CHAPTER - II

REVIEW OF RELATED LITERATURE

The researcher has made every effort to obtain literature related to the problem for the game of Judo. For this purpose, he made the maximum possible efforts by spending considerable time in the major libraries pertaining to the literature on physical education and sports. The researcher has access to the libraries of Punjab University, Chandigarh, I.G. College of Physical Education, Delhi and Lakshmibai National Institute of physical Education, Gwalior. A brief review of the studies relevant to the problem has been presented in this chapter.

The literature pertaining to present study has been abstracted in this chapter to provide the background material so as to evaluate the study well as to interpret its findings.

REVIEW RELATED TO SPECIFICITY

Fink (1960) conducted a study on the specificity of conditioning in swimming and running. He tested fresh men-swimmers and fresh men varsity runners during the first week of practice and re-tested them after six weeks. After brief warming up, the subjects ran at the maximum speed for 30 seconds on one day and swam for 30 seconds the following day. The pulse rate slow-down method was employed to determine how quickly the cardiovascular system recuperated. The experimental results supported the principles of specificity of training in that game in general endurance and cardiovascular efficiency acquired in training for one sport which made only a slight contribution to performance in the other sport.
Hooks (1962) suggested different weight training programmes for different sports like Basketball, Football, Swimming and Track and Field events etc., taking into account their different requirements of fitness.

Stothart (1966) conducted a study on the specificity concept related to muscular endurance. He tested the maximum isometric strength at 130 and 160 angles of knee extension for 42 university men who averaged 19.9 years in age, 69.9cm in height and 159.41b in weight. Muscular endurance of right quadriceps was tested at each angle with loads of 30% and 45% of the maximum strength with one week between the tests. The correlation between isometric strength and muscular endurance were low and negative. Component analysis and intercorrelation of muscular endurance measures showed that although endurance component was common to all measures specific to the angle of testing, yet endurance was not specific to the load. Correlation between the knee angle lengths were moderate, but using these in partial correlation, left the original endurance correlations relatively unaltered.

Considine (1967) conducted a study on task specificity. He concluded from his study that the data collected from groups of athletes and non athletes indicated that reflex time was significantly faster than reaction time of non-athletes. A low positive but non-significant correlation between reflex time and reaction time, suggested task specificity.

Megal (1975) et al, investigated specificity of endurance swim training on improvement of maximal aerobic power. Fifteen men trained 1 hour a day, 3 days a week for 10 weeks. Before and after the training the max VO2 of all subjects was measured during both, treadmill running and swimming. A complete specificity was noted for 11% improvement in max VO2 with swim training. Since a vigorous training exercise such as swimming, provides a general overload
to the central circulation, they had expected, at least, some improvement or transfer.

Edington and Edgerton (1976) wrote in their book, the biology of physical activity, the "specificity of training" concept suggested that an individual who trains only for one specific event will be superior in the event to the other individual who trains simultaneously for a series of events. They put forth the theory of physical training for athletes based on the concept of specificity of exercise. They also suggested that in establishing training methods, a person must emphasize those training techniques that optimally adopt the specific factors involved in the activity. The exercise task must be specific to the training goal.

Counsilman (1976) beautifully explains the principle of specificity when he says that athletes who use moderate resistance and moderate repetitions, can build a moderate amount of both, strength and endurance. A body-builder who works with heavy resistance and a few repetitions, at a slow or moderate speed, will build big muscles that will enable him to do exercises with heavy weights at a slow or moderate speed. To develop muscle-contraction speed, the exercises must be performed at a high speed.

Willmore (1984) while discussing modes of testing, said. There is an increasing awareness of the importance of selecting the appropriate test mode when testing athletes in various sports, i.e. a mode which most closely approximates the actual sport activity."

The concept of specificity can also be applied to the test protocol. When subjects are trained by hill running, the increase in VO2 max is greater when using a treadmill protocol which increments power by increases in grade compared to a protocol which increments power by increases in speed. Thus due
care should be taken to match the protocol for the testing mode or device, as closely as possible, to the conditions under which the individual trains.

STUDIES RELATED TO PRESENT INVESTIGATION

Schewegler and Engle (1924) state that United States Military Academy Physical Efficiency test was constructed and developed for Military Academy. The test is designed to measure muscular strength, ability, power, co-ordination, endurance, speed and skill. The battery items included vertical jump, bar vault, dodge run, standing broad jump, sit ups, chins, dips, softball throw, 300 yards run and rope climbing. A physical aptitude test was proposed as a basis for admission to the academy. Cadets are required to meet maximum standards. Cadets performing poorly tended to drop. This necessitated development of tests. The plan calls for the physical aptitude test to be administered with other entrance examinations. A number of events were studied and scaled and exact items in the battery varied from year to year. Typical Batteries used were: Battery I: Vertical jump, Medicine ball put, Chinning, Dodge run, Sit ups and 300 yards shuttle run. Battery II: Standing Broad jump, Medicine ball put, Dipping, Dodge run, Sit ups, 300 yards Shuttle run.

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

A Research Committee of the National Section on women's athletics U.S.A devised a Motor Fitness Test that includes: 1) standing broad jump, 2) basket ball throw, 3) potato race (shuttle run), 4) push ups, 5) pull-ups (base 42
inches) above floor, reverse grasp (pull to chest to bar position), 6) sit ups (feet 24 to 30 inches apart, fingers touching behind neck), 7) squat thrust (10 second to indicate agility and 8) squat (30 second as a partial measure of endurance) when limiting factors do not permit to give this 8 item test, a short form consisting of standing broad jump, basketball throw, potato race, squat thrust, sit ups and push-ups or pull-ups may be given. A sigma scale, scoring table is available alongwith a table of expected improvement of 4500 girls in 25 different high schools.

Philips (1949) concluded that power has shown significant correlation with strength and speed. She examined 200 college women on 27 test items selected from different tests. The data was subjected to Thurstone method of factor analysis, which yielded 4 factors viz. speed, general strength and abdominal strength as major components of Physical Education tests; and the fourth was left un-identified.

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

Barrow and Harold (1954) developed a test for measuring motor ability for men and the purpose of this study was to develop an easily administered test of motor abilities for college men. Experts opinion was used in the validation process and eight factors were chosen. The selected items were administered to 222 college men and statistical analysis covered items like reliability, objectivity, co-relation with the criterion inter co-relations through use of double technique i.e. multiple correlation and regression equation were also computed for a number of combinations. Two test batteries (including one short indoor test) were
recommended. Scoring tables, norms, score cards, profile and directions for administering the test were included in a test manual.

A study was conducted by Stein (1964) to ascertain the reliabilities of individual test items of the youth. Fitness test when administered in accordance with the instructions in the youth fitness Test Manual as a part of the regular Physical Education programmes in the Annington country (Virginia) schools. All junior and senior High School boys and girls were given the youth fitness tests during the third week of May, 1963. Four boys classes (10th and 12th grades) at work field High school were selected as the subject for the study. Before the administration of the initial test all classes were oriented as to the events included in the test battery and the procedure and objective of the respective test items. The administrative procedures recommended in the Youth Fitness Test Manual (1) were strictly followed for pull ups, broad jump, sit ups, shuttle run 1st day - pull ups 50 yds dash, soft ball throw and 600 yds run or walk. The initial testing was done on Thursday and Friday as a part of the regular programmes.

The original subjects from the four classes, 50 boys were selected at random included in the analysis of data. Raw scores were used for comparative purposes for each of the individual test items. Pearson Product moment correlation techniques were used to interpret the results. Five of the seven test items pull ups, broad jumps, sit ups, 50 yds dash and soft ball throw had very high and dependable reliability co-efficients ranging between 90 to 98. The other two items (shuttle run and 600 yds run or walk showed average to high relationship ranging between 74 to 83.

A physical fitness test with 19 items was conducted by Karvener (1964) on finish secondary school children. The test battery included balance, flexibility, agility strength, power and endurance. Several tests were of pass fail type. The following major results were obtained.
1. Balance test, squat and dizziness recovery were the tests that were included in the study.

2. Tests like floor touch, man lift and endurance hops were very easy and extended press-up was found very difficult.

3. The standing broad jump showed improvement with the age. The test battery on the whole was not satisfactory.

**John** (1965) prepared National norms for the one minute basket ball throw for goal, pull-ups, Potato race, standing hop-step and jump, push-ups, standing broad jump and softball target throw items of the Y.M.C.A. tested 2,000 boys in each group throughout the United States. The author obtained five percent of the scores at the Salem Y.M.C.A.

**Falls, et.al.** (1965) analyzed 53 variables to develop a physical fitness test battery, here in, he subjected the data to factor analysis and regression analysis factor loadings were used as validity co-relations to multiple regression analysis to develop a test battery for the isolated factors.

**Bitcon** (1966) undertook a normative study for high school boys in the state of Iowa. He selected four items, used correlation technique with the AAHPER Youth Fitness Test and established validity and reliability. The four item test and the AAHPER Youth Fitness Test were conducted on eighty four high school boys. The degree of relationship between the two tests was found by computing and correlating the composite scores. The reliability of the four item test was determined by test-retest technique. The co-efficient of co-relation between the AAHPER Physical Fitness Test and composite score and between the test-retest composite scores of the four item test were 0.934 and 0.961 respectively. Percentile norms were constructed for each of the items and composite scores.
Box (1967) prepared percentile norm tables for selected measures of strength, power, agility, flexibility, body composition, cardio-vascular and muscular endurance from data collected in five schools of the United Christian school style of Hundsoivntile.

David (1967) prepared percentile norm tables for selected measures of strength, power, agility, flexibility, body composition and cardio-vascular and muscular endurance from data collected in five schools of the Unity Christian School system at Hundseonville.

Barrow and Mcaee (1971) have reported that Glover constructed a physical fitness test battery for primary grade children. The items were: 1. standing broad jump (to measure power and leg strength), 2. Shuttle run (to measure leg strength, speed and endurance), 3) seal crawl (to measure arm and shoulder girdle strength, endurance and speed), 4. sit up (to measure abdominal strength, endurance and speed). The test was meant for measuring essential components of motor qualities. The norms were prepared for four items and were also used for classifying the children into ability groups by assessing the physical fitness.

When 128 undergraduate Physical Education Majors were administered 49 test variables by Mckinny and Dean (1972) using principal components factor analysis with varimax rotation, yielded five factor. They constructed two motor fitness test batteries for male Physical Education majors. Each battery consisted of five test variables.

Cobb (1972) aimed at constructing a test battery for assessing the motor fitness of first, second and third grade girls. The subjects for the study were 183 girls from selected elementary schools in Natchitoches Pariah, Liouisiang. The
investigator concluded that there was some general agreement among authorities in Physical Education regarding the components of the motor fitness.

Shores (1972) study aimed at constructing a test battery for assessing motor fitness of boys in lower elementary grades. The investigator formulated the following hypothesis: what battery of valid, objective and reliable motor fitness test items best reflects the total motor fitness of boys in the lower elementary grades? On the basis of review of literature following components were selected for use in the construction of a motor fitness test battery for boys of lower elementary grades: muscular endurance, cardiovascular endurance-muscular strength, speed power, agility, flexibility and balance. Thirty experimental test items were selected as valid and reliable measure of motor fitness. These test items were administered to 238 boys, enrolled in first, second and third grades. The resultant, data were factor analysed according experimental test items were selected as valid and reliable measures of motor fitness. These test items were administered to 238 boys enrolled in first, second and third grades. The resultant, data were factor analysed according the principle Axes method with variance criterion for rotation. Seven factors were revealed and tentatively named: (1) muscular strength (2) balance (3) muscular endurance (4) three factors all of which are identified factor. Two test batteries containing seven items were developed on the basis of test items. Test battery 1 contained the highest loading test items for each factor identified and included the following seven measures: (1) Clarke's strength composite; (2) Macloys Endurance Ration; (3) Well's sit and Reach; (4) Base Balance on stick lengthwise; (5) leg flexion and extension flexibility; (6) Arm flexion on the back flexibility and (7) modified push-ups.

In order to construct a scientifically designed evaluative instrument to assess the motor fitness of boys in primary grades, Dinnuce (1973) purported 30 test items to measure muscular endurance, cardiovascular endurance, power, speed, agility, flexibility and balance items were administered to an incidental
sample of 238 boys, ages six to nine years. An inter correlation matrix was constructed for the factor analysis of the data using the principle axes method. Seven factors having valued above 1000 and accounting for 67.17 percent of the variance were isolated. The first of the two test batteries developed included the test items which were loaded highest on each factor and were as follows; Darkes strength composite, Mcclays Endurance Ratio, wells sit and Reach Base Balance on a stick length wise, wrist flexion and extension, flexibility and modified push-ups. The second test battery was developed for more administrative feasibility. It included items which were loaded high on each factor and Eliminated Composite score and ratios. The items in this battery were, grip strength, 300 yards run, well's sit and Reach, Base Balance on stick, Length wrist flexion and extensions flexibility, arm flexion on the back flexibility and modified dips.

Disch (1973) in an effort to draw the dimensionality of speed of body movement administered 23 tests to 73 males by subjecting the data to factor analysis four factors of speed, i.e. Sprinting, Controlled, leg and arm speeds were extracted.

Alexander (1973) determined the factors contributing to motor performance. He administered 34 variables on Male and Female subjects numbering 220. There were six factors in male group namely : leg strength and speed, arm and shoulder girdle strength and endurance, explosive strength, basketball skill, muscular strength and endurance and grip strength. in female group, the factors were: muscular endurance and agility, leg power, explosive strength, balance and static strength of arms.

Bissonnette (1974) administered a twenty four item test on 112 seven and eight year and 117 eleven and twelve year old boys and identified the nature of physical fitness of elementary school boys though factor analysis. The data collected was co-related and the variance criterion for rotation was used to
maximize 3 loading on each factor. Five similar physical fitness factors namely body fat, body dimensions static strength, hip flexibility, recovery pulse and muscular endurance were identified for all ages.

Sixteen test items on 50 male college students have been administered by Jackson and Frankiew (1975) in their effort to find the factors of the human muscular strength. Multiple factor analysis modes confirmed four factors of muscular strength (static force-arms) Explosive-power-arms, Dynamic-work-arms and static-power-legs. The other two factors Dynamic-work-legs and Explosive -power-legs did not support that robust factor.

Andaos (1976) conducted a study on physical fitness to establish norms for physical fitness level of South African boys and compared their physical fitness levels with those of Canadian boys. The AAHPER Physical Fitness Battery (1986) consisting of one minute speed sit ups, standing broad jumps, shuttle run, flexed arm hang, 50 yds dash and three hundred (300 yds) run was administered. Test was applied to compare the mean score of the South African and Canadian students. The result was found to be significantly in favour of the South African boys.

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

One hundred chines junior school boys were administered a devised physical test by Haung (1982) Factor analysis here yielded seven factors.
percent of total variance of physical fitness was observed. The factors identified by him were speed-explosive strength, size of the body, endurance, co-ordination, strength of leg muscles, dynamic flexibility, dynamic strength and flexibility.

**Barbanti** (1983) prepared physical fitness norms for Brazilian school children and compared the same with the norms of American boys and girls. The test items conducted on 2,342 were; sit and reach test, modified sit ups test, nine minute run, twelve minutes run, 50 meter taller, heavier and with higher scores in sit & reach test, modified sit ups test, 50 meter dash test and standing long jump test. On the other hand Brazilian children scored higher on the nine minute run test than American children.

Eighteen different power tests predicted to measure anaerobic power were administered to 31 college men by **Manning et.al.** (1975) Factor analysis extracted five factors but none of the five factors agreed with the hypothesized criterion of anaerobic power. Results also revealed that unrelated aspects exist among the variables and that they were not measuring similar qualities thus emphasizing ambiguity.

**REVIEW OF LITERATURE RELATED TO DIFFERENT GAMES**

**BADMINTON**

**Ikeda** (1960) conducted a relationship study of some selected measures with the Badminton playing ability. During the last weeks of an eight week Badminton unit, a series of tests including wrist flexibility, shuttle race and various measures of kinesthesias such as arms forward- spread, supination, pronation grip pressure were administered to 72 women students. These test scores were compared to the result on the volley and clear badminton tests. There was no significant or relationship between wrist flexibility kinesthesias or agility and badminton playing ability.
Carr (1963) conducted a study on three beginning badminton classes at the university of Washington. They were given initial and final tests of physical fitness (squat thrust, toc-touch, curl-up, pull-ups) and modified Illinois Agility Run alongside the Miller wall volley, the scott-french Badminton serve and the fox beginning Badminton writer examination to determine badminton achievement.

During instructional periods, one group has progressive body conditioning exercises for fifteen minutes and the second group had isometric exercises for 5 minutes. The third class had the regular badminton periods. The time devoted to these programmes caused little or no effect on badminton achievement.

Greene (1963) tried to find out whether or not static balance is a factor in badminton playing ability. Tests were administered to 58 subjects divided by high and low badminton skill and by sex. Mean differences were tested for significant and correlations between static balance and Badminton playing ability were computed. The length wise and crosswise static balance tests failed to differentiate between tournament and badminton playing ability, except in two cases. Correlation between playing ability and static balance were essentially zero except for the low skill men on crosswise balance, where the prediction was fairly good. The crosswise and lengthwise balance tests appeared related but not identical.

Tergerson (1965) conducted a study on the relationship of selected measures of wrist strength, vision and general motor ability to badminton playing ability. The french short serve and clear test and miller wall volley test were given to 23 sophomore college women. Motor ability was measured through the Scot test, palmer and dorsi flexion with a tensiometer, temporal vision with a parameter and depth perceptions with the Howard Dalman apparatus. Total
badminton playing ability, depth perception. The highest and the lowest six players differed significantly in motor ability, depth perception and peripheral vision but not in total wrist strength.

O'Connor (1966) studied speed and skill in relation to success achieved by college women engaged in badminton singles competition. Various badminton skills, specific movement times and success in singles competition were tested. Analysis by multiple correlation and regression showed that speed and skill were essential to success, but success depended to a greater degree on skill than on speed of movement. The miller wall volley test was the best predictor of success in the singles competition and total body movement was the best time predictor.

The study proved that skill is more dominant than speed of movement in the success of badminton but speed of movement is also considered to be essential. Other things being equal, speed of movement will influence success.

Sharma (1987) constructed and standardized specific physical fitness test for Badminton players. He used factor analysis technique on the data of 100 inter college district Badminton players of North India. As many as 7 factors of specific physical fitness were obtained, out of which, five were considered a meaningful to selected test items from each factor. One test item having the highest loading was included in the test battery, from each factor. The test items thus derived were applied on 500 badminton players to develop the norms.

**SOCCER**

Garry (1966) studied the relationship of college football players, strength, speed, agility to the Coach's ranking and divided the players in two groups. Correlation were computed between the coach's subjective evaluation with strength, speed and agility. It was concluded that arm strength and agility were not valid predictors of football ability. Total strength and total 'T' scores
were moderate predictors of football playing ability, while the leg strength and speed were significant predictors.

Sharma, NP (1987) constructed a specific physical fitness test for soccer players in which he used factor analysis on the data of soccer players of North zone universities of India. As many as seven factors of specific physical fitness were obtained out of which six were considered meaningful to select test items for each factor. One test item for each factor with the highest leading was included in the test battery. The derived test items were applied on 500 players to develop norms.

**HOCKEY**

Austin (1970) administered a grip dynamometer test, the Base Dynamic Balance Test and Young's Positioning Test to 55 subjects. Three judges rated ability to perform a set technique study. No significant relationship appeared.

Singh (1978) conducted this study in order to evaluate the physical fitness of hockey players. A sample of 67 randomly selected male Hockey players acted as subjects from the total hockey playing population of Punjab. The subjects were tested in the Fleishmans basic fitness test which included extent flexibility, dynamic strength, trunk strength, co-ordination equilibrium and endurance. The data was statistically analyzed by computing mean, range and standard deviation. The following conclusions were drawn: 1. the scores of the subjects in hand grip, soft ball throw, shuttle run and 600 yards run and walk test was much more than in other tests, indicating higher levels of explosive strength and static strength of arms, cardio respiratory endurance and leg explosive strength; 2. Dynamic flexibility and co-ordination as assessed by cable jump were found to be the lowest of all the fitness elements in hockey players and 3. The scores of the subjects in arm explosive strength, cardio-respiratory endurance and static
strength were the most varying as their ranges and standard deviations were more.

**Lamba** (1980) compared the selected physical fitness components such as agility, speed, strength and physiological variables such as blood pressure, pulse rate, breath holding capacity and cardio-vascular endurance of offensive defensive hockey players at college level.

The subjects were 60 male students of four colleges of Gwalior who participated in 1978-79 inter collegiate tournaments. Data was obtained by administering the tests and was statistically analysed using t Ratio. It was concluded that (1) the offensive players are faster and have less resting pulse rate and thus have more cardio-vascular endurance than defensive players (2) The defensive players have more arm and leg strength than offensive players and (3) there is no difference between offensive and defensive hockey players in agility, blood pressure and breath holding capacity.

**Dureha** (1984) compared the selected motor components such as agility, speed, explosive and endurance and selected anthropometric variables such as height, weight, leg length, arm length, thigh girth and wrist diameter of offensive and defensive hockey players at college level.

The subjects were 50 male students of three college of Gwalior in the academic year 1983-1984. Statistical analysis of data employed the T test so as to compare the offensive and defensive hockey players. It was concluded that there was no significant difference between offensive and defensive hockey players in selected motor components and selected anthropometric variables.
VOLLEY BALL

Toyoda (1971) found through his study that volleyball players have different types of physical requirements according to the nature of the activity. He concluded that a volley ball players requires muscular strength and endurance, agility and speed of movement, flexibility of muscles and joints and ability to control body movements like timing, rhythm, balance or coordination and relaxation and coordination of the whole body. These elements had a significant relationship with volleyball skills.

Toyoda et al (1973) administered the physical fitness test on Japanese (men's) volleyball team to know the physical abilities of the players. The test included muscular strength tests, push up, grip strength, back strength, basketball distance throwing, vertical jump, block jump, three successive broad jumps, sit ups (20 sec) Bending of upper body (20 sec).

The agility tests included, 20 mts dash 3 shuttle run of 9 meters distance, side step (1.2m main line for 20 sec), rolling test (time required for 5 forward rolls, 5 backward rolls and standing up) total body reaction time.

The test of cardio-respiratory included, Harward step test (for 5 min stepping on 50 cm block) maximum Oxygen uptake amount of Oxygen debt.

The flexibility tests included forward bending of the body, backward bend, duration of hand to hand. The test of dexterity included those of horizontal bar, horse, mat work and trampoline. The results indicated that the volley ball players possess these abilities.

Farawani (1975) designed a test battery to examine the physical fitness level of the national team (men). The test were (1) run test 90 mts (2) total body reaction time (3) right hand movements time (4) left hand movement time (5)
running vertical jump (6) diving movement time (7) leg extension strength and (8) arm extension strength test. The physical performance of the volleyball players as judged by these tests successfully correlated with playing ability.

Horak (1978) evaluated the physical fitness of the 1972 Olympic men's team of Czechoslovakia to know the level of fitness. The test battery consisted of age, weight, height, percentage fat, reach height, 3 kg medicine ball put be both hands first, with right then left hand, 350 gram ball throw with run-up and without run-up, broad jump, triple jump, touching the basketball board by Jumping, 60 mts. sprint, 1000 mts run, step test and bicycle Ergometer test. He found that these items were significantly related to their performance.

Phipps (1983) inferred that the game of Volley Ball requires quickness, endurance and co-ordination and suggested that a player was to be evaluated through the skill tests, physical component, general ability tests and specific skill tests. In this study he first gave the general test of general ability test, successive long jump, vertical jumps, rolling tests, seven second run, bend reach, basketball throw, Illinois agility run, shuttle run, push up and ball roll. The vertical jump, seven second run and shuttle run had the highest co-relation to performance.

Siridhar (1984) conducted a study on 30 college volleyball players to determine the relationship of agility flexibility and muscular endurance to playing ability. The tests conducted were Sergeant jump, side step, bunk flexion, pull-up, sit-up and one minute lateral jump. The findings showed that motor fitness components of power, muscular endurance, circulo-respiratory endurance as well as flexibility contributed to the game of volleyball. The study showed significant relationship of power with performance. There was positive relationship between flexibility and playing ability. The circulo-respiratory test showed a significant
relationship to playing ability in volleyball because of repeated jumps in the game. Agility also has a significant relationship with playing ability in volleyball.

Devi (1985) tested 24 volley ball players of Lakshmi Bai National College of Physical Education, Gwalior in order to study the relationship of selected strength and flexibility measures by using Rorgers Formula, sit ups, leg dynamometer, wrist flexion and extension by goniometer, trunk flexibility by sit and reach test, shoulder flexibility by metric scale, to volley ball playing ability. She concluded that arm, abdominal and leg strength were significantly related to playing ability in volley ball. Shoulder flexibility also contributed significantly to the playing ability. Grip strength did not, however, correlate significantly to playing ability, wrist flexibility and ankle flexibility and it had a significant relationship to playing ability. Trunk flexion also showed an insignificant correlation to playing ability in volleyball.

Sandhu (1987) constructed Motor Fitness Battery for females volley ball players. The subjects of her study were 300 volley ball players representing different colleges of the state of Punjab. They were from different Universities of Punjab and their age was ranged from 17-21 years. Factor analysis were used to construct Motor Fitness Test. The subjects were tested on 27 different items of Motor Fitness Test, through the factor analysis technique, 10 factors were expected after an orthogonal rotation of each factor except three. The test items which had she maximum loading were selected for test battery, which consisted of seven tests namely, spike jump, W.M Run, W.M Agility, push ups, 20 meter run The stick test and Ben and Reach test. The scientific authenticity of the test was established by computing reliability, objectivity, validity and specificity. For the preparation of the norms 300 female volley ball players were administered. The item of the test Battery. The Hull scale and T scale were used to prepared the norms for different test items for college female playing volley ball.
WRESTLING

Johnson (1978) investigated 208 collegiate wrestlers with at least two years varsity experience who had wrestled in at least 50 percent of their teams matches during the 1976-77 school year. Subjects were classified as successful, average or unsuccessful according to their win-loss percentages. A second classification was by weight (light weight, middle weight, heavy weight). All subjects were measured for height, arm length and leg length and tested for RT, MT, static elbow flexion strength, explosive leg strength and dynamic balance. Treatment of data by ANOVA showed no differences among the wrestlers in the three weight divisions of dynamic balance, explosive leg length and RT. In elbow flexion strength the middle weights were stronger than the light weights. Light weights and middle weights were faster in MT and RT than the heavy weights. The successful wrestlers had better balance than the unsuccessful wrestlers. The unsuccessful wrestlers had longer legs than the average and successful wrestlers. Analysis of multiple R and regression showed that no combination of the independent variables was successful in predicting success.

Horswill (1968) evaluated 31 members of the 1978-79 Uw-modison wrestling team for success in wrestling (VO2 Max), max anaerobic power and upper body dynamic endurance. The success for each wrestler was defined by a performance index (P-I) based on performance in two early season tournaments. It was concluded that the VO2 Max, H.P and upper body dynamic endurance contribute significantly to the success of college wrestlers, but other variables (skill, experience and psychological factors) may have and even greater influence on wrestling success.

Four hundred sixty two interscholastic wrestlers were selected as subjects by Cutlip (1968) who were recorded left and right grip strength on a dynamometer, prior to each regularly scheduled match with in a specific weight group. Results showed that the 95-103-165 pound weight class winners had
significantly stronger grip strengths and the biserial correlation was statistically significant for eight of the 12 weight classes.

Spyke (1969) tested 102 high school wrestlers from the state of Illinois for finger reactions time in response to a visual stimulus, their won-lost records and years of wrestling experience were also recorded, subjects were placed in four groups according to their years of high school experience. Very low positive correlation were obtained for the 2 and 4 years experience groups. While significant positive correlations were obtained for the 1 year and 3 year experience group.

Kraft (1971) constructed and standardized the wrestling knowledge test for college men majoring physical education who were completing a course of instruction in wrestling. The test questions were developed and submitted to a jury of wrestling expects for review. Two part joint tests of 75 questions each were administered. Based upon their results to try out tests of 50 items each were administered to 723 Physical Education majors completing a course of instructions in wrestling at 21 institutions throughout United States. The final test of 50 direct questions of multiple choice items were administered. The spearman brown proficiency reliability co-efficient of the test of 50 items was 87 with a corresponding standard error of measurement of 2.92.

Bowman (1971) investigated the relationship between twenty-nine biographical, physiological and psychological factors and succession wrestling. One hundred thirty six Idaho high school wrestlers were tested during the 1969-70 wrestling season. The data from the Silva and his associates assessed psycho-physiological variables that influence wrestling success. The subjects were 15 male participating in 1979 United states junior world wrestling camp. Athletic performance in the camp determined whether a wrestler qualified or did not qualify for the touring United states team. Subjects were evaluated on
anthropometric, physiological and psychological variables over a three day interval. Descriptive data analysis indicated the physiologically the average qualifier was; marginally lower in grip strength, lower in relative dynamic anaerobic muscular endurance, more aerobically fit and slightly higher in percentage of body fat as compared to the average non-qualifier. Psychologically, the average qualifier was higher in state anxiety and tension but less depressed, angry, vigorous, fatigued and confused than the non-qualifier. Multivariate analysis of variance indicated that the group centroids differed significantly on the selected psycho-physiological variables considered in this study. Discriminant function analysis of the data supported the psycho-physiological model as the most accurate in predicting group membership.

**Hopkins** (1980) examined the relationship between grip strength and wrestling success. Sixty seven contestants in alternate weight classes (123, 137, 152, 167 and 191 pounds) in the New England Inter collegiate wrestling Association Tournament served as subjects. Three measures of grip strength were recorded: at weight in, at weight in per pound of body weight, and at on-deck. Tournament rank as determined by a system devised by the author, failed to correlate significantly at the 0.5 level of confidence with the three different grip strength orders.

**Kroll** (1981) investigated the relationship among total response time for two wrestling take down maneuvers, a strength test and initial take down ability. Two response time measures of actual take down maneuvers used in wrestling and the four item total proportional strength test were secured on 100 Illinois high school varsity wrestlers. These measures were compared to actual competitive initial take down performances based on 1029 individual matches and 815 initial take downs during the 1957-58 season. Wrestlers were divided into successful and unsuccessful groups on the criteria of having won a place in the sectional or state
tournament. It was concluded the strength and response time measures secured in this study were of no value in predicting competitive initial take down ability.

**Safari Lal** (1992) constructed and standardized a specific physical fitness test for college level wrestlers. The subjects were tested on 18 different items of specific physical fitness test. The data collected on 100 wrestlers was subjected to factor analysis. Through this analysis technique, 7 factors were extracted after an orthogonal rotation of each factor exceptance. The test items which had the maximum loading were selected for a test battery. The test battery of specific physical fitness of wrestlers consisted of six items, namely extent flexibility, standing broad jump, 30 meter run, side step test, modified dips and 6 minutes run. Finally selected test item were applied on 200 wrestlers to develop the norms.

**GYMNASTICS**

**DEY** (1988) designed the specific physical fitness norms for three different age groups. While designing norms one element from each structural group alongwith some specific exercises were selected to assess the skill proficiency as well as level of specific physical fitness. With the help of 16 variables two important aspects, namely proficiency in basic technical skill on all apparatus and also the level of physical abilities required to execute these element have been tested. The purpose to test all subjects through 16 variables.

**JUDO**

**Callister** et al. (1990) studies eighteen male and nine female nationally ranked Judo athletes to construct profiles that would provide some understanding of physiological capacities underlying successful Judo performance. Body composition, aerobic capacity, idokinette elbow and knee flexion and extensor strength and muscle fiber size and composition of the Vastus Laterails were examined. Higher ranked males (except heavy weight) differed from Lower ranked males in percentage of body fat 5.1+0.6 vs 82+0.8p 0.05. While more successful females tended to have greater upper body strength than less successful
females. More striking, however, was that the characteristics examine varied (p 0.05) as a function of weight division for both male and female athletes. A weight division increased, percentage of body fat increased among females in particular athletes in the higher weight divisions were stronger relatively to LBM than those in the lower divisions.

Wifred Vaz (1993) conducted a study on 80 male Judo players of all India inter-university. To fulfill his purpose he selected anthropometric variable namely height aron, girth and ponderal index, physical fitness variables were shoulder strength, leg strength, back strength, grip strength, abdominal strength, speed agility, flexibility and endurance. The anthropometric and physical fitness. Variables were considered as the independent variables. The dependent variables were the Judo performance of the subjects.

Choudhary (1996) conducted a study on selected physiological variables on eighty inter-college level Judokas with the purpose to sketch the profiles and to compare them in different weight categories. The variables selected for the study were resting heart rate, vital capacity, negative breath holding capacity, positive breath holding capacity and anaerobic capacity. Mean and standard deviations on all the variables for all the weight categories were calculated and ANOVA was used to find out the significant difference in the means scores. On the basis of results, following conclusions were drawn. (1) The training age does not depend upon the weight category (2) The training programme for the Judokas should be according to the body weight category (3) The training programme for low and middle weight categories should be more strenuous than heavy weight categories (4) In relation to positive breath holding capacity, no significant difference was found in different weight categories (5) in relation to the resting heart rate, vital capacity, negative breath holding capacity and anaerobic capacity, significant difference was found in different weight categories.