Chapter II

REVIEW OF RELATED LITERATURE

A serious and scholarly attempt has been made by the research scholar to go through the literature related to this study. The relevant studies of specific importance are cited below.

Beidleman et al. following 2 to 3 week of attitude acclimatization ventilation is increased and heart rate, plasma volume and lactate accumulation are decreased during sub-maximal exercise. The objective of this study was to determine whether some degree of these responses associated with acclimatization would be retained upon introduction to altitude after 8 days at sea level. Six male row lenders exercises to exhaustion at the same relative percentage of peak oxygen uptake at sea level. On acute altitude exposure, after a 16 days, chronic altitude exposure on pikes peak and diving 3 to 4 hours R.A. Hypoburic chamber after 8 day submaximal exercise to exhaustion time was the same sea level after 8 days sea level the acclimatization

responses were retained $92 \pm 9\%$ for $S_aO_2$, $74 \pm 8\%$ for P.V. and $58 \pm 3\%$ for LA at $75\% V_o2$ peak. In conclusion although submaximal exercise to exhaustion time is not improved up on reintroduction to altitude after 8 days at sea level retention of beneficial exercise responses associated with altitude acclimatization is likely in individual whose work athletic competitions or recreation schedule involve interknitting sojourns to high elevation.

Balke\(^2\) indicates that blood pressure changes at altitude are marked by individual differences, but a drop in peripheral resistance may cause a fall in diastolic pressure. Sudden exposure to acute hypoxia 26,000 feet may also raise systolic pressure and when this occurs diastolic pressure will probably increase slightly.

Vogel and Hansen\(^3\) indicates the heart rate response to exercise is higher than at sea level during low and moderate intensities of work. Just as the resting value is elevated, each level of sub-maximal


work elicits correspondingly increased heart rates. However it is interesting to note that maximal heart rate is lower than at sea level according to most accounts. It may be as much as 40 beats per minutes lower for some subjects exposed to acute hypoxia and it is achieved at lower work loads than at sea level.

Marino and Ward⁴ on two separate occasions eight subjects controlled treadmill speed to run the greatest distance possible in 30 mins. In a hot humid environment. For the experimental test exercise was preceded by cold water immersion. Pre cooling increased the distance run by 304 ± 166 in (p < 0.05) pre cooling decreased the pre exercise total and mean skin temperature by 0.7⁰ c and 5.9⁰ c respectively. Rectal and mean temperature were decreased upto 20 and 25 mins. During exercise respectively. Mean body temperature decrease from 36.5 ± 0.1⁰c to 33.8 ± 0.2⁰c following pre-cooling and remained lower throughout exercise, and the end of the exercise. The rate of wet storage at the end of exercise increased from 113 ± 45 to

249 \pm 55 \text{wm}^{-2}. \text{ Pre cooling lowered the heart rate at rest 5 and 10 mins exercise and increased end of the exercise blood lactate from 4.9 \pm 0.5 to 7.4 \pm 0.9 \text{m mol L}^{-1}. \text{ The } \dot{V}O_2 \text{ at 10 and 20 mins. Of exercise and total body sweating were not different between tests. In conclusion water immersion pre-cooling increased exercise endurance is hot humid conditions with an enhanced rate of heat storage and decreased thermoregulatory strain. }

Malhotra\textsuperscript{b} found that those living at higher altitude have higher vital capacity and larger chest measurement than those living at lower altitude.

A review of studies on the effects of altitude on biological characteristics seems to indicates that a resident at higher altitude has definite development effect on anthropometric measurements and physiological variables, however potential seems to be realised better when training is added to mere migrants. A large number of studies all reported comparing cardio-respiratory parameter and work capacity of people resident in high and low altitude, with and without

\textsuperscript{b} R. Malhotra, "High Altitude and Thoracic Growth," Paper Read at the All India Seminar on Human Variation, Department Human Biology, Punjabi University, Patiala (Feb. 1980):18-23.
acclimatization etc. have been found reported. However the scholar was not able to locate any study comparing the physical fitness of adolescents at high altitude and low altitude through development of physical fitness in the basic infra-structure for improved performance in sports.

Carrido et al.,\(^6\) cardiorespiratory response to exercise in elite Sherpa climbers transferred to sea level. Himalayan Sherpas are well known for their extraordinary adaptation to high altitude and some them for their outstanding physical performance ascents to the highest summits. To cast some light on this subject, we evaluated the cardiorespiratory response during exercise at sea level of six of the most acknowledged Sherpa climbers, mean age (± SD) (37 ± 7) years old. Continuous electro cardio gram and breath by breath pulmonary gas exchange until exhaustion were following the Bruce protocol. We detected maximal oxygen uptake (Vo\(_2\) max) of 66.7 (± 3.7) ml mm kg maximal cardiac frequency of 199 (± 7) beats mins, and ventilatory

anaerobic hold at 62 (± 4)% of \( V_{02} \) max. These factory could helps to explain the greater performance level shown by several elite climbers of this ethnic group of high landers could be associated with natural selection and with special physiological adaptation probably induced by long-training in a hostile environment.

Shapiro, Pandolt and Avellini\(^7\) conducted a study to evaluate sex related differences using 10 males and 9 females under hot and wet and hot dry conditions. Pre acclimatized subject were exposed to a comfortable climate (20\(^{\circ}\)c, 40\% Rh) mild wet weather (32\(^{\circ}\)c 80\% R) too hot dry conditions. (40\(^{\circ}\)c 20\% Rh: 54\%6\% Rh) exposures lasted 120 minutes walk, 10 minutes rest 50 minutes walk 10 minutes rest, 50 minutes walk. During hot dry exposures heart rate and rectal temperature were significantly lower for males than females. No significant difference in sweat loss were observed. During hot wet exposures both mean final rectal temperature and difference in sweat loss were lower in female than males. None of these differences correlated with maximal oxygen uptake, body weight, skin surface

area or percentage of body fat. During hot wet exposure, a negative relationship between surface area to mass ratio and rectal temperature, skin temperature. Heart rate and change in heat storage was found.

Hartung, Mybre and Nunnely⁸ conducted a study to determine the physiological effect of cold air inhalation during exercise. Six normal subjects were observed during rest and exercise. While they breathed (a) ambient, (b) cold - 35⁰C air. All experiments were 10 minutes in duration and the exercise experiments consisted of pedaling a bicycle ergometer at loads requiring approximately 60% and 70% of each subject's Vo₂ max. Heart rate and minute ventilations during the most strenuous exercise averaged approximately 170 bpm and 701 respectively. Diastolic B.P. was significantly higher and expired air temperature was significantly lower during cold air inhalation. Oxygen uptake respiration rate and rectal temperature were not affected by cold air breathing. The present study observed only slight changes in measured physiological responses to rest and exercise with cold air.

Balmani\textsuperscript{9} conducted a study to investigate strength, endurance and flexibility variation resulting from a 3-set volleyball match played on different surface i.e. beaten earth court and sand court. Two equated teams played a number of 3 set matches to study strength endurance and flexibility variations resulting from volleyball matches played on beaten earth court and sand court. All the subject were tested for strength in terms of vertical jump, muscular endurance in terms of push-up, cardio vascular efficiency in terms one minutes lateral jump and flexibility in terms of squatt and trench test to collect respective data. Analysis with regard two examine the significance of differences among the pre (after warm up) and post test (after playing on beaten earth court and sand court) means of all the selected variables revealed that there were significant differences in the variation of performance of muscular endurance in term of push-up ($f = 7.20$) and in the performance cardiovascular endurance of one lateral jump ($F = 4.195$) when their performance were compared to study the effect of different surfaces i.e. beaten earth court and sand court on

\textsuperscript{9}B. Balmani, "Strength, Endurance and Flexibility Variation Resulting From a 3 Set Volleyball Match Played on Different Surface," (Unpublished Master's Thesis, Jiwaji University, 1995).
strength, endurance and flexibility and for strength and flexibility variables no significant differences were observed.

Adhikari and Kumar\textsuperscript{10} were observed mean value age 27.1 years, (+ or -1.5) height 172.3 cm (+ or -4.8), weight 63.8 (+ or -4.7), fat percentage 10.8 (+ or -3.8), resting heart rate 57.8 beats per minutes (+ or -0.6), systolic blood pressure 108.3 (+ or -5.1) mm hg., diastolic pressure 70.6 mm/hg (+ or 5.9), predicted \( V_{o2} \) max 59.3 (+ or -4.9) ml/kg-1 min-1 Harward Step Test Score 105 (119) distance in coopers 12 minutes run or walk test 3.08 km (+ or -0.1), vertical jump 55.4 cm (+ or -5.2), sit up 61.7 (+ or -8.3), push-ups 46.7 (+ or -10.3), dash run 5.8 sec. (+ or -0.2), hand grip strength for left and right hand 42.3 kg (+ or - 6.1) and 46.3 kg (+or- 5.4) respectively.

Reilly\textsuperscript{11} studied the selected aspects of the application of physiology to soccer. Analysis of work rate profiles and factors effecting work rate provides a basis for describing exercise intensity during matches. Physiological responses to soccer play indicate

moderate to high intensities, intermittently high anaerobic responses and reduction of muscle glycogen stores towards the end of play game related activities impose unique physiological stress on players match play demands have implication for the modeling of training regiments and attention to specificity of soccer skill.

Wyndham et al.\textsuperscript{12} conducted a study to establish relationship between $V_{O_2}$ max and body temperature in hot humid air conditions. The subject six men who were conditioned to a step climbing routine followed by $V_{O_2}$ max determinations on a treadmill. They worked for 4 hours at the step climbing routine at Tab 32.3\textdegree c (saturated) and low air movement. Relating 4th hour rectal temperature to percent $V_{O_2}$ max showed that the higher percentage of maximum used, the higher was the 4th hour rectal temperature. The men were acclimatized for 12 days to identical condition. Measurement of $V_{O_2}$ max showed no significant change from pre acclimatization values. A similar close relationship was observed between the 4th hour rectal temperature and percent $V_{O_2}$ max. In acclimatized state six men were also studied 50 percent $V_{O_2}$ max. Fourth hour rectal temperature showed close

relationship with percent \( \text{V_o}_2 \text{ max} \), the residual variance being only 0.288. The plots of the 4th hours rectal temperatures against oxygen consumption, however showed wide but consistent difference between individual in rectal temperature responses, which are probably due, in part, to difference between them in \( \text{V}_2 \text{ max} \).

Gurovich et al.\textsuperscript{13} physiological assessment soccer may improve the player's physical performance making a team more successful, thus a physical training period oriented by individual and functional work load may be the base of regular competitive season. 17 professional first division soccer players were evaluated before the physical training period (P.R.E.) 4 week later (post) and 10 weeks after the beginning of the national championship (During). A soccer field lactate Threshold test 6x408 mts. progressive protocol were used to determined speed at 4 mmol/Lt (volba). Maximal heart rate recorded by heart rate monitoryes relative maximal heart rate, maximal lactate level and maximum oxygen uptake. Result shown a greater volba post them

PRE and no changes during there were no significant changes in the
$V_{O_2}$ max HRM decreased at post but increased in during as % HRM did
Lamax decreased at post and it keeps during. These data suggest the
useful in professional soccer of a scientific training protocol with
worked load individually determined, to achieve physiological
improvement and to maintain this performance pre and during
competitive season.

Al Hasso and Saeed\(^\text{14}\) conducted a study on the effect of selected
sports surfaces on vertical force in walking, running and jumping. The
result showed that all tests sports surfaces were soft and characterised
by low resiliency. However super - x supreme track, gymsol N and
Laykal 440 were formed to have a higher and increased absorbing
ability as the velocity of the performed skill increased, walking,
running and squat jumping on these sport surfaces were shown to be
inefficient and the different thickness of these surfaces had no effect on
energy loss during tested skills, moreover, higher kinetic energies in
running and improved running velocities were achieved on the super -

\(^{14}\) Al Hasso and Thamer Saeed, "The Effect of Selected Sports Surfaces on Vertical
Force in Walking Running and Jumping," \textit{Dissertation Abstract International}
49.5 (Nov. 1988):1089-A.
x surface. Higher center of gravity displacement was identified only during counter movement jumps on sper - x and on duration surface of 0.625 cm thickness.

Ramsey\textsuperscript{15} conducted a study on environmental heat from synthetic and natural turf where he had made a series of 81 daily observation between the month of April and December on the campus of Taxes Technical University, Lubbock, Taxes. He came out with the following conclusions:

1. There is very little differences between the two surface temperature at 10 w temperature (i.e. 10.12 - 10.0\textdegree c) about 1.6\textdegree c (3\%0\%0) differences at moderate temperature (i.e. 24.6 - 28.0\textdegree c) and only 2.3\textdegree c (5\%0\%0) differences between the two turf surfaces at high temperature lie 38.3 - 36.0\textdegree c).

2. Both dry bulb and globe temperature at high heat condition reduce an average synthetic turf temperature approximately 2\textdegree c (4\%0\%0) above the natural turf temperatures.

3. The natural wet bulb, the relative humidity and vapour pressure value to be slightly lower for the synthetic turf.

4. Air temperature and mean radiant temperature over synthetic turf have a persistent and slightly higher value them do pirea observation of the same psycho-metric variables over natural turf.

Bargsbo et al.\textsuperscript{16} the ability to work at high intensity is markedly impeded when the oxygen pressure is reduced, eg - corresponding to an altitude higher than 2000 m. thus the maximum oxygen uptake is decreased and ventilation and blood locate concentration during severe, sub-maximal exercise are increased when subject exercise at low pressure as in a pressure chamber.

Chakraborty\textsuperscript{17} conducted a relationship study on 20 male soccer players that strength, speed, endurance were significantly


\textsuperscript{17} Debananda Chakraborty, "Relationship of Selection Motor Components and Physique Characteristics to Performance in Soccer," (Unpublished Master's Thesis, Jiwaji University, 1986).
correlated with performance in soccer. The physique characteristics i.e. height, weight, fore leg length, thigh length, shoulder width, trunk length, ponderal index and crural index were not found significantly related to the performance in soccer.

Malhotra et al.\textsuperscript{18} conducted a study on physical and physiological stress of playing hockey on grassy and Astroturf field. The study was conducted on 12 hockey trainers admitted to NS NIS for regular diploma course in coaching. They came with the conclusion which exhibits the following differences between playing hockey on grassy and astroturf fields.

1. speed of running an astroturf field is higher than the grassy field.

2. Turning of players on the astroturf field is more difficult and time consuming than on the grassy field.

3. The ground resistance offered to the ball by the astroturf is less and so the ball moves on it faster than on the grassy field.

4. Stress on the heart is more during the game played on the astroturf than on grassy field.

5. The increase in ventilation is more by about 22% during play on the astroturf than on the grassy field.

Kansal et al.\textsuperscript{19} studied the physique and body composition of the intervarsity soccer players of zonal champion and runners-up team of the north zone. They concluded that the defense line players were significantly taller and heavier, than forward line players. Forward line players had narrower hips and broader femur bicondylardiameter accompanied by better developed thighs and calves in comparison to the defensive players. The forward line players had also slightly lesser percentage of body fats and more of lean body mass.

Campbell\textsuperscript{20} conducted research on the relationship of selected measures of physical performance and structure to quality of performance in college football. He tested 40 male members of the 1978 Springfield College Football Squad. They were tested for height, weight, 10, 20, 30 and 40 yard dash, vertical jump, agility, upper body strength and lateral movements. In addition each player had a game performance score assessed by the grading of game film selected at random. No relationship were found between height, weight and performance.

Amusa\textsuperscript{21} selected 46 subjects, who were well conditioned soccer players with atleast two years playing experience on the college level. They were tested for running speed, power agility, amx Vo\textsubscript{2} strength, anaerobic capacity and flexibility. In addition, 11 anthropometric measurement consisting of skinfolds and body diameters were taken.

soccer playing ability served as the criterion and was measured by the rating of three experienced soccer coaches based on selected soccer skills and strategies. Analysis of data was by zero order correlation and multiple regression analysis resulting in the following conclusion age (experience) is the best single predictor of playing ability, weight LBW and height are considered good predictors of playing ability, max Vo2 and running speed are considered important factors in soccer performance. Flexibility, agility, lactate concentration and leg power are not considered as valid indicators of playing ability.

Mathew22 studied the effect of soft playing surface for teaching defensive skill in volleyball. In order to find out the effect of soft playing surface the scholar selected twelve outstanding volleyball players age ranging 14 to 16 years and studying in Kendirya Vidyalaya, Trichy. The subject were divided into homogeneous groups on the basis of initial test. The group was divided into two as control and experimental group. The experimental group was put into practice in the soft ground for the period of six weeks. The control

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group practiced the same skill on the normal volleyball court. The data obtained through conducting final test and subjective assessment during actual game situation by the expert were put into statistical treatment. From the analysis of data collected it is evident that suggested surface help to improve the performance in dive and pass skill in volleyball.

Christian\textsuperscript{23} identified the contribution of selected variables to the football game performance. Thirty members of the 1973 South Eastern State College Football Team were chosen as the subject. Each subject was tested on 12 variables and a stepwise multiple regression was used to determine the weight of each of these variables to the ultimate criterion, the performance of plays executed correctly as determined by regarding the film of the ten 1973 regular season football games. It was found that the best predictor of the game percentage score for the backs was lateral movement with a correlation of .33. for the line, the best predictor of game percentage score was bench steps with correlation of .67. When the back and line groups were combined the best predictor of the game percentage score was the

vertical jump with correlation of .30. It was concluded that for the
total group, the vertical jump and the twelve minute run were the two
best predictors.

Prince\textsuperscript{24} conducted a study on the relationship of college football
players strength, speed and agility to the coaches ranking of ability,
playing position were combined defensive backs, offensive lines man,
defensive linesman and into whole group units. The players were
further divided into group I or group II correlation were then computed
between the objective test score and the coaches subjective evaluation.
It was concluded that arm strength and agility were not valid;
predictors of football ability total strength and total t score were
moderate predictors of football ability and the leg strength and speed
were significant predictors of football ability.

\textsuperscript{24} N. Gary Prince, "The Relationship of College Football Players, Strength, Speed and
Agility to the Coaches Ranking of Ability," \textbf{Completed Research in Health,
Physical Education and Recreation} 10 (1968):130.
Roy\textsuperscript{25} has conducted a study on the body size, strength, muscular endurance and power of top flight team in England - Rugby and soccer players mean superiorities by team were amateur. Rugby plays in muscular endurance and the professional Rugby players in push-ups and pull-ups and muscular endurance. Professional soccer players in back strength and sit-ups. The offensive amateur and professional Rugby players in physical fitness and some muscular endurance tests. The defensive soccer players superior to the forward in body weight and height and amateur defensive players were superior in strength index.

Vogan and Hansen\textsuperscript{26} studied the cardio-vascular function during exercise at high altitude. Twenty four healthy young male subjects who were life long sea level residents served of subjects. The twenty four subjects were divided into groups of eight. One group


remaining at sea level. Another's group was transported to an altitude of 4300 m. and the third group was moved gradually with one week interval at 1640 meters and 3475 meters of altitude. Each group, eight subjects was further divided into half and assigned to an increased physical training programme, and other was given reduced physical activities programme. These programmes commenced after the initial sea level run and three weeks before arrival at high altitude and continued throws out the period of the study. The conclusion of their study was that the heart and circulation were quite capable of meeting the demands of oxygen delivery during heavy work at altitude upto 4300 metres. There was no evidence of effect on the circulatory system, nor of any reduced efficiency in the heart action.

Micheie²⁷ explored the possibility of developing a regression equation were by football ability could be predicted from analysis of selected anthropometric measurements, strength tests, power measures balance, standing height and body weight. Subject were 56 scholarship football players at U.A. Six assistant football coaches,

three offensive and three defensive, rated each offensive and defensive player, respectively. This rating on football ability was used as the criterion measures. Stepwise multiple regression and polynomial regression were utilized to form predictive equation. The equation by polynomial regression was: Football ability = 787.65 + 7.33 (bow legs) - 143.52, standing height - 2.60 (tibial tension) - 33.40 (hours power), - 0.408 (body weight), $R^2 = 0.573$ and percent, standard error of the estimate was 15-7%.

Amusa\textsuperscript{28} selected 46 subjects who were well conditioned soccer players with at least two years playing experience on the college level. They were tested for anthropometric measurement consisting of skinfolds and body diameters were taken. Analysis of data was by zero order correlation and multiple regression analysis resulting in the conclusion that age (experience) is the best single predictor of playing ability weight. L.B.M. and height are considered good predictors of playing ability.

Ozkan\textsuperscript{29} investigated the physical, physiological and motor skill characteristics of 77 male volunteer high school players between the age of 15 and 18 years old. Test items consisted of age, height, weight percentage of body fat, resting heart rate, 1.5 mile run 50 yard sprint, vertical jump, South East Missouri State College (SEMO) agility test, trunk extension and flexion, ball control, wall volley and obstacle dribble skill test.

Statistics performed in this study were means standard deviation, analysis of variance, Scheffer's post hoc test and correlation. For all statistics the .05 level of significance was used. The statistical analysis revealed an average height and weigh of 174.92 cms. And 64.74 kgs., for the entire group of players. Average resting heart rate and body fat were 70.07 bpm, and 10.38 percent, respectively. On the 1.5 mile run the subject scored in the excellent category. Whereas they scored fair on the 50 yard sprint and the vertical jump. Result of the semo agility run indicated that the subjects had similar level of agility

as that of college soccer players. In terms of trunk extension and flexion, subjects scored below average and good on the two test respectively. On the three soccer skill test, the players scored between the 85th, 100th percentile of norms established for high school and college age soccer players.