Basketball players on the basis of skill performance. The subjects were 38 inter-collegiate basketball men players of Jiwaji University in the age group between 18 and 25 years. The test battery consisted of eight items namely field goal speed test, basketball throw for accuracy, dribble, three points shooting, rebounding, defensive shuffle, dribbling cum lay-up shooting, and reverse dribble. A panel of three experts judged basketball-playing ability during an Inter-collegiate Basketball Championship. All the test items were significantly correlated with the judge’s rating. In the order of their high magnitude, three tests were selected to develop the test battery. The multiple correlation co-efficient
was computed between criterion variable and independent variable and it was 0.82. Reliability coefficient of the different test items of basketball skill test battery was established. For Field goal speed test, it was 0.92, for three points shooting 0.93 and for dribbling and lay-up shooting 0.91. The raw scores of finally selected skill test items were converted into standard scores (Z scores). The standard scores for each subject for all the three items were added to obtain composite score. It was correlated with basketball playing ability scores. The validity coefficient was 0.91. Different test items of validity were calculated. Field goal speed test was 0.90, three points shooting was 0.91 and dribbling and lay up shooting were 0.92. Norms were developed on the basis of normal curve principles.

A modified form of the AAHPERD health related physical fitness test was administered to a sample of 200 college physical education majors by Dinucci et al., (1990). The skin fold measures were changed from the original test and the flexed arm hang was added to the test battery. The validity and reliability of the test battery has been established
for middle school boys and girls. This study determined the multivariate reliability of the modified test battery using a canonical correlation model. The univariate interclass reliability of the test items ranged from 0.91 to 0.99. The total redundancy for the modified test battery was 0.87.

Yadav, (1986) conducted a study on standardization of physical fitness norms for School children of Haryana (13 to 16 years of age) with the purpose of estimating the fitness and comparing the standard of physical fitness between urban and rural boys of Haryana. For the purpose of this study, 3600 school boys of the twelve districts of Haryana were randomly selected and the performance of the boys were recorded on 50m dash, shot-put, standing broad jump, zig-zag run, sit-ups and step up test. The norms in terms of percentile rank were developed.

Bhattacharya (1984) constructed an objective skill test battery in soccer for professional students of physical education. The subjects were 130 men students of Bachelor of Physical Education. The test battery consisted of 4 items,
namely kicking for distance, kicking for accuracy, heading for
distance and dribbling the ball. The reliability of 0.96, 0.92,
0.94 and 0.92 was obtained for the above test items
respectively. The validity co-efficient obtained was 0.86.

Summary

From the review of related of related literature it became
very clear to the investigator that measurement in Physical
education and Sports had been parallel to the development
and growth of every game. Studies on various fields like
anthropometrical, motor qualities, cardiovascular, athletic
ability and fitness have begun much earlier. The need for
assessing sports skills had been felt on every stage of the
development of every game and the review clearly unfolds
studies on construction and evaluation of skill tests in all
games. The investigator was able to gain a thorough
knowledge of the studies already done relating to the present
problem.