CHAPTER – II

REVIEW OF RELATED LITERATURE

The research scholar has made every possible effort to go through the literature related to the problems in the game of Kabaddi wherever available. The scholar has gleaned through almost every source like research quarterly, journal of various kinds, periodicals, encyclopedia, relevant books and e-resources on Kabaddi to pick up the related materials. While going through the various sources of literature, it has been observed that very little work has been done on Kabaddi. However, the scholar has gone through the literature of allied studies that are related with other games and sports to collect the necessary information.

The research scholar visited Dr. Sivanthi Aditanar College of Physical Education, Tiruchendur, Y.M.C.A. College of Physical Education, Chennai, Department of Physical Educations, Annamalai University, Annamalai Nagar and Department of Physical Educations, Bharathidasan University, Tiruchirappalli for collecting the reviews related to this study.

The purpose of this section was to relate the studies pertaining to the under study and to organise the collected review into meaningful sub sections as listed below:

a) Prediction and other related Studies in Kabaddi

b) Prediction Studies in Other Sports Disciplines.
Prediction and other related Studies in Kabaddi

The purpose of the study was to predict the playing ability in Kabaddi from selected Anthropometrical, Physical, physiological and psychological variables among College level Players. One hundred and twenty six male inter collegiate Kabaddi players were randomly selected from various colleges in Tamilnadu state, India and their age ranged between 18 and 28 years. The subjects had past playing experience of at least three years in Kabaddi and only those who represented their respective college teams were taken as subjects. A series of anthropometrical measurements was carried out on each participant. These included Standing height measured by Stadiometer; Body weight measured by weighing machine, Two Length measurements - Arm length, Leg length, measured by Lufkin Anthropometric Tape. The data were collected by following standard testing protocol of International Society for the Advancement of Kinanthropometry. Physical fitness components were measured by the following tests. Speed were assessed by 50 meter dash, Flexibility assessed by Sit and reach test, Leg explosive strength assessed by Standing broad jump, Muscular power assessed by Modified sit – ups and Muscular endurance assessed by 2.4 km run. The Physiological Parameters namely Resting heart rate by Digitalized heart rate monitor, Peak expiratory flow rate was assessed by Peak flow meter and Breath holding time was assessed by Manual nose clip method. Psychological factors namely Somatic anxiety, Cognitive anxiety and Self confidence were assessed by Competitive Sports Anxiety Inventory – II (CSAI - 2) questionnaire developed by Martens, Burton, Vealey, Bump and Smith (1990) and Sports
achievement motivation level was assessed by Kamlesh (1983) SAMT questionnaire. The playing ability which was taken as the performance factor was subjectively assessed by three qualified Kabaddi coaches. All testing was done two day before inter-collegiate competition by using scientifically approved equipments. Mean and Standard deviations were calculated for each of the selected variables. The inter-relationship among the selected anthropometrical, physical, physiological and psychological variables and Kabaddi playing ability, were computed by using Pearson’ product-moment correlation coefficients. All selected anthropometrical, physical, physiological, psychological variables that statistically correlated with performance were used to form respective linear predictive models (step-wise argument selection). The results revealed that an Inter-relationship exists significantly between the anthropometrical, physical, physiological and psychological variables among male intercollegiate Kabaddi players. The results also revealed that Leg explosive strength, Speed, Self confidence, Muscular endurance, and Muscular power become the common characteristics which can predict the playing ability in Kabaddi players. (Devaraju and Needhiraja, 2012)

Devaraju and Needhiraja, (2012) conducted a study to predict the Kabaddi playing ability from selected Anthropometrical and Physical variables among College level Players. One hundred and Forty four male inter collegiate Kabaddi players were randomly selected from various colleges in Tamil Nadu state, India and their age ranged between 18 and 28 years. The subjects had past playing experience of at least three
years in Kabaddi and only those who represented their respective college teams were taken as subjects. A series of anthropometrical measurements was carried out on each participant. *These included Standing height measured by Stadiometer; Body weight measured by weighing machine, Two Length measurements - Arm length, Leg length, measured by Lufkin Anthropometric Tape.* The data were collected by following standard testing protocol of International Society for the Advancement of Kinanthropometry. Physical fitness components were measured by the following tests. *Speed were assessed by 50 meter dash, Flexibility assessed by Sit and reach test, Leg explosive strength assessed by Standing broad jump, Muscular power assessed by Modified sit – ups and Muscular endurance assessed by 2.4 km run.* The playing ability which was taken as the performance factor was subjectively assessed by three qualified Kabaddi coaches. All testing was done two day before inter-collegiate competition by using scientifically approved equipments. Mean and Standard deviations were calculated for each of the selected variables. The inter-relationship among the selected anthropometrical, physical variables and Kabaddi playing ability, were computed by using Pearson’ product-moment correlation coefficients. All selected anthropometrical and physical variables that statistically correlated with performance were used to form respective linear predictive models (step-wise argument selection). The results revealed that an Inter-relationship exists significantly between the anthropometrical, physical and performance variables among male inter-collegiate Kabaddi players. The results also revealed that speed, agility,
weight and flexibility become the common characteristics which can predict the playing ability in Kabaddi players.

Verma, et al. (2012) developed the physiological profiles of Kabaddi players. 100 male Kabaddi players were selected from West-Zone Inter-University Championship as the subjects of the study. Their age ranged from 18-23 years. Keeping the feasibility criterion in mind, resting heart rate, resting respiratory rate and vital capacity had been selected for this study. The resting heart rate, resting respiratory rate and vital capacity was measured with help of manual method- stop watch and dry spirometer. The data was analyzed by applying descriptive analysis. The result of study indicate that in case of resting heart rate and resting respiratory rate of Kabaddi Players were having average heart rate and resting respiratory rate. In case of vital capacity Kabaddi Players scored average vital capacity.

The current investigation is likely to illuminate the variableness on arterial blood pressure and heart rate in response to exercise. For this purpose, fifteen male Kabaddi players in the age group of 20 to 25 years were selected as subjects from Annamalai University, during their competitive season. The selected dependent variables such as (systolic blood pressure, diastolic blood pressure, mean arterial pressure and heart rate) were appraised using Oscillometric method and instruments of scientific standards at resting conditions and after exercise. To statistically analyse and compare the changes on arterial blood pressure and heart rate response to exercise, ‘t’ test was used. The analysis of data revealed that there is a significant magnification on systolic, diastolic, mean arterial pressure and heart rate in response to exercise. These findings suggest that
exercise induces significant transformation in cardiovascular variables. (Jothi, et.al., 2011)

Verma, et al. (2011) developed the physical profile of Kabaddi players. 100 male Kabaddi players were selected from West-Zone Inter-University championship as the subjects of the study. Their age ranged between 18 to 23 years. Keeping the feasibility in mind speed, agility & explosive power had been selected for this study. Speed & agility were assessed by administering 50 yard dash and the performance was recorded in seconds & shuttle run respectively. To determine for the explosive power, standing board jump was used and the reading was recorded in meters. To develop the physical profile of Kabaddi players, descriptive analysis was applied. The results of study indicates that in case of 50 yard dash, standing broad jump and shuttle run Kabaddi Players were having average in scores. In case of standing broad jump Kabaddi Players scored above average. It was concluded that West-Zone University Kabaddi players were average in speed and shuttle run and in case of standing broad jump were above the average.

Khanna, et. al. (1996) conducted a study to determine the physical and physiological profile of Kabaddi players and the physiological demands of playing a Kabaddi match. Maximum aerobic capacity (VO2max), maximum ventilation (VEmax), O2 pulse, respiratory equivalent (RE), maximum heart rate, and O2 debt were assessed on 16 players. The somato type of the players was calculated by the Health and Carter method. Heart rate was monitored during a selection trial match on eight players who represented India in the Asian Games, 1994. From the playing heart rate, oxygen consumption (VO2) was computed through a
heart rate v VO2 regression equation. Maximum lactate was evaluated from the blood samples collected at the end of the match. RESULTS: The average heart rate and oxygen consumption during the match were 146.5 (SD 9.25) beats min-1 and 2.25(0.59) litre min-1 respectively. During raiding the maximum heart rate attained varied from 162.4(11.3) to 177.4(4.2) beats min-1. Out of 40 min of match play a raider raided on average on 8.13(2.03) occasions. The average time per raid was 20.8(6.26) s. The match heart rate and oxygen consumption was 72.3-83.3% of the maximum heart rate, and 43.5-70.5% of VO2max respectively. Maximum lactate at the end of the match was 6.13(2.53) mmol litre-1. Kabaddi players had the somatotype of 2.68-4.71-1.83, with absolute back strength of 175.0 kg. VO2max and O2 debt were 3.59(0.36) litre min-1 [47.82(3.68) ml kg-1 min-1] and 5.3(1.85) litres (70 ml kg-1) respectively. Kabaddi is an intermittent sport. The rest pause during the game is sufficient for recovery. During raiding the main source of energy is anaerobic.

Dey, et al. (1993) Twenty-five national Kabaddi players (Asiad gold medalists 1990), mean age 27.91 years, who attended a national camp at the Sports Authority of India, Bangalore before the Beijing Asian Games in 1990, were investigated for their physical characteristics, body fat, lean body mass (LBM) and somatotype. The physiological characteristics assessed included back strength, maximum oxygen uptake capacity and anaerobic capacity (oxygen debt) and related cardio-respiratory parameters (oxygen pulse, breathing equivalent, maximum pulmonary ventilation, maximum heart rate). Body fat was calculated from skinfold thickness taken at four different sites, using Harpenden
skinfold caliper. An exercise test (graded protocol) was performed on a bicycle ergometer (ER-900) using a computerized EOS Sprint (Jaeger, West Germany). The mean (S.D) percentage body fat (17.56(3.48)) of Kabaddi players was found to be higher than normal sedentary people. Their physique was found to be endomorphic mesomorph (3.8-5.2-1.7). Mean (S.D) back strength, maximum oxygen uptake capacity (VO2max) and oxygen debt were found to be 162.6(18.08) kg, 42.6(4.91) ml kg-1 min-1 and 5.02(1.29) liter respectively. Physical characteristics, percentage body fat, somatotype, maximum oxygen uptake capacity and anaerobic capacity (oxygen debt) and other cardiorespiratory parameters were compared with other national counterparts. Present data are comparable with data for judo, wrestling and weightlifting. Since no such study has been conducted on international counterparts, these data could not be compared. These data may act as a guideline in the selection of future Kabaddi players and to attain the physiological status comparable to the present gold medalists.

De, et al. (1982) The participants of inter-university "Kabaddi" competition showed higher values of height, weight and surface area than average Indian population, indicating better attainment of growth in them. Further, the values of respiratory efficiency tests like, FEV1, MEFR and PEFR were also observed to be more in these players, probably due to training effect. The grip strength values were high in comparison to those of Indian football goalkeepers and hockey players.
Prediction Studies in Other Sports Disciplines

Jeyaraman (2011) conducted a study to find out the predominance of selected anthropometric and Physical fitness parameters on performance among university badminton players. For this purpose fifty two male Badminton players from eight universities were randomly selected as the subjects. Their age ranges from 18 and 25 years. The selected Anthropometrical variables namely weight, length measurements: standing height, arm length, leg length & hand length Girth measurements: fore arm, wrist, mid thigh and calf. Physical fitness parameters namely speed, agility, explosive strength and explosive power were taken as variables for this study. The playing ability was assessed by three qualified Badminton coaches as taken as the performance factor. The data were collected using standardised tests. To determine the relationship between the selected anthropometric, physical fitness parameters and the coaches rating on playing ability, the coefficient of correlation was used. Anthropometric and physical fitness parameters that statistically correlated with performance were used to form respective linear predictive models (stepwise argument selection). The results revealed that there exits relationship among selected anthropometric, physical fitness parameters and playing ability among university Badminton players. The results also indicates that the agility, mid thigh girth, explosive strength, height, length, leg explosive power, wrist girth and hand length were predominant factors among University Badminton Players.

Needhiraja and Kalidasan (2011) predicted the playing ability from selected anthropometrical, physical and physiological
characteristics of Inter collegiate Handball Players. For this purpose one hundred and fifty eight male inter collegiate Handball players from various colleges in Tamilnadu in the year 2009 to 2011 selected as a subjects for this study and their age ranged between 17 and 25 years. The anthropometrical variables namely Body weight, Length measurements (cm) - Standing height, Arm length, Arm span, Leg length, Hand length, Hand breadth, Palm length and Palm breadth; Breadth measurements (cm) - Humerus breadth and Femur breadth; Girth measurements (cm) - Arm girth relaxed, Arm girth flexed, Fore arm, Chest, Waist, Hip, Thigh and Calf were selected. Physical variables namely Speed, Agility, Flexibility, Leg explosive power and Muscular strength were selected and Physiological variables namely Vital Capacity, Resting heart rate, Diastolic blood pressure, Systolic blood pressure, Peak expiratory flow rate and Breath holding time were chosen as variables taken for this study. The playing ability was assessed by three qualified Handball coaches as taken as the performance factor. The data were collected by following standard techniques of International Society for the Advancement of Kinanthropometry (ISAK) during the competition using scientifically approved equipments. To determine the relationship between the selected anthropometrical, physical and physiological variables and the coaches rating on playing ability, the coefficient of correlation was used. Anthropometrical, physical and physiological variables that statistically correlated with performance were used to form respective linear predictive models (stepwise argument selection). The results revealed that there exits relationship among selected anthropometrical, physical and physiological characteristics and
playing ability among inter collegiate Handball players. The results also revealed that arm span, diastolic blood pressure, palm span, Peak expiratory flow rate, resting heart rate, palm length, flexibility, systolic blood pressure, agility, leg explosive power and breadth holding time were common anthropometrical, physical and physiological characteristics which can predict the playing ability in Handball players.

Viswanathan and Chandrasekaran (2011) predicted the playing ability from selected anthropometrical characteristics of Elite Indian Basketball Players. Two hundred and seventy six (age, 15.1 ± 1.3 years) youth elite male Basketball players from 23 states of India participated in the 26th Lakadawala Youth National Basketball Championship at Mastan YMCA, Mumbai from 9th to 16th May 2009, were selected as the subjects. The selected subjects were divided into three groups according to their playing positions namely Guard (GD = 72), Forward (FD = 126) and Centre (CR = 78). The selected anthropometric variables namely Body weight, Skinfold measurements (mm) - Biceps, Subscapular, Triceps, Supraspinale, Abdominal, Iliac Crest, Front Thigh and Medial Calf; Girth measurements (cm) - Arm girth relaxed, Arm girth flexed and Calf girth; Length measurements (cm) - Standing height, Arm span, Arm length, Leg length and Breadth measurements (cm) - Humerus breadth and Femur breadth as the independent variables were taken for this study. The data were collected by following standard testing protocol of International Society for the Advancement of Kinanthropometry (ISAK) during the competition by scientifically approved equipments. The criterion variable, playing ability of the selected Basketball
players are assessed by three qualified Basketball coaches. To determine the relationship between the selected anthropometric variables and the coaches rating on playing ability, the coefficient of correlation was used. Anthropometric variables that statistically correlated with performance were used to form respective linear predictive models (stepwise argument selection) with special reference to their playing positions for predictive equation development. The results revealed that there was a strong correlations ($r = 0.9$) exists between the playing ability versus height, weight, arm length, arm span, leg length and flexed arm girth among all the playing positions.

Debanne and Laffaye (2011) conducted a study to predict the throwing velocity of the ball in Handball with anthropometric variables and isotonic tests. The aims of this study were to (1) investigate the influence of general anthropometric variables, Handball specific anthropometric variables, and upper-limb power and strength on ball-throwing velocity in a standing position and (2) predict this velocity using multiple regression methods. Forty-two skilled male Handball players (age $21.0 ± 3.0$ years; height $= 1.81 ± 0.07$ m; body mass $= 78.3±11.3$ kg) participated in the study. We measured general anthropometric variables (height, body mass, lean mass, body mass index) and Handball specific anthropometric parameters (hand size, arm span). Upper-limb dynamic strength was assessed using a medicine ball (2 kg) throwing test, and power using a one repetition maximum bench press test. All the variables studied were correlated with ball velocity. Medicine ball throwing performance was the best predictor ($r = 0.80$). General anthropometric variables were better predictors ($r = 0.55–0.70$)
than Handball specific anthropometric variables ($r = 0.35\text{–}0.51$). The best multiple regression model accounted for 74% of the total variance and included body mass, medicine ball throwing performance, and power output in the 20kg bench press. The equation formulated could help trainers, athletes, and professionals detect future talent and test athletes’ current fitness.

Natarajan and Vijayaragavan (2011) predicted the Handball playing ability from selected psychological variables among college level Handball players. To achieve the purpose of the study, the investigator selected 100 College Handball Players from different colleges. In this study the Handball playing ability was predicted from 100 College Handball Players with the help of selected Predictor variables namely Psychological Variables such as Anxiety, Aggression, Achievement Motivation and Self Confidence. The Handball playing ability was determined by subjective rating by 3 experts and was use as the Criterion variables. The Backward multiple regression method was used to determine the prediction equation (Thomas and Nelson, 1990). Based on the limitation and delimitation of the present Research study, it was concluded that 1. The Handball playing ability could be best predicted from psychological variables namely Anxiety, Aggression, Achievement Motivation and Self Confidence.

Needhiraja (2011) predicted the Playing ability from selected anthropometric characteristics of elite Indian Handball players. Eighty two male Junior Handball players from 13 states of India participated in the 33rd Junior National Handball Boys Championship held at Chennai during 22nd to 27th June 2010,
were randomly selected as the subjects. The mean age of the subject was 18.1 (±0.83) years, and 3.41(±1.67) years of playing experience. Body mass, Length measurements namely Body height, arm span, arm length & hand span and Girth measurements upper arm, fore arm, chest, waist, hip and thigh were selected as anthropometrical variables for this study. The playing ability was assessed by three qualified Handball coaches as taken as the performance factor. The data were collected by following standard techniques of International Society for the Advancement of Kinanthropometry (ISAK) during the competition using scientifically approved equipments. To determine the relationship between the selected anthropometric variables and the coaches rating on playing ability, the coefficient of correlation was used. Anthropometric variables that statistically correlated with performance were used to form respective linear predictive models (stepwise argument selection). The results revealed that there exits relationship among selected anthropometric characteristics and playing ability among elite Indian Handball players. The results also revealed that height, arm span, arm length and hand span becomes the common anthropometrical characteristics which can predict the playing ability in Handball players.

Visnapuru and Jurimae (2008) investigated the relationships between basic body and specific hand anthropometric parameters with some specific and non-specific throw test results in young male Handball and Basketball players. The subjects included 34 Handball and 38 Basketball players of the 10-11 years old age group, 39 Handball and 22 Basketball players of the 12-13 years old age group and 39
Handball players of the 14-15 years old age group. Body height and body mass, arm span, height with outstretched hands and sitting height were the basic anthropometric parameters to be measured. For hand anthropometry, 15 specific hand parameters were measured using the method presented by Visnapuu & Jurimae (2007). Stepwise multiple regression analysis indicated that medicine ball throw results in the youngest age group are highly dependent on the body height (Handball players) and body mass (Basketball players). In the middle age group, the most important parameter from the hand anthropometry is TL (Handball) or height with outstretched hands (Basketball). In the oldest group of Handball players, the medicine ball throw results were dependent on the P2 from hand anthropometry and sitting height. Quite different anthropometric parameters appeared to influence the Handball or Basketball throw results. In the youngest age group, most important were body height (Handball) or LFL (Basketball). In the middle age group, the most important was height with outstretched hands and in the oldest Handball players LFL and sitting height. Handball or Basketball pass on speed depended on the combination of body mass and FS5 and body height with height with outstretched hands (even 61.40%, R2 x 100) in the oldest age group. The results of passing the Handball or Basketball on precision were dependent on body height and P3 or P1 among Basketball players in the youngest group. In the middle age group the combination of FS3 and body mass and LFL and height with outstretched hands were the most influential. Anthropometric parameters influence on the passing of the ball on speed or precision is lower in Handball players compared with Basketball players. Our conclusion is that the
basic anthropometric parameters are slightly more important than hand anthropometry that influenced different throw tests results in young Handball and Basketball players.

Davis, et al. (2004) investigated the physical characteristics that predict functional performance in division I college Football players. Investigator was to examine the relationship among 6 physical characteristics and 3 functional measures in college Football players. Data were gathered on 46 NCAA Division I college Football players. The 3 response variables were 36.6-m sprint, 18.3-m shuttle run, and vertical jump. The 6 regressor variables were height, weight, percentage of body fat, hamstring length, bench press, and hang clean. A stepwise multiple regression analysis was performed to screen for variables that predict physical performance. Regression analysis revealed clear prediction models for the 36.6-m sprint and 18.3- m shuttle run. The results of this investigation will help strength and conditioning specialists better understand the variables that predict athletic performance in Division I college Football players.

Govindarajulu (2004) predicted the Basketball playing ability from selected traits of men varsity players. Three experts assessed the Basketball playing ability (criterion variable). The independent variables were zig zag dribbling for 30 seconds, Basketball shooting for 30 seconds, motor ability (vertical jump and shuttle run), anthropometric measurements (standing height, body weight, arm length and leg length) and physiological variables (resting pulse rate and vital capacity). The Wherry Do little method of multiple correlation analysis revealed that zig zag dribbling for 30 seconds, Basketball shooting for 30 seconds and
standing height contributed in order of correlation to the Basketball playing ability among university men players.

Someren and Palmer (2003) conducted a study to determine the anthropometric and physiological profile of 200m sprint kayakers and to examine relationships with 200-m race performance. Twenty six male kayakers who were categorised in two ability groups, international (Int) and national (Nat) level, underwent a battery of anthropometric and physiological tests and a 200-m race. Race time was significantly lower in International than National (39.9 ± 0.8 s and 42.6 ± 0.9 s, respectively). International demonstrated significantly greater measures of mesomorphy, biepycondylar humeral breadth, circumferences of the upper arm, forearm and chest, peak power and total work in a modified Wingate test, total work in a 2-min ergometry test, peak isokinetetic power, and peak isometric force. Significant relationships were found between 200m time and a number of anthropometric variables and anaerobic and dynamometric parameters. Stepwise multiple regression revealed that total work in the modified Wingate alone predicted 200-m race time (R² = 0.53, SEE = 1.11 s) for all 26 subjects, while biepycondylar humeral breadth alone predicted race time (R² = 0.54, SEE = 0.52 s) in Int. These results demonstrate that superior upper body dimensions and anaerobic capacities distinguish international level kayakers from national level athletes and may be used to predict 200 m performance.

Selvakumar (2002) predicted the soccer playing ability from selected physical fitness, physiological, psychological and game skill variables. To achieve the purpose, the investigator selected
hundred intercollegiate male Football players. The selected physical fitness, physiological, psychological and skill variables were tested through standardized objective tests and the playing ability were subjectively rated by three expert during the intercollegiate matches. The obtained data were analysed statistically by using multiple regression equation. The result of study shows that soccer playing ability could be predicted from abdominal strength, VO\(_2\) max, self concept, kicking for distance (left) and kicking for distance (right), speed, agility, vital capacity, achievement motivation and dribbling were good predictors of Soccer playing ability.

Ugarkovic, et al. (2002) examined the relation between jumping performance and standard strength, anthropometric, and body composition variables in elite junior Basketball players. The 33 males were tested for maximal vertical jump, as well as for maximal isometric voluntary force and rate of force development of hip and knee extensors. Standard anthropometric and body composition measures (body height, lean body mass, as well as the percentage of fat and muscle tissue) were also taken. Except for maximal isometric forces (0.38 and 0.52 N.kg (-1) for hip and knee extensors, respectively), all correlation coefficients between the selected variables and jump height were insignificant. As a consequence, the corresponding multiple correlation coefficient, R = 0.71, also suggested a moderate predictability of jumping performance by the standard strength tests and anthropometric and body composition variables. The results obtained dispute the use of the examined tests in sport performance assessment, and also question applying the tests for other purposes such as evaluation of training procedures or selection of young athletes.
Therefore, the results are in line with the concept that a reliable performance assessment in homogeneous groups of athletes requires predominantly movement-specific testing.

**Summary**

In this chapter, totally 20 related literature (8 studies in Kabaddi and 12 studies in other games) were presented. From the observations of above elicited literature it was observed that only few prediction research studies were done on Kabaddi. This chapter also reveals that prediction research studies in other sports discipline were very many, but only few have been added in this chapter.