Chapter 2

REVIEW OF RELATED LITERATURE
Chapter-II

Review of related literature

Lockhart and McPherson (1949) proposed a badminton test for college women, which consist of volleying a shuttlecock against a wall. In the validation of the test, the originators obtained the following correlation: .71 between the test results and the evaluation of badminton playing ability by three experienced judges, and .60 between the test results and percentage of total games won in a round-robin badminton tournament. The test-retest reliability correlation for the volleying test was .90.

French and Stalter (1949) constructed tests of footwork, wrist action and smashing ability to supplement the previously validated French test items and from a battery of skill test in badminton to measure playing ability. A four-test battery of serve, clear wall volley and shuttle resulted in a validity coefficient of .698. Eliminating the serve, govern three tests battery with a validity of .678.

Miller (1951) found that both the men's and women's finalists employed clears more than any other stroke in all of their games. After analysing movies of the various types of clears, she devised a badminton test based on this stroke. With one hundred college women as subjects, a reliability coefficient of .94 was obtained with the test-retest given one week apart. A validity coefficient of .83 was reported. The criterion was standing of the subjects after round-robin badminton play.
Ikeda (1960) conducted a relationship study of some selected measures with the badminton playing ability. During the last weeks of an eight week badminton training series of tests including wrist flexibility. Shuttle race and various measures of Kinesthesia, such as arms-forward-spread, supination, pronation and grip was conducted. Pressure was administered to 72 women students. These test scores were compared to the results on the volley and clear badminton tests. There was no significant relationship between wrist flexibility, Kinesthesia or agility and badminton playing ability.

Kowert (1962) constructed a badminton ability test battery for men. The judges rating scale yielded a reliability coefficient of .88 when correlated with the class ranking of the judges’ rating scale as determined by the intra-class correlation method. The coefficient of multiple correlation between the sum of the three judges’ rating and found that the badminton playing ability of male college students (N=46) can be successfully measured by multiple regression equation containing the variables of the diagonal run test, French's Long Service Test and Miller's Wrist test.

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, the Miller wall volley test were given to 23 sophomore college women. Motor ability were measured through the scott test, planter and dorsi-flexion strength with a tensiometer, temporal vision with a parameter and depth perception with the Howard-Dolman apparatus. Total badminton playing ability correlated, significantly with general motor ability, depth perception and peripheral vision. The highest and the lowest
six players different 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 depends 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.

Craston (1968) studied the relationship of reaction time, movement time and visual tracking to performance in badminton. A reaction time-movement time device, a pursuit rator, and the Miller badminton wall volley test were used to collect the data of 32 college women enrolled in badminton classes at Smith college. Reaction time, movement time and visual tracking had no apparent relationship to performance in badminton.

Cooper (1968) reported that the distance an individual can cover by run-walk test in 12 minutes, is a highly reliable and valid indicator of his cardio-respiratory fitness and further Doolittle et al. (1968), concluded that it is more valid than the 600 yards run walk test. Since the coefficient of
correlation of 12 minute run-walk test with VO$_2$ maximum was higher (0.90) than that between 600 yards run and VO$_2$ maximum (0.62).

Cooper (1968) formerly of the U.S.A. Air Force, did extensive research in an attempt to establish a rating scale for measuring relative values of activities in term of circulo-respiratory conditioning. His research showed the importance of such activities as running, swimming, cycling, walking, handball, football, basketball and others in the development of cardiovascular endurance.

Pankonin (1969) selected 33 college women randomly from seven beginning tennis classes, who were tested for agility, balance, hand eye co-ordination, grip strength, height and shoulder strength. The criterion of tennis ability was the combination T-score from the Dyer test. Brower and Miller forehand and backhand test and skill rating by the judges. The most economical predictor of tennis ability combined agility balance arm and shoulder girdle strength for an $r$ of .62 height and grip strength improved the $r$ slightly, although the correlation of grip strength and hand eye coordination with tennis ability was not significant.

Hicks (1973) conducted a study to measure a player’s ability to execute selected badminton strokes and general playing ability using 64 college women enrolled in badminton classes. Originally, she wanted a five item battery of valid and reliable tests, but conducted by recommending three items: a clear test, a smash test and a strategy test. Reliability was determined by the odd-even method for each test item.

Talton (1973) investigated the selected physical and physiological
assessment as predictor of successful high school football performances by selecting 156 football players who were classified by coaches into successful or unsuccessful players category based on performance in the 1971 football season.

Garay et al (1974) examined a total of 1265 Olympic athletes out of the total members of 6084 competitors belonging to 13 sports at the Mexico Olympic games. The relationship between the sports, speciality and body structure of the athletes was studied thoroughly perhaps for the first time. This remarkable study highlighted the following aspects:

a) There is a strong relationship between structure of the athletes and another specific task in which they excels.

b) There are clear physical prototypes exist for optimum performance at the Olympic level competitions.

c) There are significant differences in the size, somatotype of participants in different sports, but in some sports participant are similar in size for somatotype. Performance with similar somatotype excel at specific events regardless of race.

Brooks (1977) has stated that due to differences in leg length among the athletes it seems logical that leg length would be a better indicator of stride length than height and Hoffman (1972) gives a ratio of leg length to stride length for world class female sprinters of 2.38 to 2.50.
Parizkova (1977) noted that a relationship between skinfold thickness and body fat exist in normal children but the relationship is expressed most clearly when multiple skinfolds at different sites of the body are measured.

Coad, Rasmussen and Mikkelson (1978) investigated the physical demands of recreational badminton. The subjects were members in a badminton club in Denmark. The subjects' maximal oxygen uptake was determined by a bicycle ergometer test. By use of a wireless transmitter the heart rate was recorded during two or three game matches of different events in badminton. The length of work and rest periods was recorded during actual play. The heart rate for every 30 seconds was used to calculate the average rate during a game. The relative work load for every subject was also calculated.

Nail (1978) determined the relationship of balance, speed, strength, height, arm and leg strength to success in collegiate wrestling. Subjects were classified as successful, average or unsuccessful according to their win/loss percentage. A second classification was weight (i.e. light, middle and heavy weight). All subjects were measured for height, arm length and tested for reaction time and movement time, static elbow flexion strength, explosive leg strength and dynamic balance. Treatment of the data by analysis of variance showed no significant difference among the wrestlers in the three weight divisions on dynamic balance, explosive leg strength and reaction time. In elbow flexion strength the middle weight were faster in movement time and reaction time than the heavy weights. The successful wrestlers found better balance than unsuccessful ones.
Amusa (1979) selected 46 subjects, who were well-conditioned soccer player's with at least two years playing ability experience on the college level. They were tested for running speed, power agility, maximum VO$_2$ strength, anaerobic capacity and flexibility. In addition all anthropometric measurements consisting of skinfolds and body diameter were taken. Soccer playing ability served as the criterion and was measured by the rating of three experienced soccer skill and strategies. Analysis of data was by zero order correlation and multiple "R analysis resulting in the following conclusions. Age (experiences) is the best single predictor of playing ability, weight, L.B.W. and weight are considered good predictors of playing ability. Max VO$_2$ and running speed are considered important factors in soccer performance, speed, strength and ability locate concentration and leg power are not considered as valid indicators of playing ability.

Bobrich (1979) prepared a badminton observational rating scale to measure total skill development as a student participant in a regular game. The tool was developed using two classes of 67 girls enrolled in a high school beginning badminton courses. The reliability was estimated on a test retest basis using three qualified judges. Both Pearson's 'r' and analysis of variance techniques were used to determine the reliability of the testing tool. The coefficients ranged from .77 to .87 for section 1 of the observational rating scale and from .60 to .83 for section 11.

Downey (1981) say that long drawn rallies of the game of badminton require a top class anaerobic fitness. The energy transportation mechanism that is cardio-respiratory function, should be very efficient which could meet
the demands of prolonged working of muscles involved in constant running and jumping around the court.

There was no sprinting speed involved in badminton. However, the movements of a player were very quick and fast with measured steps, within the small area of the court. Anaerobic power of the player facilitates the player’s moving up and down the court and covering the whole court in a few strides.

The demonstration of agility in badminton depends upon the aerobic and anaerobic fitness of the player. In early stages of the game, a player might be very agile but the degree of agility decreases directly proportional to the length of the rally and the aerobic fitness of the player.

Smith (1981) noted that there are certain specific type of qualities in sportsmen, which are essential to reach the top level of athletic performance. Those various types of qualities should be analyzed for different types of sports activities. Once these components have been selected, tests can be devised to measure them. The recognition of different type of qualities for each sports activity, is the starting point for training.

Carter et al., (1982) studied 309 male athletes of 20 sports consisting of 72 events at 1976 Montreal Olympic games. They also studied Canadian students (153 men and 94 women) on the same variables to serve as a general reference for comparison with athletes.

Chakravarty (1983) investigated the relationship between strength, leg strength, grip strength, agility, flexibility, balance and performance in
gymnastics. The findings of the study showed significant correlation between arm strength, leg strength, grip strength, agility, spine and shoulder flexibility to the performance in gymnastics.

The study of Promoda Devi (1984) was to determine the relationship of selected Physical Fitness Variables as strength (a) Arm strength (b) leg strength, agility, speed, flexibility, anthropometric measurements, weight, height, arm length, leg length, foreleg length, thigh width, ponderal index, crural index to performance in shot put. Product movement correlation method was used to compute correlation and to know the significance of the study. The findings of the study revealed that (1) there was significant correlation between arm strength, leg strength, speed, flexibility and shot put performance; (2) there was no significant correlation between weight, height, arm length, leg length, foreleg length, ponderal index, crural index and shot put performance.

Teneka et al. (1984) established that well-trained long distance runners and marathon runners accumulate lesser levels of lactate in their blood and working muscles with a progressive elevation of work rate.

Ghai (1984) conducted a study on the relationship of selected physique characteristics and motor ability components to performance of gymnastics. Twenty male gymnasts who had represented different universities in All India Inter-University competitions were selected as subjects for the study. The subjects were tested for all the characteristics and motor ability components such as height, weight, chest girth, thigh girth, upper arm girth, strength, flexibility, agility, dynamic balance. It was concluded that strength, flexibility,
agility, dynamic balance were significantly corrected with the performance in gymnastics and physique characteristics were not significant to the performance of gymnastics.

Mathur et al. (1985) analysed the body composition of 150 female Nigerian subjects and concluded that there were statistically significant differences between university and national level athletes with respect to all the physical characteristics and body composition measurements except the chest circumference within the athletic group significant differences were noted in physical characteristics and body composition measurements. The findings showed that all athletes were taller, heavier, with broad shoulders and hips. Non-athletes had higher percent body fat of throwers, basketball and volleyball players were significant in the study. In female distance runners the value of percent body fat was higher than noticed by Wilmore. However, lower height, weight and percent body fat values had been observed in Nigerian female non-athletes as compared to those reported by other authors.

Connor (1986) 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.
Ghosh et al. (1987) undertook a study to investigate the physiological variables of elite Indian badminton players at anaerobic threshold level. The VO$_2$ max and anaerobic capacity of male and female players were observed to be 3.75 L/min (58.0 ml/kg/min) and 2.64 L/min (51.4 ml/kg/min) 10.4 L (150.8 ml/kg) and 6.1 (119.4 mg/kg) respectively. The mean heart rate (HR), oxygen (VO$_2$) consumption, ventilation (VE), breathing (BE) equivalent, oxygen pulse (O$_2$-P) and work load (WL) of the male and female badminton players at anaerobic threshold level were HR : 159.8 and 159.3 beats/min; VO$_2$: 2.69 L/min (39.0 ml/kg/min) and 1.64 l/min (32.1 ml/kg/min) corresponding to 67.4 and 62.3% of VO$_2$max; VE : 88.8 and 48.6 L/min; BE : 30.25 and 29.53; 02-P: 17.66 and 10.30 ml/beat; WL : 227.5 and 133.8 watts respectively.

The mean VO$_2$ max of the Indian male badminton players were comparable to that of their International counterpart as recorded in the literature. The authors conclude that though the physiological variables exhibited by the badminton events were lower than those of players involved in long distance events, the value reflect a high level of cardiorespiratory fitness required for badminton.

Narain (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 seven factors of specific physical fitness were obtained, out of which, five were considered as meaningful to select test items from each factor. One test item having the highest loading was included in the test battery from each factor. The test items that derived were applied to 500 badminton players to develop the norms.
Ghosh et al. (1990) investigated the heart rate and blood lactate response in competitive badminton. Ten junior level (13-14 years of age) female badminton players were studied to investigate the demands of the game on heart rate and blood lactate during competition. The mean VO\textsubscript{2} max. Anaerobic threshold level was 8.3 ml/kg/min and 66.3% of VO\textsubscript{2} max. Game analysis revealed that heart rates were higher in the second and third game than in first game. Whereas no difference was found in blood lactate concentration. Anaerobic threshold heart rate and total duration of the game indicated an anaerobic-aerobic time domain ration of 3:1. The authors concluded that junior national level female badminton players attained optimum aerobic capacity and anaerobic threshold levels that could be improved later through further training and dissimilar strain on cardiovascular and anaerobic metabolic systems is possible due to the intermittent nature of the game.

Ghosh, Goswami and Ahuja (1993) studied the effect of a short three week programme, dominated by specific training, on the aerobic capacity (VO\textsubscript{2} max) and ventilatory anaerobic threshold (VO\textsubscript{2}T) of badminton players and also to evaluate the intensity of the specific training on the basis of heart rate and blood lactate concentration.

The subjects were five women badminton players who were semifinalists in the 1988 sub junior national badminton championship. The VO\textsubscript{2} max evaluated on an automatic analyzer during a graded running protocol on a treadmill and VO\textsubscript{2}T determined by the gas exchange method from the VE-VO\textsubscript{2} relationship were determined at the commencement and at the cessation of the training following the specific training programme. The mean VO\textsubscript{2} max
and $\text{VO}_2$ at $\text{VO}_2\text{T}$ improved significantly. The mean HR and blood lactate concentration during the specific training were 160 L/min and 3.9 m mol/L while training with the shuttle cock, and 185 L/min and 6.2 M/L respectively during shadow practice. The finding indicated that the intensity of the specific training was quite high, varying from aerobic-anaerobic transition level to aerobic overload region and was able to alter the $\text{VO}_2\text{ max}$ and $\text{VO}_2\text{T}$ of the player, even with a short pre-competition training.

Pramanik (2001) predicted an equation of physical and physiological variables of playing ability of badminton players out of 22 variables. 25 men badminton players of Maharashtra state were drawn to act as subjects. Forward regression was applied to draw out the regression. The equation consisted of four items namely reaction time, height, arm length and endurance which accounted for 87% of the variance where as reaction time alone contributed 55% of the variance.