Chapter - II

REVIEW OF RELATED LITERATURE

A review of literature that the research scholar could gather in the library of the Lakshmibai National Institute of Physical Education, Gwalior is given in this chapter.

S. Grant, G. Armstrong, R. Sutherland, J. Wilson, T. Aitchison, E. Paul, and S. Henderson\(^1\) examined the physiological and psychological responses to a university fitness session entitled ‘pop-mobility’. A pop-mobility session consists of 20 minute of aerobic activities, 5 minute of local muscular endurance exercise and 5 minute of flexibility exercises. Ten regular participant of these sessions, women of mean (s.d.) age 21.2 (1.5) years, took part in the study. A maximal oxygen uptake (Vo\(_2\)max) treadmill test was performed by each subject to obtain Vo\(_2\) max and maximum heart rate values. In a laboratory, heart rate and Vo\(_2\) were measured throughout a popmobility session for each subject. Rate of perceived exertion (RPE) was measured every 5 min throughout the session. The mean intensity of the aerobic part of the session ranged from 67.7-82. 6% of the subject’s Vo2max (mean of 76.4% Vo2 max).

The mean heart rate reserve for the aerobic section was 75.6%. While the relative oxygen consumption remained fairly static during the aerobic section, the RPE score rose. The mean (s.d.) total energy expenditure was 236.6 (28.4) kcal (range 203-208). The pop-mobility session is of adequate intensity to improve the aerobic fitness of its participant. Heart rate, as used as a measure of intensity during a pop-mobility session, would appear to be a fairly accurate indicator of intensity. However, the use of RPE for exercise prescription in pop-mobility sessions is inappropriate. Pop-mobility could also be useful in a weight reduction programme.

Len Kravitz and et.al\(^2\), Step training is a relatively new type of exercise modality. Minimal research is available demonstrating the physiological benefits of this activity. The purpose of this investigation was to determine the physiological characteristics of female step aerobics instructors who had been continuously teaching step aerobics for over one year, a minimum of two or more times per week. Analysis of the physiological profiles of the step instructors (N=24; average age=31 years) indicated good Cardio respiratory fitness (VO\(_2\) max = 43.75 ml O\(_2\)/kg/min), excellent body fat levels (%BF= 19.0%), above average

strength for six different muscle groups, excellent low/back/ hamstring flexibility (90th percentile), good flexibility of the ankle Doris flexors but poor flexibility for the ankle plantar flexors. The VO₂ max, % BF and teaching experiences for step aerobics instructors compared favorably to data previously reported for aerobic dance instructors. The average VO₂ step aerobic instructors was 5.4 ml O₂/kg/min less than that of aerobic dance instructors. Possible explanations for this difference include test specificity and the intermittent nature of step aerobics instruction. Instructors reported that they move around the room as they teach, providing individual attention and encouragement to the participants. The step aerobics instructors VE (95.17 L/min) was significantly greater than that reported for the aerobic dance instructors (76.22 L/min). A possible explanation for this finding is the effect of high altitude on ventilation due to decreased atmospheric pressure. This study was conducted at an altitude of 1,524 meters; whereas the aerobic dance instructors were tested at an altitude of 100 meters. The physiological profile of step aerobic trainers suggests that step aerobics is an excellent mode of exercise for maintaining low body fat levels, good Cardio respiratory endurance, above average levels of muscular strength, and excellent low back/hamstring flexibility.
Randall L. Wilber and et.al\textsuperscript{3}, There are minimal scientific data describing international caliber off-road cyclists (mountain bikers), particularly as they compare physiologically with international caliber road cyclists. Elite female (N=10) and male (N=10) athletes representing the United States National Off-Road Bicycle Association (NORBA) Cross Country Team were compared with elite female (N=10) and male (N=10) athletes representing the United States Cycling Federation (USCF). National Road Team. Sub maximal and maximal exercise responses were evaluated during the “championship” phase of the training year when athletes were in peak condition. All physiological test were conducted at 1860 m. Among the female athletes, physiological responses at lactate threshold (LT) and during maximal exercise (MAX) were similar between NORBA and USCF cyclists with two exceptions: 1. USCF cyclists demonstrated a significantly greater (p<0.05) absolute (16\%) and relative (10\%) maximal aerobic power, and 2) MAX heart rate was significantly higher (P< 0.05) for the USCF athletes (6\%). Among the male athletes, physiological responses at LT and MAX were similar between NORBA and USCF cyclists with two exception: 1) USCF cyclists produced significantly greater (P<0.05) absolute (18\%) and

relative (16%) power LT, and 2) USCF cyclists produced significantly greater (P<0.05) absolute (12%) and relative (10%) power at MAX. These data suggest that, in general, elite off-road cyclists possess physiological profiles that are similar to elite road cyclist.

Hinton and Rarick⁴ studied the correlation of Roger’s that of physical capacity to the Cubberley Cozens Test of Basketball. Achievement subjects for the study were school girls. The Cubberley Cozens Basketball Achievement Tests consisted of throw for goal, jump and reach, push pass for accuracy. Pivot and pass, throw for distance, pivot and dribble. The Roger’s physical fitness test consisted of a battery of strength test from which the strength index is obtained. The nine parts of the test were weight, height lungs capacity, right grip, left grip, leg lift, back lift, pull ups and push ups.

The multiple correlation of variables of lung capacity, back lift and arm strength with the criterion (Basketball Achievement test) indicated a positive relationship and also that these variables may be used to achieve basketball achievement scores.

Harrison\textsuperscript{5} studied the relationship of strength and anthropometric measures to physical performance involving the trunk and legs.

The purpose of this research was to investigate further the relationship of strength and anthropometric measures to physical performance primarily involving the trunk and legs. In this study 16 strength and 10 anthropometric tests were related by correlation methods to trunk and leg measures involving dynamometric strength, muscular endurance, agility and power. The subjects were 53 unselected non-disabled male students at the university of Oregon.

The inter-correlation among some of the anthropometric variables were especially high, 0.91 standing height with leg length, 0.88 foot length with leg length and 0.87 body weight with both thigh width and thigh girth.

The highest strength inter-correlation was 0.65 between trunk flexion and trunk extension significant of multiple correlations obtained were: 0.74 for leg strength and trunk flexion strength, 0.71 for back lift knee extension strength, high width trunk flexion strength, and knee flexion strength and 0.66 for standing broad jump with adipose tissue over the abdomen (negative) and hip extension strength (positive).

\textsuperscript{5} H. Harrison Clarke, Relationship of Strength and Anthropometric Measures Physical Performance Involving the Trunk and Legs\textsuperscript{a} The Research Quarterly, 28:1 (October 1957) p. 223.
Hooks\(^6\) conducted a study to determine the relation of 19 selected structural and strength measures to success in the baseball skills of hitting, running, throwing and fielding and to ascertain if there are patterns of combinations of these measures which can be used to predict success in each skill in addition to overall baseball ability. The subjects used for this study were 56 men participating in the freshmen physical education classes at Wale Forest College. The structural measures tested have consistently low correlation with the criteria. The measures of strength tested have consistently high correlation with the Criteria 79-left shoulder flexion with hitting, 72- right shoulder flexion with throwing and 67- left shoulder flexion with total ability. Left shoulder is the best single measure found to predict Baseball ability. Right shoulder flexion ranked second.

Jack\(^7\) studied the relation of physiological factors to football performance, minutes (amount of time) played during the 1958 football season was used as criterion. Players were measured in 50-yard dash; right grip, left grip and arm push and pull strength. Speed correlated 60

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and total strength 40 with the criterion. Both correlations were significant but the predictive value for minutes played was less.

Nicholson\textsuperscript{8} carried out a relationship study to determine the relationship of selected anthropometric measurements to leg strength. A number of anthropometric measurements were correlated, highest (418) with leg strength, lateral thigh area, binomial diameter 2 (depth \times Width of ankle) depth \times width of knee), length of the upper leg for the glutial fold, bi-iliac diameter, knee width (lateral thigh area \times anterior thigh area) relationship of reach length to leg length is not an important factor in performance of the toe touch test. For persons with average body builds a longer trunk plus arm (reach) measurement in relation to shorter legs gives an advantage in the performance of this test.

Leedy\textsuperscript{9} and others studied the relationship between physical performance items and body composition. The purpose of the study was (a) to determine the relationship between body composition and physical performance and related items and (b) to determine whether or not certain physical performance and related items might be useful in estimating body composition in terms of total lean mass and percentage lean body

\textsuperscript{8} Carolyn Nicholson, "A study to Determine The Relationship of Selected Anthropometric Measurement to leg length", \textit{Completed Research in Health, Physical Education and Recreation}, 6 (1964) p. 94.

\textsuperscript{9} H.E. Leedy, A.H. Ismail, W. V.Kessler, "Relationship Between Physical Performance Items and Body Composition", \textit{The Research Quarterly} 36:2 (May 1965) p. 158.
mass as measured by potassium 40 determination in adult men. Data on

Physical performance items where obtained from 40 subjects between

21 and 57 years of age. The results are of value to researchers in physical

education in particular for estimating gross body composition using
certain physical performance items.

Selder\(^{10}\) conducted a study on anthropometric cardio vascular and

motor performances characteristic of university Ice Hockey players. Characteristic of physique, motor and cardio vascular fitness were

repeated for 14’ varsity hockey players, some of whom had represented

Canada in 1964 winter Olympics. Most of the players were dominant

mesomorph, with low adipose measurement. It was found that the

majority were above average in dips and in dynamometrical strength but

average or below in other tests of motor fitness.

Ellis\(^{11}\) used selected physiological and psychological variables for

prediction of performance in the 12 minute run. 19 measures were taken

on 39 male students and placed in multiple linear regression models.

AVOVA was used to determine which predictor or combination of

predictors would best determine the distance one would cover in the 12

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minute run. The measures used as predictors were maximal oxygen uptake, blood pressure, heart rate, percentage recovery from the astrand bicycle, ergo meter test, reciprocal of the ponderal in index, manifest anxiety test, anxiety index of social status neurotic anxiety and introversion – extroversion. The most criterion variance was accounted for by the measures of percentage recovery. The Two equations that represented the best predictors were maximum \( O_2 \) uptake (liter per minute) and percentage recovery and resting heart rate. No physiological variables used in the study accounted for the significant amount of criterion variance.

Mofatt Etall\(^\text{12}\) investigated body composition, physical dimension and maximum physiological responses of female high school gymnasts to non – athletic high school females.

Thirteen high school female gymnasts were compared with 13 randomly selected non - athlete females. Parameters chosen were body weight, height, total body volume, residual volume, body fat was calculated from body density using siri formula and lean body weight was determined by difference. Six fat fold sites-triceps, sub-scapular, supra iliace, abdomen, thigh and calf. Girth measurement includes neck,}

\(^{12}\) Robert, J. Mofatt, Blacke Sumina And Nola Ayres, “Body Composition and Physiological Characteristic of Female High School Gymnasts” Research Quarterly 42.3 (October 1971) p. 264.
shoulder, chest, waist, abdomen, hips biceps, fore-arm, wrist, thigh, knee, calf and ankle. A continuous treadmill test was administered. Open circuit spiro-meter methods were utilized for the collection of metabolic data. Respiratory gases were also selected. Anaerobic power out-puts and anaerobic capacity was determined by the bicycle ergo-meter test.

Statistical independent test was made to compare the groups. Multivariate, analysis of variance was employed to compare various fat folds, circumference and diameters.

The gymnasts had 10 percent less relative fat than controls of the same age.

The lower body fat of the female gymnasts was also evident from fat folds. Female high school gymnasts had similar skeletal structure when compared to non-athletic controls. Non-athlete high school females had less lean tissue and more fat as indicated by densitometry and anthropometry. The percentage body fat of these gymnasts was 14.22 percent less than that reported for more mature female gymnasts. The female gymnasts also exhibited higher VO2max and performed better on test to estimate anaerobic capacity and anaerobic power out – put than control.
Ali\textsuperscript{13} conducted an investigation to determine the physiological difference between runners and throwers. Their resting pulse rate, blood pressure, respiration rate, maximum breath capacity were reduced. Maximum breath capacity was reduced by an improved method on basal metabolic apparatus for 15 seconds and multiplied by 4 to determine the maximum volume of air inhaled (or exhaled) in one minute voluntary effort. Vital Capacity was also determined that throwers have higher resting pulse rate and maximum breathing Capacity and Vital Capacity. Runners were more efficient because the average amount of all was less in them.

Bakker\textsuperscript{14} used college women volleyball players in a study to determine the relationship between degree of success in volleyball and certain physical motor and anthropometric factors. Twenty-eight players were rated on playing ability and variables were correlated with this criterion score. Significant correlation was obtained between reaction time and between jumping ability and the criterion. Reaction time and jumping ability together correlated. 53 with playing ability. All variables combined including height, weight, jumping ability, reaction time,

movement time, grip strength, strength of the extensor of both legs and skin fold measurement correlated, 73 with the criterion.

Slaughter\textsuperscript{15} studied relationship somatotype and body composition to physical performance in 7 to 12 years old boys.

The objective methods of measuring somatotypes, Sheldon's Trunk Index method and Health Carter's anthropometric methods were used. Body composition was estimated as fat and lean mass from the measurement, using a whole body contour and from two-skin fold thickness measure. Physical performance measures consisted of three tests of running (mile run, 600 yard run and 50 yard dash) and two tests of jumping (standing broad jump and vertical jump). In general somatotype components had lower correlations with running and jumping variables than did body composition.

Michale\textsuperscript{16} explored the possibility of developing regression equation where by football ability could be predicted from an analysis of selected anthropometer measures, strength test, power measures, balance, standing height and body weight. Subjects were 56 scholarship football players at university of Arkansas. Six assistant football coaches (three

\textsuperscript{15} M.H. Slaughter, T.G. Lohman and J.E. Mishes, "Relationship of Somatotype and Body Composition to Physical Performance in 7 to 12 Years Old Boys". \textit{The Research Quarterly} 48:1 (March 1977), P. 159.

offensive and three defensive) rated to each offensive and defensive player, respectively. This rating on football ability was used as the criterion measure. Step-wise multiple regression and polynomial regression were utilized to form predictive equation.

The equation by polynomial regression was football playing ability \(-787.65 + 7.33\) (bow legs), 143.22 (standing height), 2.60 (tibial torsion), 33.40 (horse power), 0.468 (body weight). \(R^2 = .573\) and percentage of standard error of the estimate was 15.7 percent.

Burke and Brush\(^\text{17}\) conducted a study to assess physiological and anthropometric measures of teenage female distance runners who had been training regularly by running approximately 50 miles per week for two years. Their mean \(\text{VO}_2\) max of 63.24 ml/kg is among the highest ever recorded in a group of young women.

Anthropometric measures included selected segments: length, diameters, skin folds and circumference. These young women appeared to be of average height, low in body weight and subcutaneous body fat, have a high component of ectomorphy and smaller overall skeletal framework than non-athletes.

Cunning hum and Anderson\textsuperscript{18} studied a total of six high school cross country runners, who were members of the Meassacheutes State High School. Mean anthropometric values found this team to be shorter, lighter and with less fat when compared to age related norms. The mean somatotype was considered more ectomorphic and less mesomorphic than elite endurance athletes. It was concluded that members of a championship cross country team exhibit a physiological profile that is characteristic of endurance. All the team members showed little inter-individual variation. No adverse effects of season long training were noted. Several well-known cardio vascular risk factors were considered low normal on this group.

Conley\textsuperscript{19} conducted a study to determine the relationship between the female distance running performance on a token road race and body composition, VO\textsubscript{2} max, running economy and the utilization of VO\textsubscript{2} max at sub-maximal speed. The subjects were 14 trained and competition experienced female runners. No significant relationship was found between running performance and either running economy or relative body fat. A team with the male heterogeneous groups, trained female

\textsuperscript{18} L.N. Cunnigham and N. Enderson, "High School Cross Country Runners: A Physiological Profile of A Championship Team", Abstract of Research Papers (April 1981) p.120.
\textsuperscript{19} Doughlies L. Conley, "Physiological Correlates of Female Road Racing Performance", Research Quarterly for Exercise and Sports. 52.4 (December 1981), pp. 441-448.
road racing performance is significantly related to VO₂ max and % VO₂ but not related to body composition or running economy. It was further concluded that on a 10 Km road race trained females operated at % VO₂ max similar to that of trained male counter parts.

Power and Walker\textsuperscript{20} measured and described the cardio respiratory characteristics, body composition and grip strength of outstanding female junior tennis players. Subjects were 10 female junior tennis players.

Each Subject had been trained for tennis for 4 years. Mean and standard errors of physical and playing characteristics of subjects were taken out. Data was collected on age, height, weight, body fat, year of participation’s, hours of tennis practice per week of six weeks prior to testing were collected.

Testing parameters included blood pressure, underwater weighing, present body fat, skin fold at biceps, triceps, girth measurement of both arms, fore-arms and grip strength.

The next phase involved measurements of vital capacity, forced expiratory volume, p.f., maximum ventilatory volume, graded Tread Mill

test to determine aerobic power. Gas samples were analysed minute-by-minute starting at minute one of the test.

A paired t-test was used for significant differences between anthropometric measurements on the preferred and non-preferred sides of the body.

The paper determines the characteristics of the subjects and suggests that highly skilled junior female tennis players differ from young trained females in that they exhibit a higher VO$_2$ max relatively high grip strength in the preferred hand and a ventilatory capacity that exceeds those of untrained population of the same age group as mentioned.

Joseph$^{21}$ conducted a study to find out whether there is any relationship of selected anthropometric and strength variables to speed performance. Twenty four male sprinters of the Lakshmibai National Institute of Physical Education, Gwalior, who were under-going regular training at the college track and preparing for Inter-Collegiate and Intervarsity athletic meet were selected as the subjects for the study. The study reveals that there is significant relationship of leg power, abdominal strength, thigh girth and calf girth to speed performance. Height, leg length and crural index are not significantly related to speed performance.

Chakraborty\textsuperscript{22} studied the relationship of selected physique characteristics and motor components to the performance in soccer. Twenty male soccer players who represented in all India Intervarsity tournament were selected as subjects. Analysis of data revealed that revealed that there was a significant relationship between soccer performance and maximum leg strength and soccer performance and speed and also soccer performance and endurance, whereas incase of height, weight, fore leg length, thigh length, shoulder width, trunk width, ponderal index, crural index and soccer performance did not seem to have significant relationship.

Thomas\textsuperscript{23} studied the relationship of motor components and anthropometric variable to the velocity of basketball throw. Motor fitness components chosen were wrist strength, arm strength and back strength, wrist and shoulder flexibility, speed of movement of Arms and anthropometric variables were upper arm length, lower arm length and total arm length with height, sitting height, weight and leg length.

Twenty-five male basketball players in the profession of Physical Education were chosen as the subjects for the study. Analysis of data

\textsuperscript{22} Debananda Chokrobory, "Relationship Of Selected Motor Components And Physique Characteristics To Performance In Soccer", (Unpublished master's Thesis, Jiwaji University 1986).

\textsuperscript{23} Domic Thomas, "Relationship Of Selected Motor fitness components and Anthropometric; Variables To Valocty Of Basketball Throw Master's", (Unpublished Master Thesis. 1991).
showed that there is the significant correlation between the velocity of long and hook basketball players and anthropometric variables.

Dahi\textsuperscript{24} administered the AAHPER youth fitness test on 400 Negroes and white boys from the same Texas school district. All tests data was collected during spring semester of the 1969-70 school year. It was found that the Negro boys obtained a higher mean score than the white boys on good body co-ordination (softball throw) and muscular endurance.

Barrow\textsuperscript{25} conducted study to develop an easily administered test for motor ability for college men. Expert opinion was used in the validation process and eight factors of motor ability and 29 items measuring those factors were chosen. The selected tests were administered to 222 college men and statistical analysis covered items were used: zigzag running, Medicine Ball Put, standing Board Jump, 60 yards Dash, soft Ball Throw, wall pass. The standard motor ability rating was found.

\textsuperscript{24} Ealph Loyd Dahi, "A Comparison of Physical Fitness of Negros and White Boys of Some Texas School" \textit{Dissertation Abstracts International} 31 (April 1971): 517-A.
Box\textsuperscript{26} prepared percentile norms tables for selected measures of strength, power, agility, flexibility, and body composition. Cardiovascular and muscular endurance from data collected in five schools of the unity Christians school system of muscles on vile.

Richerson\textsuperscript{27} studied the relationship of several physical fitness variables in elementary school (100 fourth grade) boys and girls data on the following variables were collected, age, weight, height, leg strength, body movement, time 50 yards dash, shuttle run, and standing broad jump. The mean scores on AAHPER Test items were compared on National norms. Several significant correlation’s were found the light being weight with leg strength (46) leg strength with shuttle run (35) and leg strength with 50 yards dash (.86).

Pouluse\textsuperscript{28} compared the performance of elementary school children in selected fundamental skills and found that the level of every subsequent class was higher than the preceding class. All performances were found significant at .01 level of confidence. The ‘t’ ratio obtained in class I and II and class IV and V were higher than the rate of the other.

\textsuperscript{26} David L. Box, “Physical Ability Testing of Male Students in Grades Four Through Twelve,” \textit{Completed Research in Health, Physical Education and Recreation} 9 (1967), p. 77.
\textsuperscript{27} Harold V. Richerson, “The Relationship of Physical Fitness Variables in Selected Elementary School Children,” \textit{Completed Research in Health Physical Education and Recreation} 10 (1968), p. 76.
classes in 25 meters race and cricket ball throw for distance. In standing broad jump this difference was observed between class III and IV and V.

Glassow and Krause\textsuperscript{29} conducted a study on motor performance of girl's age 6 to 14 years. Here group's achievement scores for elementary school girls for the 30 yards dash. The standing broad jump and the over arm throw were presented to add to the limited information now available on children on the first three grades, I through viii and for ages vi through xiv years. Reliability of within day scores was reported. Correction of year to year scores and of first grade score with those of grades III through V showed that individuals tend to remain in the elementary school years. This paper is added to present knowledge of motor performance of elementary school children by retesting observations derived from achievement Scores of girls during a five-year period.

Robert\textsuperscript{30} conducted a study on eight old boys that boys of different physique type were significantly different in age, strength index (Rogers) and standing board jump, mature boys by skeletal age were longer in the body, weight, height long capacity upper arm girth and stronger in gross


\textsuperscript{30} Hindmarsh Robert, "Significance of Physique Motivational Body Size Strength, Motor Ability and Recreation Time Characteristics of 8 Year Old Boys", Completed Research in Health Physical Education Recreation 5 (1463), P. 66.
strength, than immature boys and the boys who had greater gross strength as measured by strength index were more mature and better motor ability score than weaker boys.

Robson, Uppal and Bose\(^3\) conducted a study to determine the selected physical fitness components of boys and girls at different stages of elementary school level, 20 boys and 20 girls were selected at random basis from each grade from one through five. Their age ranged from five to eleven years. The components tested were speed, shoulder strength, explosive power and agility. It was found from the analysis of the data that boys had more shoulder strength than girls in all grades in standing broad jump there was no significance difference in performance between boys and girls of grade one and two. Boys of grade three and four were significantly superior to girls grade three and four in standing broad jump. It was also found that boys of grade five were significantly superior to the girls of the same grade in 50-meter run and shuttle run.

Lee\(^4\) employed the AAHPER Fitness test to evaluate the motor fitness of a selected group of high school boys and girls over a period of two years. Result of the study disclosed that the girls who participated in


physical education throughout the study were significantly superior to the girls who participated only during the initial year. Athletes (boys) were superior in all respect of fitness to non-athletes throughout the two year study. A noticeable increase in motor fitness occurred during the school year in all group with no change in performance level over the summer months.

Loyghrey and James conducted the study to determine whether the AAHPER pull-up test or the reverse grip pull-up test, on the basis of the correlation with the Mcloy strength score, was the better indicator of upper body strength and should therefore be included in a physical fitness test battery. Seventh and eighth grade boys (N=95) served as Ss. It was recommended that the one-minute sit-up test should replace the AAHPER sit-up test in the physical fitness test battery: the no-blocks shuttle run test should replace the AAHPER shuttle run test in a physical fitness test battery; more studies need to be undertaken to find a test which adequately measures arm strength to be included in a physical fitness test battery; and further testing should be undertaken to determine whether the AAHPER 600 yard run walk test or the 300 yard run walk test, on the basis of the correction with the one-minute squat thrusts test, is the better

indicator of endurance and should be included in a physical fitness test battery.

Funk, James\textsuperscript{34} compared physical fitness levels of 7\textsuperscript{th} and 8\textsuperscript{th} grade athletes with non-athletes 199 boys were tested. An athlete was one who participated in interscholastic sports, and a non-athlete was one who did not participate in any organized athletics. Fitness level in this study were determined by scores on the 6 test items of the AAHPERD Youth Fitness Test. The fitness test was administered to both groups at the beginning of their 7\textsuperscript{th} grade year and again at the end of 8\textsuperscript{th} grade. Comparisons were made between athletes (n=94) and non-athletes (n=105), using their 7\textsuperscript{th} grade fitness scores and also using their 8\textsuperscript{th} grade scores. Within-group comparisons were made for each group by comparing the initial test scores with the final scores. The Behrens-fisher t test was used to compare the 2 groups. Significant differences were found on all 6-test items between athletes and non-athletes at both the 7\textsuperscript{th} and 8\textsuperscript{th} grade levels. These differences showed that the athletes scored higher than the non-athletes. The within group comparisons were made using Fisher’s Matched-Pairs t test Positive significant differences at the 0.05 level were found within both groups between the initial test and the final test scores.

Johnson\textsuperscript{35} conducted a study on the relationship of balance, speed, strength, height, arm and leg length to success in collegiate wrestling. The subject (N=208) for this investigation were collegiate wrestlers with at least two years inter university experience who had wrestled in at least 50 per cent of their team matches during the average or successful according to their win loss percentage. All subjects were measured for height, arm length and tested for reaction time, moment time, static elbow flexion, strength, explosive strength by ANOVA showed no difference among the wrestlers in the three-weight divisions on dynamic balance, explosive leg strength and reaction. In elbow flexion strength the middle weight were faster in moment time and reaction time the weights. The successful wrestlers had better balance than the unsuccessful wrestlers. The unsuccessful wrestlers had longer legs than the average and successful wrestlers. The analysis by multiple ‘r’ and regression showed that no combination of the independent variables was useful in predicting success.

Jokela and Hanin\textsuperscript{36} conducted a study on successful and unsuccessful athletes on optimal functioning model. According to the individual zones of optimal functioning model, an athletes performance is successful when his or her pre-competition anxiety is within or near the individually optimal zone with anxiety falls outside the optimal zone, performance deteriorates. The model also suggests that skilled athletes are aware of, and are able to accurately recall and anticipate, their pre-competition anxiety. A meta analysis of 19 studies from 1978 to 1997 was conducted to examine the validity of the assumptions regarding the in-out of the zone notion and the accuracy of recalls and anticipatory measures of anxiety. The findings provide fairly good empirical support for the IZOF anxiety model, with an overall effect size (d) for the in-out of the zone of d=+0.44 (41 effect sizes, n=3175). In other words, the performance of athletes who were within their individually optimal zones were almost one half a standard deviation until better than that of athletes who were outside their zones. Furthermore, both effect sizes (r(w)) for accuracy of pre-competition anxiety measures, recall (r(w)=+0.71, 24 effect sizes, n=369) and anticipatory (r(w)=+0.69,24 effect sizes, n=2843), exceeded the “large effect” suggested by Cohen, The

implications for future research extending the IZOF model to a wider range of positive and negative emotions are discussed.

Terry, Walrond and Carron\textsuperscript{37} conducted a study to investigate the relationship between game location and precipitation psychological states. Male rugby players (N=100) completed the competitive state anxiety inventory –2 and the profile of mood states approximately one hour before a home and away game. Repeated measures multivariate analysis of variance of mood and anxiety scores indicated significant differences between home and away locations, Participants scored higher on vigor and self confidence and lower on tention, depression, anger, fatigue, confusion, cognitive anxiety and somatic anxiety when competing at home. The findings support the proposal (Courneya and Carron, 1992) that psychological states are influenced by game location.

Hassmen, Koivula and Hansson\textsuperscript{38} had a study on the relationship between performance mood, measured by the profile of mood states inventory, and subsequent athletic performance has been the focus of considerable research. Presumably, athletes with less positive mood profiles should be outperformed by those with more favourable profiles,


The results presented so far in the literature are equivocal. One possible explanation is that more stable trait characteristics might mediate mood states prior to competitive situations. In the present study, 8 Male golf players, all Members of the Swedish National team, completed a number of trait inventories (Eysenck's Personality Inventory, Locus of Control, Sports Competition Anxiety Test, Self Conscious scale) prior to competitive season. Subsequently, they completed the profile of mood states before each game played. Analysis showed that the players performance mood states differed significantly and that these difference were associated with their scores on the trait inventories, Furthermore, pre-performance mood states were significantly related to athletic performance for some individuals but not for other. Further research should also include trait measurements to understand better relationship between mood states and the athletic performance of individual athletes.

Chantal et al. conducted the present investigation which was to proceed to a multi dimensional analysis of sport motivation in relation with elite performance and gender. The sample was made up of 98 Bulgarian top athletes (35 females and 63 males). Participation athletic performances in national and international events over the last two years

was documented. Participants also completed the Bulgarian version of the
sport motivation scale, The SMS, which is based on the tenets of self
determination theory (Deci and Ryan, 1985, 1991) assess; intrinsic
motivation, self determined extrinsic motivation, non self determined
extrinsic motivation and a motivation. Results indicated that in
comparison with less success athletes, title and medal holders displayed
higher levels of non self determined extrinsic motivation and higher
levels of non self determined extrinsic motivation and higher levels of
motivation with respect to gender, the motivation of female athletes was
more strongly characterized by intrinsic motivation, Result are discussed
in light of self determination theory and the cultural context which
prevailed in Bulgaria at the time of the investigations. It is concluded
that these highlight the role of motivation in elite sport performance.

Kavussanu and Roberts⁴⁰ had a study to examine the relationship
between perceived motivational climate and intrinsic motivation and self
efficiency and determined the role of goal orientation and perceived
motivational climate in predicting intrinsic motivation and self efficiency.
College students (N=285) enrolled in beginning tennis classes completed
a battery of questionnaires assessing perceived motivational climate, goal

⁴⁰ Maria Kavussanu and Glyn C. Roberts, “Motivation in Physical Activity Contents: The
Relationship of Perceived Motivational Climate to Intrinsic Motivation and Self Efficacy”, Journal of
Sport and Exercise Psychology 18.3(1996): 264.
orientation, intrinsic motivation, self efficacy and perceived ability. Perceptions of mastery climate were positively associated with enjoyment, effort, perceived competence, and self-efficacy and were inversely related to tension. In males, dispositional goal orientation and perceived motivational climate emerged as equally important predictors of intrinsic motivation, while mastery motivational climate was the only significant predictor of self efficacy. In females, performance motivational climate was the strongest predictor or intrinsic motivation and self-efficacy. Perceived normative ability accounted for a substantial amount of unique variance in intrinsic motivation and self-efficacy in both males and females. The motivational implications of the findings are discussed and directions for future research are provided.

Stephens and Bred Meier\(^ {41} \) conducted the study on recent sport psychology research addressing athletic aggression has tended to focus on the normal or the motivational dimensions of aggressive behavior. The current study utilized both moral and motivational constructs to investigate aggression in young soccer participation \((n=212)\) from two different age group leagues; under 12 and under 14. Stepwise multiple regression analyses revealed that players who described themselves as

more likely to aggress against an opponent also were more likely to (a) identify a larger number of teammates who would aggress in similar situation, (b) perceive their coach as placing greater importance on ego oriented goals, and (c) choose situations featuring pre conventional rather than conventional moral motives as more tempting for aggressive action. These results suggest that young athlete’s aggressive behavior is related to their team’s “moral atmosphere”, including team aggressive norms, players perceptions of these team norms and coach characteristics, and players’ moral motives for behaviour.

Sharma\textsuperscript{42} conducted a study to determine the influence of casual attribution success and failure among competitive male gymnasts. The subjects for the study were 216 male gymnasts from different states of various age level. The casual attribution was measured by the paper-pencil test of attribution (win and loss) questionnaire prepared by Roberts. The results of this study revealed differences in attribution to success and failure among successful and unsuccessful gymnasts. The successful gymnasts attributed their outcomes to the internal attributions, whereas the unsuccessful gymnasts attributed their outcomes to be

external attribution, Variations were also observed among the gymnasts on the basis of age levels.

Ommundsen and Vaglum\textsuperscript{43} had a study based on Harter’s competence motivation theory, examined the role of soccer related self-esteem, perceived soccer competence and the emotional involvement of significant others on soccer enjoyment and competition anxiety. A representative sample consisting of 223 twelve to sixteen year old soccer playing boys were personally interviewed at the beginning of their spring soccer season. Multiple regression analyses revealed that low soccer related self esteem was related to soccer competition anxiety among the younger players, whereas high perceived soccer competence and parents’ and coaches’ positive emotional involvement were individually predictive of enjoyment in soccer. Several of the results obtained from this study are in accordance with Harter’s hypothesis, and thus represent an important cross cultural validation of her theory.

Teipel, Gerisch and Busse\textsuperscript{44} suggested that the interpretation of an action as an aggressions will depend on the roles and perspectives of the observer. Extending this assumption to the sport situation, these


researchers hypothesized that coaches, athletes and referees, due to their contrasting notes, would judge aggressive sport actions differently.

Kamlesh\textsuperscript{45} made an attempt to diagnose the incentive motivation of Indian athletes through Wood’s Inactive motivation inventory and concluded that excellence; affiliation success and sensation are the major reasons for the athletes to participate in competitive sports, and male and female athletes do not differ on the level of their incentive motivation. He also found that Indian athletes are average in their motivational profile.

Flood and Helsted\textsuperscript{46} conducted a study to examine the participation motives of 161 intercollegiate athletes at medium sized public university in the northeastern United States affiliation with the university community as a result of sports participation was included as a motive. Results showed that affiliation is important both as a motive and as a reward for athletic participation. Overall the competitive aspects of participation are more important motives than social or fitness motives such as parental or peer influence liking the coach and using the facilities are least important.

\textsuperscript{45} M.L. Kamlesh, “Indian Athletes: A Diagnosis of their Incentive Motivation”, \textit{Proceeding of the Seventh World Congress in Sports Psychology}, Singapore (7-12\textsuperscript{th} August, 1989).

Mishra\textsuperscript{47} made a psychological profile of national hockey academy trainees and concluded on the basis of norms in the variables of incentive motivation, achievement motivation, state and trait anxiety and sports competition anxiety and concluded that:

1. Incentive motivation among national hockey academy trainees was fairly high in the systems of excellence, affiliation, sensation and success.

2. The level of their achievement motivation was just moderate.

3. They were slightly higher on trait and state anxiety as per the norms set by Spielberger et al.

4. They had a low level of sports competition anxiety which justifies that they were quite relaxed at the time of competitions.

Uppal, Sidhu and Gangopadhyay\textsuperscript{48} administered Butt's sports motivation scale to 15 Indian and 15 Zimbabwean International Women hockey players. It was concluded that the Indian and Zimbabwean women hockey team did not significantly differ in sports motivation. Total Zimbabwean Hockey team was higher on neurological conflict

\textsuperscript{47} S.N. Mishra, "Psychological Profiles of National Hockey Academy Trainees", (Unpublished Master's Thesis, Jiwaji University, 1995)

score and Indian Hockey Team’s co-operatives are higher from each other.

Nandi\textsuperscript{49} conducted a study on anxiety and its effect upon the performance soccer skill test requiring gross motor skills and concluded that low anxiety subjects perform significantly better than that of high anxiety subject in dribbling the ball for time and kicking the ball for distance with left foot and performed well in gross motor soccer skills, who where having low anxiety state.

Jackson and Roberts\textsuperscript{50} have done a study in which they have investigated relationships among peak performance, flow, goal orientation and perceived ability in an attempt to ascertain possible conceptual basis to peak performance. Collegiate athletes (n=200) answered a questionnaire that assessed mastery and competitive goal orientation, perceived ability, flow and experience in best and worst competitive performance. Analysis of athletes best performances indicated a total focus on performance and other Characteristics of flow were key to perception of a superior state of functioning. In contrast,


over concern with the outcome reflecting a competitive orientation, was often associated with athletes worst performance.

Liweiz\textsuperscript{51} has discussed the developing trend of China’s sports psychology. It was pointed out that in the field of competitive sport psychology small sample study, experimental study the development sport oriented psychological testing instruments, talented selection by psychological means coaches, education of sports psychology and development cognitive sport psychology should be paid close attention.

Maxon\textsuperscript{52} conducted a study in which the Mehrabian Measures of achieving tendency and a survey of a swimming achievements instrument designed by the investigator were given to 44 college swimmers (29 male, 15 female) from 4 universities. There was a significant positive ‘r’ between tile score the achievement motivation questionnaire and the swimming success survey, In addition college swimmers achieved significant higher score on the Mehrabian measures of achieving tendency then the norms for college students in general and female swimmers obtained significant higher level of achieving tendency than the level of the male swimmers.


Keith\textsuperscript{53} studied the relationship of selected anthropometric measurement and leg and foot to speed and vertical jump of male collegiate Track & Field athletics. The Newman Keith follow-up test was used to make multiple was used to determine the relationship of selected anthropometric measurements to vertical jump and 50 yard dash. There was a high level relationship between speed in the 50 yard dash and vertical jump.

Nail\textsuperscript{54} determined the relationship of balance, speed, strength, height, arm and leg length to success in collegiate, wrestling subjects will class a successful average or successful according to their win loss percentage. A second classification will be by weight (light middle, heavy).

Catherine\textsuperscript{55} studied the relationship between various structural components and selected arm strength measures of high school girls. Ninety nine girls were tested on isotonic (modified pull ups) and isometric (flaxed arm hang) strength test. The result were correlated with


height, weight, forearm, hand length, girth of upper arm, lean body mass and strength of elbow flexion.

Cordoyn\textsuperscript{56} studied the relationship of selected anthropometric measurements to leg strength, one hundred spring field college women were tested, with the leg dynamometer and were photographed with points marked by the Rotary plenimeter. A number of anthropometric measurements were correlated with leg strength.

Baacke\textsuperscript{57} utilized data from 87 male students of high school to determine the relationship of selected anthropometric and physical performance measures to performance in running hop, step and jump. He conducted that all the variables measured in the study showed significant relationship with criteria beyond the 0.05 level of confidence.

Ellen\textsuperscript{58} carried out a study of relationship of height and weight to the performance of College women in selected Basketball skill test. A 3 - item basketball test (Push pass, half minute shoot and bounce & shoot) was administered to 100 college women who participated in intramural basketball tournament. Four groups of 15 each were selected to represent

\textsuperscript{56} Nicholson Corolyn, A Study to Determine "The Relationship of Selected Anthropometric Measurement to Leg Strength" \textit{Completed Research in Health Physical Education & Recreation} (1964): 94.

\textsuperscript{57} Leverne W. Bassecke, "Relationship of Selected Anthropometric and Physical Performance Measures to Performance in Running Hop Step and Jump" \textit{Research Quarterly} 35 (March 1964): 107.

the extremes in height and weight. Height has a statistically significant relationship with weight and the combined test with the bounce and shoot test when weight was held constant. Comparison of mean between heavy and light group, however showed that the only significant difference was height and weight.

Dies\textsuperscript{59} investigated the relationship among selected anthropometric variables and relative body fat in college age women. The subjects were enrolled in physical education classes of the University of Illinois. Percent body fat was estimated by densitometry using underwater weight. Eight skin fold sites, eight body circumferences and seven body diameters were evaluated as predictors of body density. The result indicated that simple anthropometric measurements can be used to predict body density and body fat in college age women but that the use of regression equation developed on other sample of college age women are some what what less predictive of fat content.

Kishore\textsuperscript{60} conducted a study in which he took thirty intervarsity weightlifters. Their anthropometric measurements such as arm length, leg length, thigh length, trunk length, thigh and skin folds were measured.


He concluded that there is significant relationship between girth, trunk length, upper arm girth, lean body mass and weight lifting performance. There is no significant relationship between arm length, fore length, calf girth and weight lifting performance.

Mc Crown\textsuperscript{61} studied the throwing of 18 G F D person "shot put question and answers" measurements of the arm. Ability to throw baseball for a distance was correlated with the age and weight with grip, wrist and shoulder medial rotation strength and with the length of the hand, lower arm and upper arm as a proportion of total arm length.

Uppal and Ray\textsuperscript{62} conducted a study to find the relationship of selected strength and body composition variables to the performance in Shot put and Javelin throw. They concluded that there was a significant relationship of explosive leg strength to performance in javelin throw.

Gabberd\textsuperscript{63} in his studies investigated the relationship of children's body size to body performance of force production tasks have been limited with the exception of grip strength to numerous anthropometric variables. Investigations relating to ballistic type force production


comparison indicated that age, height and weight were significantly different (P<0.05) between groups with weight and height measures greater with the age. Although, the striking task sources were greater with age there was no significant difference between four & five year old, six & seven year old group with two older groups. There was a significant correlation (P<0.01) in all anthropometric measurements.

Beck\textsuperscript{64} in his study of block spacing and selected measurements and the sprint start tool, seventh and eighth grade students (N-38) having less than two seasons experience in after school sprinting competition were each measured for weight, height, leg length, leg strength and reaction time. Each subject was then allowed five practice trials and six test trials at such of four starting position using 15, 16,21 and 26 inches block spacing. Test trials were measured by using taken times to second the elapsed times. For each subject over a distance of 10 yards. Data subjected to a 3 x 4 factorial design with repeated measures, significantly related to starting times in the sprint start. The 26 inches starting position offered the fastest mean time.

Chetia\textsuperscript{65} took up a study of the relationship of leg length, thigh, calf girth and abdominal strength standing broad jump on 44 college student. The result indicated that there was a significant relationship between standing broad jump and calf girth and abdominal strength.

Bosworth\textsuperscript{66} studied on hundred and seven college women who were tested for leg strength and vertical jumping ability. Anthropometric measures and ratios were obtained from photographs. Correlations were computed between the vertical jump and each of the anthropometric variable and leg strength. A multiple correlation of 0.012 was obtained with the criterion.

Neither anthropometric measurements of strength variables nor the cumulative effort of the selected variables were significantly related to the vertical jump performance, adequately.

Epinschade\textsuperscript{67} concluded that age has direct bearing on physical performance of boys and girls in the elementary schools, whereas, height and weight had low correlation with performance in California. Physical performance test was done when age was held constant.

\textsuperscript{65} Uday Kumar Chetia, “Relationship of Leg Length, Thigh Calf Girth and Abdominal Strength Standing Broad Jump” Unpublished Master’s Thesis, Jiwaji University (1982).

\textsuperscript{66} Janice M. Bosworth, “Relationship Between the Vertical Jump Performance of College Women and Selected Anthropometric Measurements and Strength Variables”, \textit{Completed Research in Health, Physical Education and Recreation} 7(1967) P.93.

\textsuperscript{67} Annas Epinschade, “Restudy of Relationship between Physical performance of school children and age, height and weight”, \textit{Research Quarterly} 34 (May 1963) : 144.