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.

Carrido et. al.¹ cardio respiratory 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 of them for their outstanding physical performance ascents to the highest summits. To cast some light on this subject we evaluated the cardio-respiratory response during exercise at sea level of six of the most acknowledged Sherpa climbers, mean age (±SD)(37±7) years old. Continuous electro-cardiogram and breath-by-breath pulmonary gas exchange until exhaustion were following the Bruce protocol. We detected maximal oxygen uptake (Vo₂ 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 Vo2 max. These factors could help to explain the greater performance level shown by several elite climbers of this ethnic group of highlanders and could be associated with natural selection and with special physiological adaptation probably induced by long training in a hostile environment.

Benjamin\(^2\) this well controlled study showed that acclimatization to altitudes plus training at low altitude, "Living High-Training Low", improves sea-level performance in well-trained runners more than an equivalent sea level or altitude control.

The living high training low group significantly increased O\(_2\) max (51) in direct proportion to an increase in red cell mass volume (9%,x=0.37, P<0.05), neither of which changed in the control. Five-kilometer time was improved by the field training camp only in the high-low group (13.4±10 s), in direct proportion to the increase in O\(_2\) max (\(\Lambda-0.65\), P<0.01). Velocity at O\(_2\) max and MSS also improved.

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only in the high low group. Four weeks of living High-training low improves sea-level running performance in trained runners due to altitude acclimatization (increase in red cell mass volume and $O_2$ max).

Shaji$^3$ conducted a study on performance variations in selected soccer skills on different ground conditions. The study was delimited to only three ground conditions, grassy ground, non-grassy hard ground and muddy ground. The findings showed there were significant differences on selected soccer skills when performed on these different ground conditions. Further, it was observed that all the selected soccer skills were performed well on grassy ground as compared to non-grassy hard ground and muddy ground.

Balamani$^4$ investigated the strength, endurance and flexibility variation resulting from a 3-set volleyball match played on different

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$^4$ B. Balamani, “Strength Endurance and Flexibility Variations Resulting from a 3-Set Volleyball Match played on Different Surfaces” (Unpublished Dissertation of Master of philosophy in Physical Education, Jiwaji University, 1995).
surfaces. The study was conducted on twelve male volleyball players of Lakshmibai National College of Physical Education, Gwalior. She came to the following conclusion:

1. Muscular endurance and cardio-vascular endurance showed significant increase after playing 3 sets volleyball matches on beaten earth surface and on sand court, whereas for strength and flexibility no significant variations were observed.

2. Volleyball matches (3 set) played on different surface resulted in significant variations in endurance ability and for strength and flexibility no significant differences were observed.

Ann⁵ has conducted a comparative study on the biomechanical and physiological responses of suspended deep water running (SDWR) to hard surface running (HSR). Ten subjects were filmed at incremental speed (3-9 mph) 96m.min⁻¹-288m.min⁻¹ on the treadmill and at increase leg alteration (80-164 mph) in the pool. A cinematographical analysis was undertaken to compare faint angles of

the two running modes. Twenty subjects performed a maximum oxygen uptake test on a treadmill and running suspended in deep water. Variables analyzed were oxygen uptake (\(V_{o2}\)), heart rate (HR) Ventilation (VE), substrate utilization (R) and lactic acid production (LA). Significant differences in joint angles were found between HSR and SDWR. Greater maximum oxygen uptake and heart rate were found between HSR and SDWR. Significantly higher oxygen uptake and heart rate values were found for HSR at RPE 5-6 and RPE 9-10 SDWR is significantly different biomechanical than HSR. One cannot work as hard during SDWR as compared to HSR and RPE training level for SDWR do not equate to HSR.

Vogan and Hansen⁶ studied the cardio-vascular function during exercise at high altitude twenty-four healthy young male subjects who were life long sea level residents served as subjects. The twenty-four subjects were divided into groups of eight, one group remained at sea level. Another group was transported to an altitude of 4300 mts and

the third group was moved gradually with one-week interval from 1640 mts to 3475 mts of altitude. Each group of eight subjects was further divided into half and assigned to an increased physical training programme and the other was given a reduced physical activities programme. These programmes commenced after the initial sea level run and three weeks before arrival at high altitude and continued through 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 mts. There was no evidence of effect on the circulatory system, nor of any reduced efficiency in the heart action.

Indira\textsuperscript{7} investigated the comparative effects of batting practice on cemented wicket and matting wicket on reaction time and speed of movement and concluded that:

1. Cement wicket batting practice can contribute to left foot reaction time.

\textsuperscript{7} Manohar Indira, "Comparative Effects of Batting Practice on Cemented Wicket and Matting Wicket on Reaction Time and Speed of Movement", (Unpublished thesis of Master of Physical Education, Jiwaji University (1983).
2. Cement wicket batting practice can improve right foot reaction time.


4. Cemented wicket batting practice does not contribute to right and left hand reaction time.

5. Cemented wicket batting practice does not contribute to right and left foot speed of movement.


7. Matting wicket batting practice does not improve right foot and left foot reaction time.

8. Matting wicket-batting practice does not improve right hand and left hand reaction time.

Malhotra et al.\textsuperscript{8} conducted a study on physical and physiological stress of playing hockey on grassy and Astroturf fields. The study was conducted on 12 hockey trainers admitted to NSNIS, Patiala, for regular diploma course in coaching. They came to the following

conclusion, which exhibit the following difference between playing hockey on grassy and Astroturf fields.

1. Speed of running on Astroturf fields is higher than on 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 grass field.

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

6. The expenditure of energy on Astroturf field is greater than on the grassy field by about 18%.

Moffat\textsuperscript{9} states that environmental factors and field conditions affect the game of soccer to a large degree and the team that best adapts to them will increase its chance of winning. Bumpy fields can

adversely affect the playing quality of a soccer games particularly for teams with inferior ball handling. Their lack of skill will be exposed on a bumpy field. Soggy and muddy fields will slow the ball down. A wet, slippery field will assist ball kicks along the ground. Penalty takers must be aware of existing field conditions and weigh them carefully before taking their kicks. A kick in the air on a muddy field is better advised than a kick along the ground.

Baver\textsuperscript{10} states that on wet, slippery and icy surfaces, it is best to use safe, short, accurate passes to your team mates 'feet'. The man with the ball tries to wear down defenders by dribbling and feinting. Shots from all positions including the second line of attack – are likely to succeed. When the ground is very muddy or covered in snow, an uncomplicated kick and rush game using a lot of space is often preferable.

Walter\textsuperscript{11} conducted a study on the effects of velocity, surface and angle of incidence an angle of rebound of tennis balls. 102 trials of tennis ball contacting three different surfaces at various angles of incidence and various velocities. It was concluded that angle of rebound of tennis ball is greater than its angle of incidence, that angle of rebound from a laykol surface, a tartan surface and hard wood gymnasiuim surface will not differ due to surface effects; deviation in angle of rebound from the angle of incidence increases from 20-30 degrees and then decreases as the angle of incidence increases, and tennis balls projected with a slow incidence velocity will rebound at a greater deviation angle then tennis ball projected at the same angle of the incidence and a faster incidence velocity.

Uppal\textsuperscript{12} selected 80 untrained subjects and divided them equally into three experimental groups and one control group, to determine


\textsuperscript{12} Arun Kumar Uppal, “Comparative Effects of Two Duration Load Methods and Interval Running Method on Cardio Respiratory Endurance and Selected Physiological Variables” (Unpublished Doctoral Dissertation, Jiwaji University, Gwalior, 1980).
the effect of interval training and two continuous load methods, cardio respiratory and selected physiological parameters. One group was given interval training, the second Fartlek, and the third slow continuous running, for a period of 10 weeks. The load was progressively increased. He found that all three groups had equal training effects on maximal oxygen uptake, vital capacity, leg strength, positive breath holding time and negative breath holding time. Slow continuous and Fartlek method indicated significant improvement in cardio respiratory endurance when compared to interval training. Slow continuous training and interval training were superior to Fartlek in reducing resting pulse rate. However, all these training methods did not show significant difference in diastolic blood pressure.

Parks\textsuperscript{13} undertook a study to determine the effects of a ten weeks physical fitness programme on selected physiological and psychological variables of elderly people of 65 to 82 years. The

subjects were 15 females. Pre and Post Measurements were obtained for psychological variables by the state trait Anxiety Inventory. The physiological variables measured were body composition, flexibility, heart rate and blood pressure. The subjects participated in the fitness programme half an hour in the morning on three days a week for 10 weeks. Each exercise session began with 10 minutes of warming up followed by 15 minutes of exercise of moderate intensity. The last five minutes were used as a cooling-off period. The 't' test for correlated samples was employed to determine if a significant difference existed between pre and post test measures on the physiological and psychological variables. The following significant changes were found:

1. The subjects decreased in percentage of body fat.

2. There was an increase in flexibility.

3. There was a decrease in heart rate. However, there was no significant change in systolic and diastolic blood pressure and anxiety levels of the subjects.
Campbel\textsuperscript{14} 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 Spring Field 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 was found between height, weight and performance.

Amusa\textsuperscript{15} selected 46 subjects, who were well-conditioned soccer players with at least two years playing experience at the college level. They were tested for running speed, power agility, max Vo$_2$ strength, anaerobic capacity and flexibility. In addition, 11-anthropometric measurements 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 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.

Crist\textsuperscript{16} conducted a study to determine whether there was a significant difference between three day a week and five days a week physical education programme. The ‘t’ test was used to analyze the data. The results obtained indicated a significant difference in favour of these students who were involved in the five days a week physical education.

education programme over those involved in the three-day a week programme.

Mathew\(^{17}\) studied the effect of soft playing surface for teaching defensive skills in volleyball. In order to find out the effect of soft playing surface. The scholar selected twelve outstanding volleyball players with ages ranging from 14 to 16 years and studying in Kendriya Vidyalaya, Trichy. The subjects were divided into homogenous groups on the basis of an initial test. The group was divided into two as control and experimental group. The experimental group was put to practice on the soft ground for a period of six weeks. The control 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 experts were put into statistical treatment. From the analysis of data collected it is evident that suggested surface helps to improve the performance in drive and pass skill in volleyball.

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Thomas\textsuperscript{18} conducted a study for the ten weeks on the effect of a programme of progressive resistance exercise on strength, muscle girth and body composition. Forty-Two college women participated in the study 20 serving as control group and 32 participated in progressive resistance exercises on the Universal gymnastic weight training apparatus. The results of the study revealed significant increase in strength within the experimental group on six of the eight strength tests. No significant increase in strength within the control group with the exception of the test for knee flexion and significant exercises for the experimental group over the control group in the elbow flexion. Knee extension and shoulder horizontal adduction strength test.

Mayers\textsuperscript{19} examined and compared the effect of training highly conditioned varsity soccer players on running circuits of 1.86 degree


down hill and zero degree during a competitive season. The specific questions, with which this study was concerned were the effects of downhill and level circuits on a varsity soccer player's maximum running speed, stride length, stride frequency and leg strength. After a five week of training the study concluded that:

1. The down hill methods of training significantly improved the stride length of the varsity soccer players.

2. The down hill method of training can be effectively used as a supplementary sprint training method.

3. The downhill methods of training did not significantly increase running speed and stride frequency.

Diclemente\(^{20}\) states that in playing a wet ball on a wet field, the long passing game is more effective than the short passing game, since the wet ball is so much more difficult to handle. A ball on a wet field does not bounce but slides and comes off the ground much lower and faster than a bouncing ball on a dry field.

Balke\textsuperscript{21} indicates that blood pressure changes at altitude are marked by individual differences, but a drop of peripheral resistance may cause a fall in diastolic pressure. Sudden exposure to acute hypoxia 26,000 ft. may also raise systolic pressure and when this occurs diastolic pressure will probably increase slightly.

Vogel and Hansen\textsuperscript{22} indicate 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 minute, lower for some subjects exposed to acute hypoxia and it is achieved at lower workloads than at sea level.


Lane\textsuperscript{23} selected the AAHPER youth fitness test and the Humiston Motor Ability Test to determine the relationship between physical fitness and motor ability before and after a planned physical fitness programme for high school girls. The test was administered to 69 girls of ninth grade (14 years). The group improved on both the tests and the correlation obtained between physical fitness and motor ability was higher after the planned fitness programme.

Lodziak\textsuperscript{24} states that the ball does not run smoothly on sticky, muddy patches. Thus, on muddy pitches the ball will have to be kicked with more force than is necessary on a dry pitch. In order to cover the same distance. Besides kicking with more force and determination, experience has shown that the longer pass is more effective than the shorter pass, partly because the longer pass requires a greater impetus and is less likely to stick in the mud, but mainly


\textsuperscript{24} Conrad Lodziak, \textit{Understanding Soccer Tactics} (London: Faber and Faber Ltd., 1966), P.162
because muddy pitch is often slippery. Slippery pitches provide difficulty to the defender beaten by a ball because the slipperiness impedes his turning speed. Pools of water on the pitch will cause the same difficulties as muddy patches and can be tackled in a similar fashion. Snow covered pitch posses some of the characteristics of a muddy pitch, but provide less difficulty because they tend to be crisp rather than sticky. Snow does, however, slow the ball down, thus it is necessary to kick harder than is normal. Hard pitches can cause problems for players because each bump becomes accentivated and can therefore alter the path of the ball drastically. On such pitches it is advisable to play the ball along the surface.

King\textsuperscript{25} studied the effect of two training programmes on selected cardio-respiratory variables of college women. The physiological reactions measured were pulse rate, respiratory rate, respiration amplitude, minute volume of respiration and oxygen consumption. The respiratory variables were recorded simultaneously.

by a respirometer. The cardio-vascular reaction was measured by counting the pulse rate. All variables improved during the four weeks training period regardless of the training programme prescribed. Both training programmes were of sufficient duration and intensity to effect changes in post exercise scores.

Charles\textsuperscript{26} states that the season in Britain often begins in a heat wave, with the grounds hard and unyielding. The come the rains and the mud, then come the fog and the freeze ups, which make the ground so hard that the animal loving British refuse to allow horses to race or even train on it, but expect footballers to play on it. Then there is the thaw, with more mud. And finally comes the spring and the hard grounds again. So the perfect British players would be able to withstand blistering heat and freezing cold, would be able to produce the delightful and accurate ball control so necessary on firm grounds, and the dexterity and agility, not to mention the nerve, which are necessary on the frozen grounds.

Nagle and Irwin\textsuperscript{27} studied the effects of two types of weight training on cardio-respiratory endurance and selected physiological factors. Sixty freshmen students of the University of Florida, who volunteered to serve as subjects, were divided into three groups. Two Experimental and one Control. They were tested doing moderate and all out experience on a bicycle ergometer. Selected physiological responses and the cardio respiratory endurance times were measured. An eight-week training programme followed during which the experimental group participated in weight training programmes and the control subjects participated archery or bait assisting. After training, the tests were again administered. Though there was an indication of improved cardio-respiratory responses by the weight-training group, statistical treatment of the data revealed no significant differences among three groups in their responses to the exercise.

Creek\textsuperscript{28} states that the long passing game as the name implies, means making progress by means of a series of long cross passes from one side of the field to the other, with the object of catching the opposition facing the wrong direction. A wet day will be of assistance to this type of game because the ball will skid rapidly over the slippery surface and cause defenders to make mistakes.

On firm dry grounds, the short passing game often pays good dividends especially if it is judiciously mixed with long swinging passes.

\textsuperscript{28} F.N.S. Creek, \textit{Soccer for Boys} (London: English University Press Ltd., 1951), PP. 60-61.