Chapter-II

REVIEW OF RELATED LITERATURE

A literature review enables a researcher to accomplish a number of more specific aims. It is likely, for example, that in the early stages of research the researcher may have only a vague idea of the area the researcher would like to explore vastly. The researcher may have only a tentative outline of the research problem. A review of the related literature will help the researcher to focus his tentative problem by both limiting and defining more clearly the topic he is interested in researching. The researcher will be aware of possible pitfalls, or search questions that have been thus far neglected reading around the subject will help the researcher to distil the issues he wish to concentrate upon and leave him with a concise, detailed and distinct plan of action.

A well-structured literature review is characterized by a logical flow of ideas; current and relevant references with consistent, appropriate referencing style; proper use of terminology; and an unbiased and comprehensive view of the previous research on the topic. Review of related literature decides, allowing the researcher to acquaint himself with current knowledge in the field or area in which he is going to conduct his research, serves the following specific purposes.

➢ The review of the related literature enables the researcher to define the limits of his field. It helps the researcher to delimit and define his problem. The knowledge of related literature, brings the researcher up-to date on the work which others have done and thus to state the objectives clearly and concisely.
By reviewing the related literature the researcher can avoid unfruitful and useless problem areas. He can select those areas in which positive findings are very likely to results and his endeavours would be likely to add to the knowledge in a meaningful way.

Through the review of the related literature, the researcher can avoid unintentional duplication of well-established findings. It is no use to replicate a study when the stability and validity of its results have been clearly established.

The review of related literature gives the researcher an understanding of the research methodology, which refers to the way the study is to be conducted. It helps the researcher to know about the tools and instrument, which proved to be useful and promising in the previous studies. The advantage of the related literature is also to provide insight into the statistical methods through which validity of results is to be established.

The final and specific important reason for reviewing the related literature is to know about the recommendation of previous researchers listed in their studies for further research.

The researcher made a systematic attempt to review the related literature by keeping the aforesaid points in mind. The researcher reviewed some detailed in the following studies:

The review of the literature has been classified under the following headings:

1. Reviews related to Anthropometric variables
2. Reviews related to Physiological Variables
3. Reviews related to Biochemical Variables

4. Reviews related to Psychological Variables

5. Overview of Studies

2.1 REVIEWS RELATED TO ANTHROPOMETRIC MEASUREMENTS:

Muratovic; Vujovic and Hadzic (2014) compared anthropometric measurement and body composition between elite handball and basketball players. The purpose of this study was to describe anthropometric characteristics and body composition of elite handball and basketball players as well as to make comparisons between them. Fifty-nine males were enrolled in the study, divided into three groups: fifteen handball players, fourteen basketball players and thirty healthy sedentary subjects. The descriptive statistics were expressed as a mean (SD) for each variable, while the ANOVA and LSD Post Hoc tests were carried out to detect the effects of each type of sport. The results showed there was no significant difference in body mass index among the groups, while a significant difference was found for body height and body weight as well as for all three of the body contents measured (muscle, bone and fat) among the groups.

Sarachandra (2014) studied on anthropometric dimensions of basketball and volleyball players. To achieve the purpose of the study eighty men intercollegiate players, forty basketball players and forty volley ball players were selected as a sample for the study. The data in respect of anthropometric dimensions were collected as per the standard procedure. The collected data were analyzed by using ‘t’ statistical technique with the help of 19th version of SPSS. The results of the study shows that, there exists significant mean
difference between basketball and volleyball players in the selected anthropometric dimensions, viz., height, arm length, chest girth, thigh girth, calf girth, there were no significant difference leg length.

Singh and Khan (2014) presented a comparative study on thigh and lower leg length of high and low performance volleyball players. The purpose of this research work was to compare the thigh and lower leg length of high and low performance Indian volleyball players. 50 subjects of each high and low performance of volleyball players’ data was taken for analyzing the thigh and lower length. High and low performance volleyball players were selected from senior national, All India inter-varsity, zone, State, North zone, Inter-varsity, District tournaments. Z-test analysed with one tail test, concluded the mean Thigh and lower leg length, of high performance volleyball players to be significantly greater than the mean thigh and lower leg length of low performance volleyball players.

Gaurav and Singh (2014) measured a study of anthropometric characteristics of Indian volleyball players in relation to their performance level. The purpose of this study was to find out the differences in anthropometric characteristics of volleyball players in relation to their performance level (i.e., inter-university and inter-college). For this study, two hundred and forty (N=240) male volleyball players (inter-university level, N1=120, inter-college level, N2=120) of age ranging from 18-25 years were selected as subjects from various colleges and universities of North India. The purposive sampling technique was used to select the subjects. All subjects were assessed for height, weight, lengths, circumference and diameters. The independent samples t-test revealed that inter-university volleyball players had significantly higher height
(p<0.05), weight (p<0.05), leg length (p<0.05), lower leg length (p<0.05) than inter-college volleyball players. However, inter-college volleyball players had significantly greater forearm length (p<0.05). The inter-university volleyball players also had significantly greater upper arm circumference (p<0.05), forearm circumference (p<0.05), thigh circumference (p<0.05) and calf circumference (p<0.05) than inter-college volleyball players. The inter-university volleyball players had significantly wider elbow diameter (p<0.05), shoulder diameter (p<0.05) and lesser hip diameter (p<0.05) than inter-college volleyball players. It was concluded that there were significant differences between inter-university and inter-college volleyball players with regard to anthropometric characteristics. Inter-university players showed better anthropometric measurements as compared to inter-college volleyball player.

**Popovic et al. (2013)** purposed of the study was to describe anthropometric characteristics and body composition of elite soccer and basketball players as well as to make comparisons between them. Seventy-one males were enrolled in the study, divided into three groups: twenty-six soccer players, fourteen basketball players and thirty-one healthy sedentary subjects. All subjects were assessed for the anthropometric measures required for the calculation of body composition variables, using the standardized procedures recommended by established literature. Data was analyzed using SPSS and the descriptive statistics were expressed as a mean (SD) for each variable, while the ANOVA and LSD Post Hoc tests were carried out to detect the effects of each type of sport. The results showed that there was no significant difference in body mass index among the groups, while a significant difference was found for body height and body weight as well as for all three of the body contents measured.
(muscle, bone and fat) among the groups. Basketball players were significantly taller and heavier than soccer players and the subjects of the control group, while there was also a significant difference between the weight of soccer players and the subjects of the control group, who were significantly heavier. The muscle and bone contents in the bodies of the subjects in the control group were significantly lower than that of all other subjects while there was no difference between soccer and basketball players. Lastly, the fat content in the body of the subjects in the control group was significantly higher than that of all of the other subjects, while there was no difference between soccer and basketball players.

Fattahi; Ameli and Sadeghi (2013) purposed a study of relationship between anthropometric parameters with vertical jump in male elite volleyball players due to game’s position. Vertical jump is one of the necessary components in performing spike and block skills in volleyball. Recent study was performed to determine relationship between anthropometric properties with vertical jump on 40 male elite volleyball players (27.93±3.92 years old and 8±1.53 years sport history) which at least played for 4 years in Iran premier league. Individual satisfaction and information forms were completed. 42 anthropometric parameters were measured. In order to decrease parameters covering the same measurements among 42 anthropometric properties, multiple correlation were applied and parameters with coefficient higher than 0.8 were selected for further analysis, so number of parameters decreased to 17. Using principle component analysis method on 17 parameters, three main components including 70% of data variance were extracted. In the main components, parameters with coefficient more than 0.7 including weight, seated height in fixture, shank length, foot length, torso circumference at hip level, maximum
calf circumference, abdomen fat, middle tight circumference and tight length were used for further analysis. The difference in distance between the standing reach height and the jump height was measured as the vertical jump records. To determine differences between vertical jump records and also relationship between anthropometric properties with vertical jumps, one way variance analysis (F-Test) and regression coefficients were used. Results show that spikers and liberos have the highest and the lowest vertical jump. There are significant differences between vertical jump of spikers and liberos, also between setters and liberos, but there are no significant differences between vertical jump of spikers and setters. According to the study, there was significant relationship between vertical jumps with shank length, maximum calf circumference, foot length for spikers and setters, also tight circumference and weight for liberos.

**Dravin; Singh** and **Bangari (2013)** investigated the study of Anthropometric Physical Fitness and Skill Measurements of Selected Hockey Players of Uttar Pradesh. The sample consists of forty male hockey players were selected from following places of Uttar Pradesh i.e. Lucknow, Varanasi, Saifai, and Shajahanpur. Ten players from each city were selected through purposive sampling technique. The Anthropometric measurements were taken on each subject using standard methodology given by Weiner and Laurie (1969) which were Height (cm), Weight (kg) and Body Mass Index. The selected Physical fitness test items used for the study were- Pull ups and Shuttle run and for skill level, SAI hockey skill test was used. The only selected item from the hockey skill test was shooting the target. Analysis of Variance was used to find out the significant difference in selected physical fitness, anthropometric and skill test
variables among the players. The results in relation to Anthropometric measurements i.e. height, weight and BMI were found almost similar in all players of different selected places. Statistically, result was found insignificant but Varanasi hockey players were found taller as compare to other selected places. In selected Physical fitness i.e. arm and shoulder strength and speed were found significant. Post hoc test indicate Shajahanpur players were better in arm and shoulder strength as compared to Varanasi and Lucknow hockey players. In level of selected hockey skill i.e. ball shooting ability, no significant difference was found among all.

Singh; Singh and Singh (2012) purposed of the study was to find out anthropometric measurements, body composition and somatotyping differences in high performer and low performer shot putters. 20 male shot putters of age 18 to 25 years were assessed for the present study. Out of which 10 were high performers and 10 were low performers. All subjects were assessed for height, weight, widths, girths and skinfold thickness. The independent samples t-test revealed that high performer shot putters were significantly taller (p<0.01) and had significantly greater all the length measurements when compared to low performer shot putters. The high performer shot putters also possessed significantly greater upper arm (p<0.05), forearm (p<0.01), chest (p<0.05), thigh (p<0.05) circumferences and bi-humerus (p<0.01), wrist (p<0.05), bi-acromial (p<0.01), hip (p<0.05) diameters as compared to low performer shot putters. Endomorphy (p<0.05) was significantly higher in low performers while the lean body mass (p<0.05) was significantly greater in high performer shot putters. It was concluded that in most of the parameters there were significant differences between high performer shot putters and low performer shot putters, and the
high performer athletes showed better anthropometric measurements and somatotyping scores.

Rathore; Narwaria and Mukherjee (2012) purposed of this study was to compare anthropometric measurements between handball and volleyball players at college level. A total of thirty (N=30) subjects were selected from St. Joseph College of Physical Education, Moolamattom. In each group fifteen subjects were selected from volleyball and handball group. The age of subjects ranged from 17 to 25 years. For this study, the selected variables were body weight, standing height and chest circumference. Data was obtained with the help of electronic weighing machine, stadiometer and non-stretchable measurement tape. The researcher followed Standard procedures during collection of data. For the analysis of data, independent ‘t’ test was employed with level of significance 0.05. The result of the study shown insignificant differences in body weight and chest circumference. However, in case of standing height, significant differences were found between volleyball and handball players.

Hadzic; Bjelica and Popovic (2012) compared the study of anthropometric measurement and body composition between elite basketball and volleyball players. The purpose of this study was to describe anthropometric characteristics and body composition of elite basketball and volleyball players and to make comparison between them. Fifty-nine males were enrolled in the study divided into three groups: fourteen basketball players, fourteen volleyball players and thirty-one healthy sedentary subjects. All subjects were assessed for the anthropometric measures required for the calculation of body composition variables, using standardized procedure recommended by established literature. Data was analyzed using SPSS and the descriptive statistics were expressed as
mean (SD) for each variable, while ANOVA and LSD Post Hoc test were carried out to detect the effects of each type of sport. The results showed there was no significant difference in body mass index among the groups, while a significant difference was found for body height, body weight and all contents of body among the groups: muscle, bone and fat content.

Chahal; Ghildyal and Chahal (2012) analysed the study of predicting excellence in basketball: anthropometric and physiological attributes in elite Indian female players. Talent identification, selection, training and improvement (TISTI) programs were scanty in team sports especially in consideration of Indian female Basketball. This study tested the hypothesis that predicting excellence in junior Indian female basketball players in relation to anthropometric, physiological variables and then helpful to determine the squads of other levels. The regression and factorial analysis to predict the excellence were applied. The study measured anthropometric measures (height, weight, arm length, palm length, leg length and the girths of the upper arm, wrist, thigh and calf) and physiological variables (anaerobic power, peak flow rate, vital capacity and four skin folds for body fat percentage) of ninety six female players competing at junior National Basketball championship. To collect the data of selected variables were taken on each subject individually during rest hours with the help of standard scientific instruments and techniques. Significant relationships were found between performance in relation to palm length (0.32), leg length (0.29), upper arm circumference (0.24), anaerobic power (0.30), peak flow rate (0.69), vital capacity (0.22) and body fat percentage (0.37). The performance in junior female basketball players could be attributed to selected anthropometrical and physiological variables followed by prediction equation.
Factor analysis of data showed four prominent factors. Application of the findings may prove more beneficial and effective TISTI program to optimize playing ability at appropriate chronological and competitive age (peak performance age).

Bozo and Llesh (2012) investigated the study on comparison of Albanian female volleyball player with anthropometric, performance and haematological parameters. The purpose of this study was to investigate and compare, on a set of basic anthropometric characteristics, specific volleyball performance indicators and a number of haematological parameters, between elite and nonelite female volleyball players in Albania. A total of 39 subjects were assesses and analyzed for three sets of indicators: 5 anthropometric characteristics (BH, BW, BMI, %BF, and %LBM), 3 performance tests (Jump with one hand, Jump with two hands, Height of the Arm) and 11 haematological markers (WBC, Lymph, Mid, Gran, Hgb, RBC, Hct, MCV, MCH, MCHC, ERC). The obtained results show that physical parameters such as body height, height of the arm, body weight, %BF display generally better values in elite teams but special abilities could be found and appreciated also in a local team, although with less better starting anthropometric and physical characteristics. The physical parameters are collinearly correlated to jump performance tests in both teams but with better values in the local team, different from the expectations. Haematological profiling does not show evident differences between the team groups; however these markers signal for eventual health or performance related alterations especially those related to anemia, which is a predictable and expectable health problem for this gender and age group. The above parameters, alone and in combination with each other, would allow coaches and athletes to identify and
assess the physical and performance characteristics specific to the age groups for purposes of professional evaluation, selection, monitoring and continuous development at both individual and team level.

Koley; Singh and Kaur (2011) conducted a study of arm anthropometric profile in Indian interuniversity basketball players. The purpose of this study was threefold: firstly, to evaluate the arm anthropometric profile of Indian inter-university basketball players; secondly, to search for the correlations among these arm anthropometric characteristics; and thirdly, to search for the association of handgrip with arm anthropometric characteristics in Indian inter-university basketball players. Three anthropometric characteristics, nine arm anthropometric characteristics, and grip strength of both right and left hand were measured on randomly selected 60 Indian inter-university basketball players (35 males and 25 females, aged 18–25 years) of six universities, who participated in the Inter-university Championship organized at Guru Nanak Dev University, Amritsar, Punjab, India. An adequate number of control subjects were also taken from the same place for comparisons. The results indicated statistically significant ($p<0.05$ - 0.01) differences between the male basketball players and the controls in height, right handgrip strength, upper arm, forearm and total arm length, whereas no significant differences were found between the female basketball players and the controls. Highly significant ($p<0.01$) sex differences were found in the basketball players in almost all the variables studied (except BMI and arm fat area). Significant positive correlations were noted among the arm anthropometric characteristics studied (except arm fat area and arm fat index), and with right and left handgrip strength.
Karkare (2011) found the relationship between anthropometric measurements and body composition of hockey players with respect to their playing positions. Two hundred and ten junior national hockey players seventy each from half line, back line and forward line was selected different state of India. Anthropometric measurements including height, weight, diameter, breadth, girth, and skinfold thickness was taken from entire subjects. Body composition was measure with the help of Matiegka’s method (1921). To find out significant difference statistical method one way ANOVA was performed. Results found that, hockey players playing in different position found to be differs on some anthropometric measurements and body composition.

Gaurav; Singh and Singh (2010) purposed a study of anthropometric characteristics, somatotyping and body composition of volleyball and basketball players. The study was to compare the anthropometric characteristics and somatotype of the Guru Nanak Dev University, Amritsar’s male basketball players and volleyball players. Sixty three sportspersons (volleyball=36 and basketball=27) of age group 18-25 years were selected from different colleges affiliated to Guru Nanak Dev University, Amritsar, Punjab, India. All the participants were assessed for height, weight, breadths, girths and skin fold thickness. An independent samples t-test revealed that basketball players had significantly higher height (p<0.01), weight (p<0.01) and body surface area (p<0.01) as compared to volleyball players. The basketball players were also found to have significantly greater biceps (p<0.01) and suprailliac (p<0.01) skin fold thicknesses, calf circumference (p<0.05), percent body fat (p<0.01), total body fat (p<0.01), fat free mass (p<0.05) and endomorphic component (p<0.05) as compared to volleyball players. Volleyball players had significantly greater
body density (p<0.01) as compared to basketball players. The basketball and volleyball players of this study were found to have higher percentage body fat with lower body height and body weight than their international counterparts.

**Barut; Demirel** and **Kiran (2008)** evaluated a study of hand anthropometric measurements and grip strength in basketball, volleyball and handball players. The main objectives of the study were this cross-sectional study was performed to compare hand anthropometric measurements and grip strength among different sports groups. The study group was composed of 145 basketball players, 133 volleyball players and 96 handball players aged between 9-18 years. A digital compass (Shan, 150 mm) with a resolution of 0.01 mm/0.0005 inch was used for hand anthropometric measurements and a digital hand dynamometer (Takei) was used for grip strength measurement. During measurements values for both hands were obtained. Eight parameters were evaluated for each hand. For statistical analyses One Way ANOVA for parametric conditions and Kruskal-Wallis Variance Analyses for subgroups which have nonparametric conditions were performed. The differences within the groups were evaluated with post hoc Bonferroni adjustment. The results the study reveals that there were statistically significant differences for right and left hand width, right finger index, right hand length/height, left hand length/height values between basketball, handball and volleyball players. The differences between basketball and handball players were the reason for the aforementioned differences. There were statistically significant differences in right and left width, right and left third finger length, right and left hand grip strength values in females. These significances were caused by handball players. It was concluded that these findings suggest that different sports could constitute different effects
on hand anthropometric measurements and grip strength and sex should be considered.

2.2 REVIEWS RELATED TO PHYSIOLOGICAL VARIABLES

Sathianarayanamoorthy (2013) purposed to find out the impact of game-specific field training with and without mental practice strategies on selected physiological and performance variables namely resting heart rate, systolic blood pressure, diastolic blood pressure and Volleyball playing ability among male Volleyball players. The sample consists of thirty six male Volleyball players have been randomly selected from affiliated college of Anna University Tiruchirappalli in the state of Tamil Nadu, India. The age of subjects were ranged from 17 to 23 years. The subjects had past experience of at least three years in Volleyball and only who those represented their respective college teams were taken as subjects. A series of physiological tests was carried out on each participant. These included resting heart rate assessed by digital heart rate monitor, systolic blood pressure and diastolic blood pressure assessed by digital BP monitor, performance variable assessed by using subjective rating. The subjects were randomly assigned into three groups of 12 each, such as experimental and control groups. Group-I underwent Game-specific field training, Group-II underwent game-specific field training with mental practice strategies for 5 days a week, two sessions (morning & evening) per day and for12 weeks, each session lasted 90 minutes. The control group maintained their daily routine activities and no special training was given. The subjects of the three groups were tested on selected variables prior and immediately after the training period. The collected data were analyzed statistically through Analysis of Covariance (ANCOVA) to find out the significance difference, if any between
the groups. In case ‘F’ values found to be the significant the Scheffe’s test was
used as post hoc test. The 0.05 level of confidence was fixed to test the level of
significance difference, if any between groups. The results of the study showed
that there was significant level differences exist among game-specific field
training group, game-specific field training with mental practice strategies group
and control group. And also game-specific field training group, game-specific
field training with mental practice strategies group showed significant difference
on level of resting heart rate, systolic blood pressure, diastolic blood pressure
and Volleyball playing ability compared to control group. When experimental
groups were compared game specific training with mental practice strategies
group showed significant decrees in the resting heart rate, systolic blood pressure
and diastolic blood pressure level and improvement in the Volleyball playing
ability.

Rai (2013) determined to study the physiological characteristics of
national Volleyball players. Study was conducted on twenty Volleyball spikers
from various regions of railways which participated in National railways
Volleyball Championship. Twenty spikers from different teams were selected for
the present study. The age of the subjects ranged from 18 to 25 years. Based on
literary evidence and scholar’s own understanding the following variables were
selected for the purpose of this study: Physiological Variables Resting heart rate,
Resting respiratory rate, Vital Capacity, Total body fat percentage, Lean body
weight. Pulpatory method (Pulse rate count) was used to measure the Resting
Heart Rate. Score was recorded in numbers of pulse per minute. Resting
respiratory rate was measured by manual method over a period of one minute.
Weight was recorded nearest to half a kilogram. Height was recorded to the
nearest centimeter. Total Body fat percentage was measured by skinfold caliper and with help of Slown Weir Nomogram Technique score was recorded in percentage. To characterize Volleyball players by their selected physiological variables to standard human performance measures, descriptive statistics was used.

Nikolaidis and Ingebrigtsen (2013) examined possible discriminant physical and physiological characteristics between elite male Handball players from elite teams with different league rankings. Players from three teams (A, B and C), which competed in the first league of the Greek championship during the season 2011-2012 participated in the study. Team A finished first, B came second and C came eighth out of eleven clubs. Teams A and B also participated in European Cups, and team A won the European Challenge Cup. The players (n=44) were examined for anthropometric characteristics and performed a series of physical fitness tests. Players from teams A and B were taller (6.2 cm (0.7;11.7), mean difference (95% CI) and 9.2 cm (4.0;14.5), respectively), and had a higher amount of fat free mass (6.4 kg (1.1;11.8) and 5.4 kg (0.2;10.5)) compared to those of team C. Players from team A performed better than players from team C in the squat jump (5.5 cm (1.0;10.0)), the countermovement jump without (5.5 cm (0.4;10.6)) and with armswing (6.0 cm (0.7;11.3)) and in the 30 Bosco test (5.7 W.kg-1 (1.2;10.2)). Also, players from team A outperformed team B in mean power during the Wingate anaerobic test (WAnT, 0.5 W.kg-1(0;0.9)) and in the Bosco test (7.8 W.kg-1 (3.4;12.2)). Overall, players from the best ranked team performed better than the lowest ranked team on WAnT, vertical jumps and the Bosco test. Stepwise discriminant analysis showed that stature and mean power during the Bosco test were the most important
characteristics in TH players, accounting for 54.6% of the variance in team ranking. These findings indicate the contribution of particular physical fitness components (stature, fat free mass and anaerobic power) to excellence in TH. In addition, the use of the Bosco test as an assessment tool in talent identification and physical fitness monitoring in this sport is further recommended.

**Kumar et al. (2013)** compare the physiological variables of All India Intervarsity Level Batsmen’s, Pace Bowlers, Spin Bowlers, Wicketkeepers, and All-Rounders men cricketers of India. For the purpose of this study, one hundred and fourteen cricket players which consists 22 batsmen, 40 bowlers (i.e. 25 medium pace and 15 spin bowlers) 14 wicket keepers, and 38 all-rounders were selected. The physiological variables were considered to be the major factors contributing to the performance in the cricket- Resting pulse rate, Resting blood pressure, Hb content, Vital capacity, Anaerobic power, and Aerobic capacity. To prepare profiles of All India Intervarsity Level cricket Men players of India, descriptive analysis i.e. mean and S.D. was done. For the comparison of the physiological variables analysis of variance (Anova) and test Schafees post hoc test was applied. The mean of Hemoglobin of batsmen’s, pace bowlers, spin bowlers, wicketkeepers, and all-rounders were 13.79 mm/Hg, 13.32 mm/Hg, 13.16 mm/Hg, 13.13 mm/Hg., and 13.66 mm/Hg, Resting Pulse rate were 69.68 bt/min., 70.12 bt/min., 70 bt./min., 70.64 bt./min., and 70.34 bt./min., systolic blood pressure were 115.81, 116.28, 116.9, 116.64, and 117.2, diastolic blood pressure were 92.00, 93.24, 92.80, 89.21, and 92.97, the mean of Vital Capacity were 3.16 ltr, 3.1 ltr 2.99 Ltr, 2.52 ltr., and 2.95 ltr, Anaerobic Power were 724.57 Watt, 703.59 Watt, 706.2 watt, 704.93 Watt., 687.690 Watt, Aerobic Power were 35.13 Watt, 35.66 Watt, 35.88 Watt, 39.19 and 38.66 Watt. It was
found that only Vital Capacity among All India Intervarsity level Cricket Batsmen’s & wicketkeepers was significant and no other physiological variable were not found significantly different among Batsmen’s, Pace Bowlers, Spin Bowlers, Wicketkeepers, and All-Rounders men cricketers of India at .05 level of significance.

Kumar and Gladykirubakar (2013) compared the study on physiological variables of fast bowlers and batsman in cricket at Inter University and Inter College levels of participation. The study administered on 30 Cricket players in the age group 18-25 years of different University belonging to AMET University, Madras University, Anna University and Hindustan University on the stratified random sampling basis. Physiological variables as blood pressure (diastolic and systolic), pulse rate, and respiratory rate measured. As per results of the physiological variables, the players of Group-I (Inter-University level) were found better in blood pressure diastolic, pulse rate and respiratory rate from the players of Group-II (Inter-college level cricket players). This significant difference was found at .05 levels of confidence and on 99 degree of freedom and also on .01 levels. The inter college and inter university level cricket players have better mean value in all the physiological variable such as blood pressure (diastolic), pulse rate and respiratory rate. The statistically insignificant difference was found in the blood pressure systolic between the two groups of cricket players. The mean difference of two groups of Cricket players in blood pressure systolic and found the difference insignificant. The mean value difference between the two groups was 1.00. The standard error denoted as SE =.52. The value of t-test was found 1.92, which is insignificant to the tabulated
value ‘t’ 5 (.99 = 1.99). The difference between the two groups was very less, which indicates that they were almost of equal status in blood pressure (systolic).

Deshmukh (2013) compared the selected Physiological variables between Basketball and Volleyball Male Players of S.G.B.A.U. Amravati University. The samples of 60 male university/college level players (30 Basketball Players and 30 Volleyball Players) were randomly selected, as the subjects for the present study. The subject’s age ranged from 18 to 25 years. The variables for study were-Blood Pressure(Systolic Blood Pressure and Diastolic Blood Pressure), Vital Capacity, Resting Heart Rate, Breath Holding Capacity (Positive Breath Holding Capacity and Negative Breath Holding Capacity), and Body Fat Percentage. To comparison of selected physiological variables Basketball and Volleyball male players mean difference method (t ratio) ‘t’ test was used. The level of significance was set at 0.05 levels. Results showed significant difference in Fat percentage and insignificant differences were found in Systolic Blood Pressure, Diastolic Blood Pressure, vital capacity, resting heart rate, positive breath holding capacity.

Chakravarthi and Srinivasan (2013) determined the study on physiological effects of eliciting the relaxation response during exercise. Nine adult females volunteered to participate in this study. The subjects received 30 minutes of progressive muscle relaxation (PMR) instructions per session for eight sessions. During the week following PMR, the subjects exercised for 30 minutes of continuous activity on the treadmill. The first and third 10 minutes of exercise were control periods. During the second 10 minutes (treatment period), the subjects elicited the relaxation response. Oxygen consumption and related measures were determined using the Beckman Metabolic Measurement Cart. A
repeated measures ANOVA was used to analyze the data. During the treatment period, there were significant (p<0.05) decreases in Fb, Ve, SBP, and RPP when compared to the two control periods. There were no significant (p>0.05) differences in Vt, VO2, VCO2, RER, and HR. The result showed that the elicitation of the relaxation response during exercise did not decrease submaximal VO2 and, therefore, did not alter running economy. Statistically significant changes in ventilation and blood pressure were associated with the elicitation of the relaxation response during exercise. Regarding the latter findings, there was ample evidence that a reduction in RPP has a positive and unequivocal beneficial influence on the work of the heart during exercise.

George, Ravindran and Abraham (2012) analysed psychological variable on playing ability among Handball teams at different levels. The investigator had selected one hundred sixty seven male Handball players as subjects (n = 167) from different levels such as College, District, University and State level, who part take in various tournaments like University, State, Inter University, Inter-State (South Zone) lack during the year 2010-11. The players include twenty six from College level (n = 26), twenty nine from District level (n = 29), sixty from University level (n = 60) and fifty two from State level (n = 52). The tournaments of the above game were held at different venues in different times. Self esteem was selected as the psychological variable of this study. Analysis of Variance (ANOVA) was used to analyse the collected data. The result of the study revealed that there was a significant difference (p ≤ 0.05) on self esteem among the four levels of Handball teams.

Chaleh et al. (2012) compared Physiological factors in Iranian Football Players with World Standards. To this approach, 26 subjects from Iran Soccer
League (mean age 23/25±2/71 years, height 182/46±3/90 cm and weigh 76/61±4/97kg) volunteers and selected as the study participants. Anthropometric indicators such as body fat determined using Isaac methods. Physical fitness indexes including speed, measured using 20 m speed test, agility measured using Illinois test, anaerobic power measured by Jump auricular Bvsky test and aerobic capacity measured by 20 m Shuttle run. Descriptive statistics used to describe the demographic characteristics, and one-way variance used to analysis of data, the significance level was considered P ≤ 0/05. The study results showed that the subjects’ mean percentage of body fat was 7/93%±1, speed was 2/93±0/70 m/s, agility was 15/37± 0/63 second, anaerobic power was 45/30±6/73 watt and aerobic capacity was 46/45±6/90 mg/ml/kg. In general, the results indicated that the percent of body fat of Iranian Soccer players was lower than the world standards. Also, the averages of aerobic and anaerobic power of Iranian soccer players in first class league were lower than the elite players from other countries even in different playing positions. However, the mean speed and agility of the Iranian soccer league players compared with results of other investigations were appropriate.

**Vinothkumar, Savanam and Samraj (2011)** compared the selected physiological variables among university men basketball, Football and Volleyball players. To achieve this purpose each twenty university level basketball, Football and Volleyball players were selected as subjects from Pondicherry. Data were collected on the selected variables namely resting pulse rate and breathe holding time. One way analysis of variance (ANOVA) was used for statistical analysis. The result of the study showed that there was
significant difference among players in pulse rate and there was no significant difference in breathe holding time.

Venkatesan and Yuvaraj (2011) purposed a study to find out the effects of asana and pranayama practices on selected physiological variables among the intellectually challenged persons of love care special school in Chennai. The investigator randomly selected 45 intellectually disabled children from love care special school in Chennai. The subjects were divided into three groups. Experimental Group I consisting of 15 subjects under gone the asana training, Experimental group II consisting of 15 subjects undergone the pranayama and then Experimental group III consisting of 15 subjects act as a control group. The researcher used ANCOVA statistical technique for this study. It was found that the resting pulse rate, systolic blood pressure, diastolic blood pressure, Vo2 max, vital capacity, body fat significantly reduced due to the influence of six weeks practices of asanas and pranayama to comparing the control group. But particularly the pranayama group has significantly decreases in resting pulse rate when compared to the asana group. It was also concluded that the Vo2 max and vital capacity has significantly increases due to the influence of six weeks practices of asanas and pranayama to comparing the control group. But particularly the pranayama group has significantly increases in vo2 max when compared to the asana group.

Reddy et al. (2011) studied to find out the difference in aerobic endurance among Handball and basket ball players. The 40 male subjects between the age group of eighteen to twenty one years i.e., twenty Handball players and twenty basket ball players of Osmania University who have taken part in the O.U. inter college sports and games during the year 2010-11 were
taken for the study. The 12 Run Cooper Test were used to evaluate the aerobic endurance among Handball and basketball players. The study shows that the Handball players are having very good aerobic endurance compare to the hockey players.

Jayaraman (2011) studied the effect of weight training and fartlek training on selected physiological variables among college men students. To achieve this purpose, forty five men students were selected randomly as subjects and divided in to three groups namely resistance training group, fartlek training group and control group of fifteen subjects in each groups and the subject’s ages ranged from 18-23yrs. All the subjects were tested on selected variables prior to and immediately after the training period. The selected criterion variables such as cardio respiratory endurance was measured by Copper’s 12 min/walk test and resting pulse rate was measured by counting the pulse rate per minute. The Analysis of Covariance (ANACOVA) were used to find the significant difference if any, among the experimental and control groups on selected criterion variables separately. In all the cases, 0.5 level of confidence was fixed to test the significance, which was considered as an appropriate. Since there were three groups involved in this study the Scheffe’s test was used as post-hoc test. The study revealed that there were significant improvements in the variables such as leg strength, muscular endurance, vital capacity, resting pulse rate and cardio respiratory endurance due to physical training on the experimental groups. Participation in physical training resulted in a significant development in the physical fitness variables such as leg strength, strength endurance and cardio respiratory endurance on experimental groups when compared to control group.
Lidor and Ziv (2010) studied to physical characteristics and physiological attributes of adolescent Volleyball players-a review. The purpose of this research was to review a series of studies \((n = 31)\) on physical characteristics, physiological attributes, and Volleyball skills of female and male adolescent Volleyball players. Among the main findings were (a) that male national players were taller and heavier than state and novice players, while female national players showed lower body fat values compared with state and novice players, and (b) vertical jump values were higher in starters versus nonstarters. Among the methodological concerns based on the reviewed studies were the lack of information on maturational age and lack of longitudinal studies.

Koley, Singh and Sandhu (2010) studied on anthropometric and physiological characteristics on Indian inter-university Volleyball players. The purpose of this study was of two-folds, firstly, to evaluate the anthropometric profile of Indian inter-university Volleyball players and, secondly, to search the correlation of body mass index, \(%\) body fat, hand grip strength (right dominant) and Vo2max. with other anthropometric characteristics studied. Eleven anthropometric characteristics, four body composition parameters, two physical and two physiological variables and nine arm anthropometric characteristics were measured on randomly selected 63 inter-university Indian Volleyball players (38 males and 25 females) aged 18–25 years from Guru Nanak Dev University, Amritsar, Punjab, India with adequate controls \((n = 102, 52\) males and 50 females). The results indicated that male Volleyball players were taller \((6.63\%)\) and heavier \((7.31\%)\) and female Volleyball players were slightly taller \((0.31\%)\) and lighter \((3.74\%)\) than their control counterparts. One way analysis of
variance showed significant (p≤0.004-0.000) between group differences in all the variables (except hip circumference) between Volleyball players and controls. In volley players, significantly positive correlations was found with BMI and other 19 variables, with percent body fat and 6 variables, with right hand grip strength and 20 variables and with Vo2max and other 19 variables, and significantly negative correlations were found with percent body fat and other 16 variables, with right hand grip strength and other 7 variables and with Vo2max with other 8 variables.

Dey, Kar and Debray (2010) studied the various anthropometric parameters, motor ability and physiological profiles of the different Indian national club Footballers and also to compare the above parameters with their international counterparts. The study was carried out on one hundred fifty (150) male Indian Footballers of six different national clubs of India including three from Kolkata (East Bengal, Mohan Bagan & Mohammedan Sporting) and other three from Goanese clubs (Salgaokar, Vasco & Dempo). The players were also sub-divided according to their specific field positions. Physical and physiological profiles including height, weight, percentage body fat (%BF), flexibility, agility, explosive power, and VO2 max were measured by standard procedures. It was noted that the mean values of age, height, weight and %BF were significantly different among Footballers of different national clubs. Among the motor ability and physiological qualities only flexibility, agility and VO2 max were significantly different among the Footballers of different national clubs (p<0.01). It was also observed that the mean values of height, weight, vertical jump and VO2 max of Indian national club players were found to be inferior to those of European, American and Australian Footballers. However,
the %body fat of Indian Footballers according to their specific field positions
was found to be comparable with their international counterparts. The defender,
midfielder and striker of the present study are inferior in endurance (VO2 max)
as compared to their international counterparts. Genetic factors may be the cause
of smaller body size of the subject of the present study as compare to their
international counterparts.

Zhang (2009) conducted study on Heart rate, lifespan, and mortality risk. An increasing body of scientific research and observational evidence indicates
that resting heart rate (HR) is inversely related to the lifespan among homeo
thermic mammals and within individual species. In numerous human studies
with patients stratified by resting HR, increased HR is universally associated
with greater risk of death. The correlation between HR and maximum lifespan
seems to be due to both basal metabolic rate and cardiovascular-related mortality
risk. Both intrinsic and extrinsic factors are already postulated to determine how
the biological clock works, through regulating and modulating the processes
such as protein oxidation, free radical production, inflammation and telomere
shortening. Given the remarkable correlation between HR and lifespan, resting
HR should be seriously considered as another possible cap on maximum
lifespan. Future research is needed to determine whether deliberate cardiac
slowing, through methods like lifestyle modification, pharmacological
intervention, or medical devices, can decelerate biological clock of aging, reduce
cardiovascular mortality and increase maximum lifespan in humans in general.

Thorin and Thorin-Trescases (2009) conducted study on Vascular
endothelial ageing, heartbeat after heartbeat. The vascular endothelium starts to
age at the first heartbeat. There is no longer a need to demonstrate that an
increased resting heart rate--above 70 b.p.m.--is associated with the onset of cardiovascular events and reduces lifespan in humans. Each cardiac cycle imposes a mechanical constraint on the arteries, and we would like to propose that this mechanical stress damages the vascular endothelium, its dysfunction being the prerequisite for atherogenesis. Consequently, reducing heart rate could protect the endothelium and slow the onset of atherosclerosis. The potential mechanisms by which reducing heart rate could be beneficial to the endothelium are likely a combination of a reduction in mechanical stress and tissue fatigue and a prolongation of the period of steady laminar flow, and thus sustained shear stress, between each systole. With age, irreparable damage accumulates in endothelial cells and leads to senescence, which is characterized by a proatherogenic phenotype. In the body, the highest mechanical stress occurs in the coronary vessels, where blood only flows during diastole and even reverses during systole; thus, coronary arteries are the prime site of atherosclerosis. All classical risk factors for cardiovascular diseases add up, to accelerate atherogenesis, but hypertension, which further raises mechanical stress, is likely the most damaging. By inducing flow through the arteries, the heart rate determines shear stress and its stability: mechanical stress and the associated damage induced by each systole are efficiently counteracted by the repair capacities of a healthy endothelium. The maintenance of a physiological, low heart rate may be key to prolonging the endothelial healthy lifespan and thus, vascular health.

Rami and Silawat (2009) studied on Psychological Factors, Anthropometric Measurement and Physical Fitness of Selected University Players in Gujarat, Shodh, Samiksha aur Mulyankan. From the study of
Psychological Parameters revealed that, the players of all games were seen reserved, critical, cool, emotional, mild, easily upset, conforming, accommodating, sober, prudent, serious, shy, timid, trusting, tough minded, confident serene, self-reliant, affected by feeling. In parameters if psychological factors kabaddi’s players were shown more significant as compared to other games, while Volleyball players were for away from these factors. The results from the analysis of anthropometry measurement the players of Kabaddi’s highest in Height, Weight and circumference of chest, upper am, thigh and calf, were as players of kho-kho’s has shown lower in above sighted variables. The results revealed from analysis of physical fitness Athletics players were superior as compared to other games, where as basketball players were lowest

Palatini (2009) conducted study on Elevated heart rate: a "new" cardiovascular risk factor. A number of epidemiologic studies and several experimental lines of research point to high heart rate as a main risk factor for cardiovascular disease. However, translating research into clinical practice has been a challenge throughout medical history. From the present symposium, it appears clear that this is particularly the case for heart rate. The complex nature of atherogenesis makes it difficult to establish the role of a putative risk factor because of the correlations and complex interactions among factors. The pathogenetic mechanisms for the connection of resting heart rate with atherosclerosis and cardiovascular morbidity have been elaborated extensively in the chapter papers of this symposium, suggesting that there is a causal relationship between heart rate and cardiovascular mortality. The benefit of heart rate reduction has been proved in patients with coronary artery disease or congestive heart failure. Until now it has been difficult to determine whether
modulation of heart rate is beneficial also in patients free of cardiac diseases. This concern, however, does not in any fashion suggest that health care professionals should pay less attention to this clinical variable. The impressive amount of available epidemiologic data show support for the continued effort to raise awareness of the clinical importance of resting heart rate among health care professionals.

**Orso et al., (2009)** conducted a study on heart rate in coronary syndromes and heart failure. In the past 2 decades, there have been growing evidences that resting heart rate might be a marker of risk or even a risk factor for cardiovascular morbidity and mortality. This research current evidences concerning the relation between heart rate and patients' outcome in different clinical settings such as acute coronary syndromes, left ventricular systolic dysfunction, and heart failure. The relationship between resting heart rate and the development of coronary artery disease, as well as all-cause and cardiovascular mortality has been found to be strong, graded, and independent from other risk factors. Several lines of research indicate that heart rate plays an important role in the pathophysiology of atherosclerosis and in the clinical manifestations of coronary artery disease and that it is an independent prognostic factor in all coronary syndromes. The prognostic value of elevated heart rate in patients with heart failure has been tested in several clinical trials evaluating pharmacologic heart rate-lowering agents (e.g. beta-blockers). It is difficult to determine which percentage of the clinical benefit obtained with beta-blockers is related to induced bradycardia because cardiac slowing is only one of the effects of these drugs. In the BEAUTIFUL trial, a subgroup analysis conducted in patients with resting HR more than 70 beats per minute showed that treatment
with ivabradine was able to improve outcome. According to the results presented in this review, we can conclude that heart rate is a predictor of death in both stable coronary artery disease and acute coronary syndromes. Elevated heart rate is also able to negatively predict clinical outcomes in patients with heart failure. However, it is still unclear if heart rate reduction per se can improve prognosis.

**Baker et al., (2009)** conducted study on Resting heart rate and the development of antisocial behavior from age 9 to 14: genetic and environmental influences. The genetic and environmental basis of a well-replicated association between antisocial behavior (ASB) and resting heart rate was investigated in a longitudinal twin study, based on two measurements between the ages of 9 and 14 years. ASB was defined as a broad continuum of externalizing behavior problems, assessed at each occasion through a composite measure based on parent ratings of trait aggression, delinquent behaviors, and psychopathic traits in their children. Parent ratings of ASB significantly decreased across age from childhood to early adolescence, although latent growth models indicated significant variation and twin similarity in the growth patterns, which were explained almost entirely by genetic influences. Resting heart rate at age 9-10 years old was inversely related to levels of ASB but not change patterns of ASB across age or occasions. Biometrical analyses indicated significant genetic influences on heart rate during childhood, as well as ASB throughout development from age 9 to 14. Both level and slope variation were significantly influenced by genetic factors. Of importance, the low resting heart rate and ASB association was significantly and entirely explained by their genetic covariation, although the heritable component of heart rate explained only a small portion (1-4%) of the substantial genetic variance in ASB. Although the effect size is small,
children with low resting heart rate appear to be genetically predisposed toward externalizing behavior problems as early as age 9 years old.

Saraswat and Sharma (2008) compared a study on selected physical and physiological variables of Indian male basketball players at different levels of competition i.e. Inter State and Inter District respectively. The subjects for this study were selected from the Inter District and Inter State level Basketball players, randomly. The average age of the subject was 21.5 years ranging from 18 to 28 years. The Physical fitness components were measured using following test items- Speed-50 yard Dash (See), Strength-Grip Dynamometers (Kg), Power-Sergeant Jump (Cm), Endurance-2.4 (K.M.), (Min), and the physiological variables were measured using following test items. Resting pulse rate-Palpation of radial artery beats per Min, Peak flow rate- Peak Flow meter (Liters), Vital Capacity- Dry Spirometre (Liters). To determine the differences in selected physical and physiological variables of Basketball players at different level of participation (viz., inter district and Inter state) an independent ‘t’ test was used. The t-value found in relation to Physical variables i.e., Speed, Endurance, Power and Grip strength were 1.68*, 6.21*, 10.10* and 0.03 respectively. Results revealed that Inter State Level players were significantly superior in speed, endurance and powers Variables as compared to the inter district players, but it was found that is no significant difference in Grip Strength variable of Inter district and Inter State level players. The t -value found in relation to Physiological variables i.e., resting heart rate, Peak flow rate and Vital capacity were 0.51, 1.14 and 0.08 respectively. Results Reveals that there is no significant difference between the physiological parameters i.e. Resting heat rate, peak flow rate and vital capacity of Inter State and inter District Level players as the
assumed ‘t’ value is lesser than the required ‘t’ value and at 0.05 level of significances. The physical & physiological parameters are contributing factors to the performance in Basket ball game. Therefore, much weight age is given to these factors in training of Basketball players. At higher stages/levels of competition the volume / intensity of training increases which might directly improves the different physical fitness component of basketball players. Moreover, the total duration of training i.e. training age is higher for inter state level players to that of inter district players, which might be a factor for the improved physical variables among inter state level players while the grip strength doesn’t plays much role in the improvement of Basketball playing ability of a player. If we closely look into the physiological foundation of Basketball, we might say that speed explosive strength, endurance and grip strength are directly linked with performance. However, resting heat rate, peak flow rate and vital capacity will not have much weight age to cardiovascular endurance specific to Basket ball player as such these three components are not having much directly contribution to playing ability of basket ball player therefore for above stated reason significant differences in reference to physiological parameters were not found between inter state and inters district players.

Montgomery (2006) studied on physiological profile of professional hockey players -a longitudinal comparison. This research examined the size, strength, and aerobic fitness of players from a professional hockey team. Beginning in 1917, data on body size were obtained from historical records of the Montreal Canadiens. Body composition, strength, and VO2 max were obtained through physiological testing of Canadiens players between 1981 and
2003. Compared with players in the 1920s and 1930s, current players were an average of 17 kg heavier and 10 cm taller, with BMI increased by 2.3 kg/m². The gain in BMI was not attributed to added fat mass, since percent body fat remained unchanged over the past 22 years. From 1992 to 2003, upper body strength was assessed using a bench press test. Predicted 1 repetition maximum (1 RM) for the 17- to 19-year-old group was 107.0 kg with the highest values attained by the 25- to 29-year-old age group (128.1 kg). Gains in body mass were associated with an increase in upper body strength. VO₂ max was measured annually on a treadmill between 1992 and 2003 with annual mean values ranging between 54.6 and 59.2 mL· (kg·min)–1. Compared with values from players in the early 1980s, VO₂ max has increased with the improvements independent of body mass; however, given the variability in the data, we are hesitant to infer that VO₂ max has increased significantly during the 1990s.

Singh, Sharma and Singh (1994) compared the ability of attacker and set-upper in Volleyball. The 44 male Volleyball players (33 attackers, 22 set-uppers) of university and state levels were taken as subjects. Ten motor ability tests, along with age, body weight and standing reach were taken separately for the two groups, attackers and set-uppers. The mean, standard deviation and ‘t’-test were used as statistical tool. It was found that attackers are significantly younger, heavier and taller than set-uppers. The attackers and set-upper do not differ significantly in test except basketball throw. But attackers are better in 40 mt. sprint, standing vertical jumps, 9-3, 6-3-9 meter agility and 2.4 km. run. Set-uppers are better in block jump, forward bend reach and bend knee sit-ups.

Bangsbo (1994) study deals with the physiological demands of soccer, with a particular focus on the physiological response to repeated intense
exercise. Measurements have been performed during soccer matches and training, as well as in experiments simulating the activities of a soccer match. The information obtained has been compared to results from studies of the physical capacity of top-class soccer players and from laboratory experiments aimed at investigating metabolism and fatigue in intermittent exercise. Analysis of activities during soccer matches showed that a top-class soccer player covers an average distance of approximately 11 km during a match. The distance differs highly between players and is partly related to the position in a team. Midfield players run more at low speed’ than defenders and forwards, whereas no difference appears to exist between groups when comparing the distance covered at high speed. The distance covered at high speed is the same in the beginning as in the end of a match. The total distance covered by a player during a soccer match is only to a limited extent a measure of the physiological demands on the player during the match. In addition to running, a player is engaged in many other energy demanding activities, i.e. tackling, jumping, accelerating and turning. A more precise evaluation of the total energy demand during a soccer match may be achieved by performing physiological measurements in connection with soccer matches.

Dey, Khanna, and Batra (1993) investigated to morphological and physiological studies on Indian national kabaddi players. 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 thicknesses taken at four different sites, using Harpenden skinfold calipers. 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) litre respectively. Physical characteristics, percentage body fat, somatotype, maximum oxygen uptake capacity and anaerobic capacity (oxygen debt) and other cardio-respiratory 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.

Ghosh and Others (1985) undertook a study on pulmonary capacities of different groups of sportsmen in India. Pulmonary functional capacities, vital capacity (VC), maximum voluntary ventilation (MVSS), forced expiratory volume in 1 second and FEV 1.0 (per cent VC) of 168 sportsmen belonging to different sports activities and of 10 sedentary individuals were undertaken for study. It was observed that the pulmonary function capacities of different groups
of sportsmen were higher than those of the sedentary group. The mean VC of the basketball, boxing, cricket, football, hockey and the table tennis groups, the mean MVV of all the groups except the athletic, badminton and football groups, and the mean FEV 1.0 of football, hockey, swimming and football groups, and the mean FEV 1.0 of football, hockey, swimming and volleyball groups were significantly higher than those of the sedentary group. The mean values of all the three pulmonary function capacities of only the hockey group was found to be significantly higher than those of the sedentary individuals. The available reported pulmonary capacity values, except FEV 1.0 of a few groups of sportsmen studied abroad, were higher than those of their counterparts studied here. These might be due to the ethnic variation as well as the variation in age, body size and level of physical fitness which influences the different pulmonary capacities.

**Katch (1972)** studied the relationship between aerobic capacity (maxVO2) endurance running performance and body composition was determined in 36 college student. Maximum VO2 was measured using the bulk treadmill test. Endurance running performance was evaluated by the Cooper's 12 minutes run/walk test, where the subjects run as fast as possible in 12 minutes. Percent body fat and lean body weight were calculated from whole body density measurements using underwater weighing and residual volume techniques. Test retest reliability for max VO2 (L/min) was r=0.55, percent body fat (r=0.83), lean body weight (r=0.76) and body weight (r=0.66). The correlations between 12 minutes run time with percent body weight (r=0.55) between max VO2 (L/min) and the running performance was correlated for attainment from unreliability in the run and max VO2 scores, the correlation increased slighted
to $r=0.60$. Expressing max VO2 in ml/kg, improved the correlation only slightly with the endurance run and body composition measurements. It was concluded that the validity of Cooper's 12 minutes running performance and using max as the criterion VO2 as the criterion was too low to be of much predictive usefulness as a test of cardiovascular fitness for the college student measured in this experiment. Percent body fat; lean body eight and body weight did not seen to affect the instance a college student could run in the Cooper's 12 minutes endurance run test.

2.3 REVIEWS RELATED TO BIO-CHEMICAL VARIABLES

Devathunai Sundararaj (2010) conducted a study on effect of aerobic and anaerobic exercises on selected bio-chemical variables of college men non-athletes. For the purpose of the study ninety male subjects from Madras Veterinary College, Madras were selected. The age of the subjects selected was between seventeen and twenty years. The subjects were divided into three groups of thirty each. Among the three groups one was control group and the other two were experimental groups namely aerobic exercise group. The investigator selected the variables such as blood lactic acid, serum cholesterol, blood glucose and red blood cells count and ANCOVA technique was used for the statistical purpose. It was found that groups. Which did aerobic and anaerobic exercise groups, have significantly reduced cholesterol level than the control group. It was also found that there was no significant difference in serum cholesterol level between the aerobic and anaerobic exercise groups. It was also found that there was no significant difference between the aerobic and anaerobic exercise groups in red blood cells count.
Franceschini et al. (2007) conducted a study on comparison of the anthropometric and biochemical variables between children and their parents” carried out with 50 eutrophic and 50 obese children paired according to gender, age, socioeconomics condition, and selected from the nutritional evaluation of 2074 children aged 6 to 8 years, attending public and private urban schools in Vicosa, Minas Gerais, Brazil. The measurements evaluated were weight, height, circumferences (waist and hip) and thickness skin folds (triceps and subscapular). The serum levels of glucose, total –cholesterol, HDL, LDL, triglycerides and hemoglobin in the children were evaluated. The obese children presented a larger body size and higher percentage for total body fat as well as its accumulation in the central region, and higher serum levels for triglycerides (p <0.05 ). For all biochemical parameters, except for hemoglobin and HDL, there occurred in a positive correlation with the located fat in the central region as well as with the total body fat in children (p<0.05). The obese mother showing high percentage of body fat and its accumulation in the central region rather tend to have children with these characteristics (p<0.05). The highest number of the close relatives who are obese and present dyslipidemia is highlighted in the children (p<0.05). This study evidences the differences concerning to the distribution of the body fat and lipid profile among eutrophic and obese children, as well as the strong influence of the maternal obesity upon child’s obesity.

Corigliano et al. (2007) done a research on blood glucose changes in diabetic children and adolescents engaged in most common sports activities “Circulating insulin levels decrease and substrate glycogenolysis-mediated conversion into glucose increases just a few minutes after normal subjects start
exercising, but during sustained physical activity muscles massively utilize blood glucose, thus causing glycogenolysis to increase further until the end of the session. After that, in order to liver and muscle glycogen stores up to pre-exercise levels again, blood glucose is mostly utilized, thus causing late onset hypoglycemia in the absence of any extra carbohydrate supply and rebound hyperglycemia after a while. This and other patho-physiological mechanisms are dealt with in the present paper, and practical hints are provided to the clinician to cope with children-specific adaptation phenomena to exercise in t1DM.

Degoutte et al., (2006) examined a study on the effects food restriction, performance, biochemical, psychological, and endocrine changes in judo athletes of Twenty male judoka were randomly assigned to one of two groups (Group A : called diet, n=10; height approximately 5% of their body weight through self-determined means during the week before the competition; Group B: called control, n=10; height 176.4 +/- 1.1 cm, body weight 73.3 +/- 6.3 kg maintained their body weight during the week before the competition). A battery of tests was performed during a baseline period (T1), on the morning of a simulated competition (T2) and 10 min after the end of the competition (T3). The test battery included assessment for body composition. Performance test. Evaluation of mood. Determination of metabolic and hormonal responses. Dietary data were collected using a 7-day diet record. The nutrient analysis indicated that all the athletes followed a low carbohydrate diet whatever the period of the investigation. For the Group A, the food restriction (- 4 MJ per day) resulted in significant decreases of the body weight and altered the mood by increasing Fatigue, Tension and decreasing Vigour. Dietary restriction had also a significant influence on metabolic and endocrine parameters and was associated
with poor performance. After the competition, significant decreases of the levels in testosterone, T/C ratio, alkali reserve, and free fatty acid were observed in both groups, whereas the plasma concentrations in insulin, ammonia, urea, and uric acid were increased.

Tokmakidis et al. (2002) investigated a study on pre-exercise glucose ingestion at different time periods and blood glucose concentration during exercise. The effects of glucose ingestion (GI) at different time periods prior to exercise on blood glucose (BG) levels during prolonged treadmill running. Eight subject (X+/−SD), age 20+/− 0.5yr, body mass 70.7+/−4.1 kg, height 177+/−4 cm, VO2max 52.8+/−7.8ml x kg(−1) x min(−1) who underwent different experimental conditions ingested a glucose solution (1 g/kg at 350 ml ) 30 min(gl-30), 60 min (gl-60), 90 min (gl-90), and a placebo one 60 min (pl-60) prior to exercise in a counterbalanced design. Afterwards they ran at 65% of VO2max for 1 hour and then at 75% of VO2max till exhaustion. Fingertip blood samples (10 micron) were drawn every 15 min before and during exercise for the determination of BG levels. Oxygen uptake (VO2), heart rate (HR), and blood lactate (La) were also measured every 15 min during exercise. Peak BG values were reached within 30 min after GI but were different (p<0.01) at the onset of exercise (gl-30: 147+/−22, gl- 60: 118+/−25, gl-90: 109+/−22, pl-60: 79+/−5mg/dl). The two-way ANOVA repeated measures and the turkey post-hoc test revealed a higher BG concentration (p<0.05) for the gl-30 and the pl-60 as compared to the gl-60 and gl-90 during running (e. g. 15 min run: 82+/−11,68+/−5,64+/−3,78+/−7, and 60 min run: 98+/−12, 85+/−12, 83+/−11,94+/−11 mg/dl for gl-30,gl-60,gl-90, and pl-60, respectively). However, this did not significantly affect the duration of treadmill running. The La levels were higher (p<0.05) after GI as compared to
placebo throughout exercise (values at exhaustion: 4.6+/−0.2, 5.0+/−1.5, 4.8+/−1.7 mmol/l for gl-30, gl-60, gl-90, and 3.5+/−0.8 mmol/l for placebo). The gl-30 and the placebo fluctuated closer to normoglycaemic levels. The glucose ingestion (60 to 90 min) prior to exercise lowered the blood glucose levels without affecting the duration of running performance at 75% VO2max. Thus, in order to maintain normoglycaemic levels, pre exercise glucose supplementation should be given 30 min before the onset of exercise.

Buchanan et al., (2002) examined the effect of exercise on the biochemical, biochemical and structural properties of tendons. The chemical composition and/or mechanical properties of tendon studies that have examined mechanical changes of tendon are in response to endurance training. Available reports indicate that increases in collagen concentration or with tendon hypertrophy the paucity of data render it impossible to evaluate the response of other structural, chemical and mechanical parameters to training. Furthermore, few investigators have included discrete measures of structural, biomechanical and biochemical variables within a single study. The lake of integrative studies makes it difficult to definitively associate changes in the mechanical properties of tendon with chemical composition and structure.

Tarigopula Veeraiah Choudary (1999) conducted a study about analysis of circuit training variations on selected bio-chemical variables on college men athletes. For the purpose of the study 60 male subjects from SRVBSJB Maharani autonomous college. Peddapuram. Andhra Pradesh was selected, and their age ranged from 17 to 21. The subjects were divided into three equal groups of 20 each. Two experimental and one control group. The researcher selected blood sugar, cholesterol, pyruvic acid and lactic acid as the
variables for the study. To compare the statistical data ANACOVA was adopted. It was find out that there was no effect on blood sugar level because of circuit training. At the same time circuit training had significantly reduced blood cholesterol.

Haskell (1981) conducted a study to determine the distribution plasma lipoprotein in middle aged male runners. In this study the subjects were active men ages 35-49 years and done average 39 miles of running per week. They reached the conclusion that chronic exercise training causes decreased in total blood cholesterol than the person who just started participating in physical exercise at their age. After an 8 to 18 months period of systematic exercise it was observed lowering (general) blood cholesterol and a tendency for normalizing in various fractions of serum proteins lipids. The beta globulin and that lipoprotein content decreases the level of albumin and alpha protein increase and correspondingly there was a rise in the ratio of albumin to globulin and also a return to partial of the previously increased a return to partial of the previously increased content of the natural fat and ketenes of the blood.

2.4 REVIEWS RELATED TO PSYCHOLOGICAL VARIABLE (ANXIETY):

Rastogia and Katiyar (2014) compared the study of sports competition anxiety test between college level chess and cricket players. The purpose of this study was to compare the sports competition anxiety test between college level chess and cricket players. For the purpose of the study, forty (40) male chess players and forty (40) male cricket players were randomly selected as the subject for this study. The subject age was ranged between 20 to 25 years. In this study sports competition anxiety test (SCAT, Martens et al., 1990) questionnaire was
used to measure sports competition anxiety. Sports competition anxiety test questionnaire was distributed between the chess and cricket players one hour before the competition. The hypothesis selected for this study that there would be no significant difference between the chess and cricket players. Descriptive statistics (mean and standard deviation) and independent ‘t’ test were used to analysis the data. The level of significance was set at 0.05. The mean score chess players was 19.20 and cricket players was 22.60. The calculated ‘t’ value was 3.95 which showed that significant difference was found between chess players and cricket players (calculated ‘t’ 3.95 > tabulated ‘t’ 1.99).

Mitra and Gayen (2014) compared sports competition anxiety level among the selected ballgame players. The objective of the study was to compare the sports competition anxiety level among the selected three different ballgame players. Sixty male players representing three different ball games namely basketball, football and volleyball players, constituted the sample of the study. Sports Competition Anxiety of distinct ballgame players were selected as the variables of the study. Sports Competition Anxiety was measured by SCAT questionnaire. Descriptive statistics, One-way analysis of variance were employed to analyze the data. The result of the study shows that there was no significant difference was found among the selected three ballgame players.

Singh (2013) conducted a study of sports competition anxiety among different level basketball players Anxiety before or during athletic competitions can hinder performance of an athlete. The aim of the study was to explore the difference of sports competition anxiety among different levels Basketball players. For the purpose of the study 300 Basketball players (100 Youth National, 100 Intervarsity and 100 Senior State) were selected from various
Basketball tournaments. The sports competition anxiety test developed by Martin (1990) was used to collect the data from the subjects. After analyzing the data it was found that there was significant differences exist among different levels Basketball players.

Radzi; Md Yusof and Zakaria (2013) investigated the study on pre-competition anxiety levels in individual and team sports athletes. Malaysian males back up athletes (N=52) participated in this study. Competitive State Anxiety Inventory (CSAI-2), heart rate and salivary samples were obtained from participants across three different times which at one week, one day and one hour prior to the competition. Trait anxiety was obtained once, at one week prior to the competition. Result of this study revealed that none of the variables except trait anxiety scores showed significant difference (p<.05) between individual and team sport athletes. In addition, there is a significant effect for time existed for heart rate level in team sports athletes which at one week and one hour prior to the competition. Meanwhile, in cortisol response, a significant effect for time was found in individual sports athletes only. The difference occurred at one week and one day prior to the competition. Future studies should use physiological measure and psychological measure at the same time prior a highly competitive situation in measuring anxiety on sport performance.

Kar (2013) measured a study of competition level anxiety of college level athletes by using SCAT. 55 male and female college going track and field athletes were selected from 120 population of Nadia & Murshidabad district of West Bengal of age group 22-25. The athletes had an average of 3 years participation experience in district, state or university level track & field competitions. Among the 55 athletes 20 were sprinters and jumpers or both
(SJG), which consisted with 12 male and 8 female athletes; 20 were long
distance runners (LDG), which consisted with 12 male and 8 female athletes and
15 were middle distance runners (MDG), which consisted with 10 male and five
female athletes. To measure competition related anxiety of the athletes Sport
Competition Anxiety Test (SCAT, developed by Rainer Martens in 1977) was
introduced. Then each athlete’s composite score (CS) was found. Then that score
was analysed according to SCAT score analysis norms. The results were
prepared mainly according to Mean Composite Score (MCS) of three groups and
ANOVA. While considering MCS, SJG showed average level of competition
anxiety (CA) with mean & SD as 21.748±2.643 where female sprinters showed
on average high CA in comparison to boys. In case of MDG, the overall mean
CA level was found average (23±2.221), but girls showed high level of CA
(25±0.632) in comparison to all groups. On other hand, LDG showed, on
average, low level of CA, i.e. overall mean and SD as 16.95±1.564. One way
ANOVA showed significant difference between three groups in respect of SCAT
composite score of the subjects of three groups. Post hoc test showed no
significant difference between SJG and MDG. It was also found that, the CA of
athletes was influenced by the increase of number of participation years and the
level of participation. In the present study SCAT was used to find out the anxiety
level of college athletes in intercollegiate and university level track and field
competitions. The long distance runners showed low level of CA in comparison
to sprint-jumping and middle-distance athletes. It was concluded that the anxiety
level of athletes was increased with level of participation as well as decreased
with increment of participation year in sports.
**Yadav (2011)** investigated pre-competitive state anxiety of university badminton players. Ninety one (91) badminton players (54 men and 37 women) who participated in the West Zone University Badminton Tournament held at Jabalpur University were randomly selected as subjects for this study. The men and women badminton players who participated in any of their matches from their teams from I round to quarter finals, were randomly selected for the study. The criterion measure for testing the hypothesis was the scores obtained in the Sports Competition Anxiety Test (SCAT) by Rainer Martens. Pre-competitive state anxiety had significant difference between winners and losers of West Zone University women badminton players in semi-final league matches and had no significant difference between winners and losers of West Zone University men and women badminton players in semi-final league and I round to quarter final matches.

**Ujwala and Jigmat (2011)** compared a study on sports competitive anxiety among state level baseball players. The purpose of this study was to compare sports competitive anxiety among male and female state level baseball players, who participated in 3rd senior state level Maharashtra baseball champion. In this study Sports Competitive Anxiety Test (SCAT Martin et al., 1990) was used to measure sports competitive anxiety. Questionnaire was distributed among 40 (20 each) male and female players 30 minutes before the warm-up session. Descriptive statistics (mean and standard deviation) and t- test were used to analysis the data. The results showed significant difference (p<0.05) in sports competitive anxiety between male and female state level baseball players.
Tsopani, Dallas and Skordilis (2011) conducted a study on competitive state anxiety and performance in young female rhythmic gymnasts and examine the competitive state anxiety and self-confidence of rhythmic gymnasts participating in the Greek national competition. Only eighty six (N=86) participants selected, ages 11 and 12 years, completed the Competitive State Anxiety Inventory-2, 1 hr. before competition. Subject were categorized by performance (high and low performance) and participation in the finals (finalists and no finalists), responded to the 3 subscales i.e. Cognitive Anxiety, Somatic Anxiety, and Self-confidence. Statistical analyses indicated differences in Self-confidence between high versus low performance groups and finalists versus no finalists, and no significant differences were found on Cognitive and Somatic Anxiety. In a regression analysis, Self-confidence was the only significant predictor of performance for this sample.

Singh and Gaurav (2011) presented a study of pre-competitive and post-competitive anxiety level of inter-collegiate volleyball players. The main purpose of this study was to compare pre-competitive anxiety and post-competitive anxiety in inter-collegiate volleyball players. A group of 170 volleyball players (boys=85 and girls=85) were selected from different colleges affiliated to Guru Nanak Dev University, Amritsar, Punjab, India through purposive sampling technique. Their age was ranged from 18 to 25 years. Data were collected from athletes using a Sports Competitive Anxiety Test - (SCAT) consists of fifteen items which include 5 spurious items, 8 positive items and 2 negative items. The t-test was used to test the effect of anxiety level between pre and post completion. The significance level was determined as p<0.01. The result of the study reveals that there was significant difference in 0.01 levels of
pre-competitive anxiety and post-competitive anxiety among the male and female inter-collegiate volleyball players.

Sharma (2011) had studied on multidimensional pre-competitive state anxiety of university badminton players. The sample consisted of 49 male players and 41 female players who had competed in the badminton competition organized by the Manipur University, Imphal. The revised Competitive State Anxiety Inventory-2 (CSAI-2) was used to examine their multidimensional pre-competitive state anxiety and they found that there was no gender difference in pre-competitive somatic anxiety, however, gender difference was found with male players experienced higher than female players in pre-competitive cognitive anxiety. Khan and Ali (2010) examined the competitive state anxiety (cognitive anxiety, somatic anxiety and self confidence) in elite and non elite Indian university high jump athletes prior to competition and to investigate any possible differences between elite and non elite high jump athletes, as well as in relation to their athletic experience, among 30 elite and non elite high jumpers. Measuring instruments was used for this investigation Competitive State Anxiety Inventory-2 (CSAI-2).

Patel (2011) made a study and compared the competitive state anxiety levels of individual sports, dual sports and team game players. Sixty (60) male students of LNUPE, Gwalior were selected as the participants for the study. All subjects were divided into three main group’s individual sports, dual sports and team games depending on their activities. It was concluded that individual, dual and team games did not differ significantly in competitive state anxiety components from each other, no significant difference between individual sports,
dual sports, and team games and finally the interaction effect with regard to the individual, dual and team games indicates insignificant difference.

**Nigam (2011)** examined the effects of self-efficacy on sports competition anxiety. A total of Forty (40) students of psychology belong to D. P. Vipra College, Bilaspur (CG) affiliated to Guru Ghasidas University, Bilaspur were randomly selected for the purpose of study. Sports Competition Anxiety and the Physical Self-Efficacy Scale were administered upon all subjects who volunteers to participate in the experiment. The results of their study revealed that females who are high in self-confidence were low levels of competitive trait anxiety. The findings of their study also indicated that private and public self-consciousness and social anxiety are all contributing factors in predicting competitive trait anxiety.

**Murtaza, Imran, Bari and Najeeb (2011)** made a study and compare the anxiety state on different levels of weight lifters. Total hundred (50 State level and 50 All- India intervarsity level) male weight lifters were selected for this study. The age of the subjects were ranged between 18 to 25 years. The data on anxiety state of the subjects were obtained by using a questionnaire developed by Neary and Zuckerman (1976). They found that there was a significant difference between different levels of weight lifters at 0.05 level of significant with 98 degree of freedom. Study showed that All- India intervarsity level weight lifters have higher level of anxiety state as compared to State level weight lifters.

**Khan and Ali (2011)** conducted a study on twenty five (25) male and female elite wrestlers, carried out and examine possible significant differences in cognitive state anxiety, somatic state anxiety, and self confidence among elite
male and female wrestlers. Twenty five (N=25) medalist (12 male and 13 female) randomly selected in different weight categories from All India interuniversity wrestling competition. Competitive State Anxiety Inventory - 2 (CSAI-2) was used for data collection, after collected data was analyzed by using t- test to find out the significance differences between male and female elite wrestlers on above mentioned sub-psychological variable. The obtain result advocated that each sub-variable (cognitive state anxiety, somatic state anxiety, and self confidence) findings in contrast and that found insignificance difference among elite male and female elite wrestlers.

Vincent and Mahamood (2010) examined competitive anxiety level as influenced by gender, levels of skills, and performance. The main aim of the study was to describe and compare the anxiety differences before and during competition among different categories of skills of athletes and genders. All data were collected from nine hundred two (902) athletes using a 27 item Competitive State Anxiety Inventory-2. After analysis of collected data, their results showed that national level and male athletes obtained the lowest score on competitive state anxiety variable.

Esfahani and Soflu (2010) conducted a study on the Comparison of Pre-Competition Anxiety and State Anger between Female and Male Volleyball Players. The statistical population consisted of all male and female volleyball players (N=214) who participated in Iran volleyball university matches. It must be noted that the questionnaires were distributed among whole population either 30 minutes before competition started in the hall where competition was supposed to be held or at the time the athletes went to the hall to start the competition and finally 88 questionnaires were collected from male volleyball
players and 82 questionnaires were collected from female ones. In this research, the CSAI-2 questionnaire was used to measure cognitive state anxiety, somatic state anxiety and self-confidence. The State-Trait Anger Expression Inventory (Spielberger, 1991) was also used to provide a measure of the anger experience as an emotional state (state anger), the disposition towards anger as a personality trait (trait anger) and the expression of anger. K-S (p=0.05) was used to ascertain data normality. Descriptive statistics (mean, standard error), t test and Pearson coefficient were used to analyze the data (p=0.05). The results showed a significant difference in all pre-competition anxiety subscales: cognitive state anxiety (t=3.62), somatic state anxiety (t=4.76) and self-confidence (t=3.06) (p=0.05).

Powell (2009) investigated the impact of pre-competition anxiety on athlete's performance in track runners and found that the nature of the event (sprint, mid-distance, long distance) differentially predicted the relationship between precompetitive anxiety and performance. Results showed that the interpretation of anxiety intensity as either facilitative or debilitative, the directional component of anxiety, was a more sensitive predictor of performance than anxiety intensity alone. Findings indicated that best predictor of performance for sprinters and distance runners were their somatic anxiety direction. The performance of the mid-distance runners was best predicted by self-confidence direction. The results are interpreted as lending support to the multidimensional model of anxiety. Mullen, Lane and Hanton (2009) examined the intensity and direction of the competitive state anxiety response in collegiate athletes as a function of four different coping styles: such as high-anxious, defensive highanxious, low-anxious and repressors. Specifically, this study
predicted that repressors would interpret competitive state anxiety symptoms as more facilitative compared to high anxious, defensive high-anxious and low-anxious performers. Separate Multivariate Analyses of Variance (MANOVA) was performed on the intensity and direction subscales of the modified Competitive State Anxiety Inventory-2 (CSAI-2). A significant main effect was identified for trait worry revealing that low trait anxious athletes reported lower intensities of cognitive and somatic anxiety and higher self-confidence and interpreted these as more facilitative than high trait anxious athletes. The prediction that performers with a repressive coping style would interpret state anxiety symptoms as more facilitative than performers with non-repressive coping styles was not supported.

**Awolframm and Micklewright (2008)** examined the effects of anxiety and self-confidence on equestrian performance. Forty riders (12 male, 28 female; 15 elite, 25 non-elite; 12 dressage, 17 show jumping and 11 eventing) completed the Revised Competitive Sport Anxiety Inventory-2 (CSAI-2), which measures the levels of somatic and cognitive anxiety as well as levels of self-confidence. Two-way between-subjects MANOVA tests were used to examine competence-by-discipline interactions and gender-by-discipline interactions in CSAI-2 scores. Post hoc analysis was conducted using one-way univariate ANOVA tests. Spearman’s rank correlation tests were conducted between each of the CSAI-2 subscales according to competence, discipline and gender. Most important findings include lower somatic arousal and higher self-confidence in elite compared with non-elite riders. Negative correlations between cognitive arousal and self-confidence were found among elite riders, non-elite riders, show jumpers and female riders. Greater riding-specific skills in the elite rider may
result in increased self-confidence. Lower levels of somatic anxiety may further increase fine motor skills in elite riders. Practical implications are that non-elite riders would benefit from sport psychological interventions increasing levels of self-confidence and reducing symptoms of somatic arousal to improve performance.

**Neil, Mellalieu and Hanton (2006)** examined the intensity and direction of competitive anxiety symptoms and psychological skill usage in rugby union players of different skill levels. Total 115 (Elite and non elite) elite \((N=65)\) and non elite \((N=50)\) participants selected and completed measures of competitive anxiety, self-confidence, and psychological skills. The elite group reported more facilitative interpretations of competitive anxiety symptoms, higher levels of self-confidence, lower relaxation usage, and greater imagery and self-talk use than their no elite counterparts. The findings suggest that no elite performers primarily use relaxation strategies to reduce anxiety intensity. In contrast, elite athletes appear to maintain intensity levels and adopt a combination of skills to interpret symptoms as facilitative to performance. Potential mechanisms for this process include the use of imagery and verbal persuasion efficacy-enhancement techniques to protect against debilitating symptom interpretations.

**Mellalieu, Neil and Hanton (2006)** examine whether self-confidence mediated the relationship between competitive anxiety intensity and direction. Elite \((N=102)\) and no elite \((N=144)\) participants completed the self-confidence subscale of the Competitive Trait Anxiety Inventory-2 and the worry and somatic subscales from the Sport Anxiety Scale. The findings for elite athletes revealed worry intensity to significantly predict self-confidence and worry direction. However, when self-confidence was controlled, worry intensity did
not predict worry direction over that which was significantly predicted by self-confidence. Within the analysis for somatic symptoms, only self-confidence was found to predict somatic symptom direction. For the no elite athletes, worry and somatic symptom intensity predicted both self-confidence and direction, and direction when self-confidence was controlled. The findings for the elite athletes suggest self-confidence mediates the relationship between performers' worry symptoms and subsequent directional interpretations. However, the findings suggest that high levels of self-confidence and low symptom intensity are needed for no elite athletes to demonstrate a less debilitative interpretation.

**Bekiari, Patsiaouras, Kokaridas and Sakellariou (2006)** examine the relation of verbal aggressiveness and state anxiety (somatic, cognitive, and self-confidence) in sports settings based on the ratings by volleyball coaches and their athletes. The sample consisted of volleyball athletes (N=208; 98 men and 110 women) and their coaches (N=20; 16 men and 4 women). Analysis showed that male volleyball players rated somatic anxiety higher and were more affected by the verbal aggressiveness of their coaches than female volleyball players. No mean differences were significant for male and female coaches on somatic or cognitive anxiety, self-confidence, or verbal aggressiveness. Also, correlation between subscale scores for male and female volleyball players and coaches was found. The correlations of verbal aggressiveness with self-confidence and anxiety were positive for these athletes, leading them to better behavior. This relationship needs further examination in sport settings.

**Kais and Raudsepp (2005)** examined the relationship between the intensity and direction of competitive state anxiety, self-confidence, and performance in basketball and volleyball players prior to different matches. Male
basketball (N=12) and volleyball players (N=12) completed a modified version of the Competitive State Anxiety Inventory-2 (CSAI-2) prior to 11 different matches, and 132 questionnaires overall. The inventory included an intensity subscale as well as direction sub-scale for somatic and cognitive anxiety. The findings revealed a moderate level of state anxiety and very high self-confidence of the players before the matches. The cognitive and somatic anxiety and self-confidence were stable prior to the different matches. Correlation analysis showed that the intensity and direction of somatic and cognitive anxiety and self-confidence of the players were not related to their athletic performance. However, the intensity of cognitive anxiety was positively.

Thatcher, Thatcher and Doring (2004) conducted a study on gender differences in the pre-competition temporal patterning of anxiety and hormonal responses. Six (male) and six (female) field hockey players completed the modified Competitive State Anxiety Inventory-2, including both intensity and direction subscales, and provided saliva and urine samples 24, 2, and 1 hour before the competition. These samples were analyzed for cortisol, and nor adrenaline and adrenaline, respectively. Two x 3 repeated measures ANOVA revealed significant gender x time interactions for cognitive and somatic anxiety intensity and adrenaline and nor adrenaline, but not cortisol. While males' anxiety and hormonal responses demonstrated no significant changes, significant increases in females' anxiety, and significant decreases in their adrenaline and nor adrenaline were observed over time. Moreover, while males' anxiety and hormonal responses mirrored each other, this was not the case for the females with increases in females' cognitive and somatic anxiety intensity levels accompanied by decreases in adrenaline and nor adrenaline. Although this study
has extended this line of research by adopting a psycho-physiological approach and measuring anxiety intensity and direction in male and female athletes, replication is required with larger samples from a greater diversity of sports.

Jones and Uphill (2004) conduct a study and examine the capability of the Competitive State Anxiety Inventory-2 in distinguishing between anxious and excited states. Total athletes (N=188) were randomly assigned to one of two groups and asked to complete the CSAI-2 as if they were either excited (excited group) or anxious (anxious group) prior to the most important competition of the season. Data were initially analyzed using Multivariate Analyses of Covariance, with gender as the covariate. Participants in the anxious group reported higher scores on the cognitive and somatic anxiety intensity subscales, while the participants in the excited group reported a more facilitative perception of their symptoms on the somatic anxiety subscale. A logistic regression correctly classified 62.9% of the participants as belonging to either the anxious or excited group on the basis of the scores from the CSAI-2. It is possible to observe differences in scores on the CSAI-2 from participants asked to complete the inventory as if they were either excited or anxious. However, differences in scores were typically small with 37.1% of participants incorrectly classified on the basis of these scores. Accordingly, caution is advised in interpreting the results of the CSAI-2 in research and applied settings.

Zeng (2003) conducted a study with four intercollegiate athletes' teams from a Division III college. Sixty-nine (69) varsity athletes from team and individual sports participated in this study. It targeted the constructs of three self-confidence variables State Self-Confidence, State Sport- Confidence, and Trait Anxiety as well as levels of Cognitive State Anxiety, Somatic State
Anxiety, and Competitive Trait Anxiety variables. The results demonstrated for college varsity athletes, team sport athletes had lower levels of cognitive state anxiety and somatic state anxiety compared to individual sports in a competition. On the other hand, the level of competitive anxiety demonstrated similar results. The increased levels of state self-confidence, state sport-confidence, and trait sport confidence were found in the team sports during competition.

Jones and Hanton (2001) examined differences in feeling states indicated by performers who reported being facilitated or debilitated by symptoms associated with competitive anxiety before completion. A sample of high standard swimmers (N=190) competed a modified version of competitive state anxiety inventory 2, including both intensity and direction subscales, and an exploratory checklist of feeling state levels, which compare positive and negative feeling state labels these finding supported the general hypothesis that facilitator’s report significantly more positive feeling than debilitator’s, who report significantly more negative feelings. Descriptive frequency counts of the largest percentage differences between facilitator’s and debilitator’s resulted in the in the selection of the confident feeling state level of the positive sub scales with it being, identified most frequently by the facilitators. Furthermore, of the negative feeling, the groups indicated the label MGS most frequently this study has extended previous research into the nation of positive and negative anxiety and has revealed individual differences in the combination of feeling states experienced by performers during competition.

Parfitt and Pates (1999) conducted a study to consider the influence of competitive anxiety and self-confidence state responses upon components of performance. Basketball players (n = 12) were trained to self-report their
cognitive anxiety, somatic anxiety and self-confidence as a single response on several occasions immediately before going on court to play. Performance was video-recorded and aspects of performance that could be characterized as requiring either largely anaerobic power (height jumped) or working memory (successful passes and assists) were measured. Intra-individual performance scores were computed from these measures and the data from seven matches were subjected to regression analyses and then hierarchical regression analyses. The results indicated that, as anticipated, somatic anxiety positively predicted performance that involved anaerobic demands. Self-confidence, and not cognitive anxiety, was the main predictor of performance scores with working memory demands. It would appear that different competitive state responses exert differential exerts upon aspects of actual performance. Identifying these differences will be valuable in recommending intervention strategies designed to facilitate performance.

Kirkby and Liu (1999) had studied on pre-competition anxiety and self confidence in a sample of 132 male and 103 female Shanghai college athletes. The participants were administrated the competitive state anxiety inventory-2 of marten, at al. 30 to 40 minute before the competing important track and field events and basketball games. Analysis by independent t- test shows that there were no sex differences in scores on the cognitive anxiety, somatic anxiety, or self confidence sub scales; however, compared to those in team sports (Basketball), athletes competing individually (track and field) scored significantly higher on the somatic anxiety scale and significantly lower on the self confidence sub scale. Comparisons with data form comparable North
American samples indicated that Chinese athletes reported lower score on cognitive anxiety and somatic anxiety but similar score on self confidence.

**Barr (1997)** examined in twofold: first to examine the effects of a nontraditional sport course on the general physical self-efficacy and components of competitive state anxiety of participants and second to examine the association between nontraditional sport performance, general physical self-efficacy and components of competitive state anxiety. Eighteen males (18) (54.5%) and 15 females (45.5%) enrolled in noncredit whitewater kayaking courses constituted the subjects in this study. Each participant completed a short questionnaire along with the Physical Self-Efficacy and Competitive State Anxiety Inventory-2 as pretest measures. Next, participants received 17 hours of whitewater kayaking instruction as the treatment. During a river experience, participants' whitewater kayaking performance was measured using the Kayaking Performance Checklist (KPC). Following the treatment, participants completed the pretest inventories, excluding the questionnaire, as posttest measures. Paired samples t tests and Pearson product correlations were performed to test twelve null hypotheses. Two of the twelve null hypotheses tested for significance were rejected. Findings suggest a significant increase in cognitive state anxiety for participants after receiving the treatment. In addition, findings suggest a significant association between physical self-efficacy and whitewater kayaking performance.

**Wiggins and Brustad (1996)** conducted a study to examine accetpation of performance and the directionality of anxiety. Directionality refers to the facilitative or debilitative aspect of anxiety. Subjects were 91 athletes competing in soccer, swimming and track and field. Competitive State Anxiety Inventory-2
with an added facilitative and debilitative scale and expectation of performance scale was employed. Analysis shows that athletes with lower scores on cognitive and somatic anxiety and higher score on self confidence perceived their anxiety as more facilitative of performance these athletes also had significantly higher scores on the expectation of performance scale.

**Bejek and Hagtvet (1996)** examined between two existing groups of females gymnasts, Top level (N=20) and lower level (N=50), were administered the Martens Competitive State Anxiety Inventory-2 and a reduced version of the Spielberger State-anxiety scale prior to a national competition. The study was carried out to examine in what respect pre-competitive state anxiety was different in top level and lower level gymnasts. The results displayed no differences in mean values of the included anxiety-oriented state measures. However, the top level group reported higher mean value of self-confidence. A most salient finding indicated a positive relationship between pre-competitive state anxiety and gymnastic performance in the top level group, while no relation could be detected in the lower level group. A path analysis within each group of gymnasts suggested that their pre-competitive state anxiety was differently composed in terms of the state parameters cognitive anxiety and self-confidence.

**Swain and Jones (1993)** investigated the intensity and frequency of symptoms of competitive state anxiety. Total, Forty-nine track and field athletes (27 males, 22 females) responded to a modified version of the Competitive State Anxiety Inventory-2 (CSAI-2) on four occasions during the period leading up to an important competition: 2 days, 1 day, 2 h and within 30 min of competing. The questionnaire included the existing CSAI-2 (intensity) scale as well as a frequency scale for each of the 27 items of the CSAI-2. The intensity and
frequency dimensions of each of the CSAI-2 sub-scales were then compared between the four conditions by means of two-way analyses of variance (gender x time-to competition). In the case of cognitive anxiety, time-to-event effects were observed for intensity and frequency for both males and females. The intensity of the response was significantly greater at the final stage of testing than it was 2 days before competition, while the frequency of the response increased progressively throughout the experimental period. This dissociative patterning for the cognitive anxiety dimensions is discussed in the light of multidimensional anxiety theory predictions. For somatic anxiety, the time-to-event effects that emerged for intensity and frequency revealed that both values increased progressively as the time to compete neared, for both male and females. The results for self-confidence revealed no effects for intensity or frequency for either gender. The findings from structured follow-up interviews served to corroborate these quantitative findings by providing information that supported the conclusions drawn from the questionnaire data. In particular, the athletes reported that they experienced considerable increases in the frequency of intrusive anxiety cognitions. While these findings clearly need to be substantiated, they do provide evidence of the existence of an additional dimension of anxiety that may assist our understanding of this complex concept.

Finkenberg, Dinucci, McCune and McCune (1992) conduct a study on 77 cheerleader participating in a national collegiate championship competition were administered the competitive state anxiety inventory 2 immediately prior to the performance significant correlation were found between cognitive and somatic state anxiety, a finding consistent with previous research. Negative correlation was found between both cognitive and somatic anxiety and self
confidence, also as previously reported. Canonical discriminate analysis indicated that significant discrimination between the teams could be accomplished by a combination of the state anxiety variables. Groups, 36 men and 41 women, differed significantly from normative scores on the somatic subscale.

Matheson and Mathews (1991) examined the study on changes in cognitive anxiety, somatic anxiety and self confidence as measured by the competitive state anxiety inventory 2 in a sample of fifty (50) female high school gymnasts prior to their performances at a practice session, dual meet, and district championship meet. Analysis shows that the dual meet athletes experienced significantly greater cognitive and somatic anxiety and lower self confidence than at the practice or district championship. State anxiety did not vary significantly with the athletes over all experience or the difficulty of the routines which they performed. The unexpected finding that the dual meet was most anxiety-provoking was attributed to the greater uncertainty of outcome in a competition and that fact that the dual meet occurred yearly in the session.

Rodrigo, Lusiarod and Pereira (1990) examined how the component of the Spanish version of the Competitive State Anxiety Inventory (CSAI-2) are related to each other and their relationship with performance in 51 male soccer players from our professional team. The results indicate a moderate relationship between cognitive worry and somatic anxiety, confirming that these are separate, but related components of state anxiety. Also, cognitive worry was the more consistently and inversely related to performance. Finally, alpha coefficients of this Spanish version indicate that it was an internal reliable measure.
Caruso, Dzewaltowski, Gill and McElroy (1990) confirmed that state anxiety was multidimensional and revealed that its psychological and physiological components change over time. Somatic anxiety tends to increase rapidly as the start of an event approach, while cognitive anxiety increases more gradually. Self-confidence tends to decrease in females on the day a competitive event was to occur (Jones & Cale, 1989 as cited in Swain & Jones, 1992). As an event approaches, negative thoughts and feelings associated with competition increase (Swain and Jones, 1992). This accounts for the increase in cognitive anxiety.

Bowger (1989) conducted a study and compares the state anxiety levels, age, gender and skill at practice and pre-competition. The study included 137 athletes. Each subject completed the Spielberger State Anxiety Inventory, A-State twice, one just prior to a practice session and again just prior to the state age group swimming meets. Mean comparisons were made using the Newman Keuls Multiple Range Test which indicated that 15-18 age groups. Females had significantly higher state anxiety than males and significantly higher state anxiety was found at the pre-competition situation than at the practice situation.

2.5 OVERVIEW OF STUDIES

The review of the literature helped the researcher to spot out relevant topics and variables. Further the literature helped the investigator to frame the suitable hypothesis leading to the problems. The latest literature also helped the investigator to support his findings with regard to the problem. Further the literature collected in the study will also help the research scholar understanding in the similar areas.
The reviews were presented under the two sections such as comparative study on physiological variables (n=31), biochemical (n=8), Anthropometrical (n=16) and psychological variables (n=37) among different game players with chronological order. All the research studies were presented in the section proves that physiological, biochemical, anthropometrical and psychological variables varies among different game players among different level players.

The research studies reviewed are from many journals available in the websites. It is also observed from the review of the literature that only few research studies are related normative studies and few studies related among Athletic performance. The studies conducted in many countries and few studies conducted in India. This inference has motivated the research scholar to compare the physiological, biochemical, anthropometrical and psychological variables among different categories of athletes.