Chapter II

2. REVIEW OF RELATED LITERATURE

Brief accounts of literature which are relevant to the present study are cited in this chapter.

Research related to effects of different training for physical fitness and soccer playing ability, are sufficient. A good number of studies have been conducted on these aspects. But the study of “EFFECTS OF HARNESS RUNNING, SAND RUNNING, WEIGHT - JACKET RUNNING AND WEIGHT TRAINING ON THE PERFORMANCE OF SOCCER SKILLS IN RELATIONS TO THE LEVEL OF PHYSICAL FITNESS” is an area where very few investigators have been attracted. Some studies on physical fitness and some of soccer skill and some of different training methods separately available, but studies on teen age footballers, there physical fitness Impact of different training over there fitness and soccer ability are very limited.

The coverage as presented in this chapter has been attempted to make it as adequate as possible under the circumstances; and some useful knowledge has been extracted by pulling together the relevant findings. The important ones have been noted and critically examined to draw some general conclusions and to use these as reference for comparison with the present study and interpretation there on.

2.1 Extracts of the previous studies and critical estimates of closely related studies have been presented below.

Singh compared effects of Harness Running and Weight-Jacket Running on leg strength, length of the stride and sprinting speed.
Fifteen subjects were then used for each of three treatments and the average age of subjects was sixteen years. Different groups were given different treatments for six weeks. The groups were administered tests for leg strength, length of the stride mid sprinting speed. Pre-test and post-test was conducted. The result of this study disclosed that (a) leg strength and sprinting speed can be effectively improved by administering a systematic resistance programmed comprising of a) Harness Running and Weight-Jacket Running, (b) Harness Running contributes to a significant increase in length of stride, (c) Resistance Running programmed using Weight-Jacket Running employed in the study was not found effective in improving length of the stride.\(^1\)

Roy studied the comparative effect of Acceleration Running, Resistance Running and Sand Running on sprinting speed, explosive leg strength and length of the stride. The subjects were sixty male students of two schools studying in 9\(^{th}\) and 10\(^{th}\) standard. The subjects divided into four groups. One group of subjects Performed acceleration running, other group performed resistance running, third group performed sand running and last group served as control. The experiment was conducted for a period of six weeks. Pre and post tests were conducted. The findings of the were as follows : (1) Sprinting speed and Explosive leg strength can be improved by administering a training programme of acceleration running, resistance running and sand running. (2) Length of the stride can be improved by administering a programme of Resistance running and Sand running, where as Acceleration running is not effective. (3) Resistance running was superior to acceleration running and sand running in improving the

length of the stride. Controlled group did not show any improvement.  

Rogers conducted a study, to determine the effect of the weight of football uniforms on speed and agility. The uniforms classed as heavy (18 - 5 lbs.), medium (16 -3/16 lbs.) And light (14 - 11/22 lbs.). The subjects performed two speed runs and two agility runs with the uniforms and without a uniform. The selected uniform had an effect, on the speed and agility of the subjects. Almost all groups’ comparisons, as the uniform weight decreased, speed and agility performances were faster. The strength index of the players had a significant effect on speed but did not affect agility. 

Humak conducted a study to determine the effect of selected progressive resistance running programme on free running, Speed, circulo-respiratory efficiency and power. Male subjects (N-45) were divided into three equated groups. : Interval running, resistance running (employing an Exer-Genic) and control.

The effects of the six weeks training programme were determined by a pre-test, initial post-test and final post-test for free running speed, power developed by the legs, oxygen debt, rapid and elapsed time for a 600 yard run and walk. Significant improvement

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3 Wm Dudley Rogers, “A Study to determine the effect of the weight of football uniforms on speed and agility,” Completed research in health, physical education and recreation 10 (1968): 111.
was found in oxygen debt repair (.05 levels) and elapsed time for a 600 yard run or walk (.01 levels) between the interval and control group.\textsuperscript{4}

Tressel notified the effects of selected resistance exercise programmed upon muscular strength and speed. The training devices used were: correct O—sizer, Exer-Genic and Weight Training. Male College students (N = 120) were assigned to four groups with the groups assigned to three treatment groups, plus one control group assigned by random techniques. An initial and final test was administered. Larson muscular strength test was used as the measure of dynamic strength. McCoy Strength test for boys was used to determine static strength and an electric timer was used to measure speed. The result of the study disclosed the treatments were equally effective in improving dynamic and static strength.

All three experimental groups improved significantly as compared to the control in all the individual dynamic strength measures and in the majority of the individual strength measures.\textsuperscript{5}

Uppal and Singh conducted a research study on comparative effects of Harness running, weight jacket running on leg strength, length of the stride and sprinting speed. The subject for the study were 45 male students of classes tenth and eleventh. The average of the subject was sixteen years. During the experimental period of six weeks, the group a trained using Harness running, group B perform


running with weight jacket, group C did not perform any activities. Training was carried out thrice a week for both Harness running and weight jacket running. The subjects run over a distance of 80 meters. After the six week experimental period the following conclusion were drawn:

1. Leg length can be effectively improved by administering systematic resistance training programmed comprising of Harness running and weight jacketed running.

2. Harness running contributes to a significant increase in length of the stride.

3. Sprinting speed can be effectively improved by administering a systematic programmed comprising of Harness running and weight-jacket running.

4. Weight jacket running was not found effective in improving length of stride.

5. No significant change in leg strength, length of the stride and sprinting speed in case of control group is obviously a reflection of their inactivity.  

Keith took thirty untrained collage males participated in a ten week study comparing the effects of three different type of training on 800 meter run performance. All subjects were engaged in 20 – 30 minutes of endurance running three times a week. In addition to the endurance running, subjects participated in hill running, sprint training or weight training three days a week. The hill training consisted of repeated 30 second sprints up and eighty percent graded

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hill. Sprint training includes distance running from 50 – 300 meter with 2 – 3 minutes recovery period between sprints. The weight training include cleans, squats, calf-raises, leg-extension and leg-curl. Each exercise was performing in three sets of 8 – 10 R.M

Only the hill and sprint showed significant difference between pre-test and post-test 800 meters run performance. It was concluded that concurrent weight on endurance training, is not an effective way to improve 800 meters run performance of untrained subject.

Groups comparison revealed that both hill and sprint training resulted in significantly greater changes than weight training (P<.02).

Sprinting training significantly improved leg-flexion torque at slow and fast speed ANCOVA results, however fail to establish differences between training groups on the adjusted post-test is kinetic strength measures.

Hill and sprint training resulted in nearly identical changes in the parameter tested. It was concluded that they are effective training method for improving 800 meters run performance in untrained subject. Endurance capacity, anaerobic capacity and percent body fat were significantly singular correlated to 800 meter run performance (P<.01).

Lawman investigated the effects of two training on the development of creation biomechanical factors of sprinting speed i.e. stride length, stride frequency and dynamic range of motion of the femoral shaft. All subject (N=25) were divided randomly into experimental group and control group. Training programmed was

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established thrice a week for a six week period. After six week post test conducted for investigation showed that:

1. Subject who were engaged into training significantly increase speed.

2. Control group did not significantly increase in speed and the only identify variable which showed a significant positive change was flexion of the femoral shaft.

3. Total sample (N=25) significantly increased in speed, dynamic range of motion and femoral flexion.8

Panny investigated the effects of resistance running on speed, strength, power, muscular endurance and agility. The training programmed consisted of forty minutes session per week for six weeks.

Result indicated that:

1. Training programmed of resistance running alone or supplemented by weight training, isometric contraction and repetitive sprinting would significantly increase speed, leg strength, leg power, muscular endurance and agility.

2. Resistance running supplemented by isotonic leg exercises, isometric contraction an repetitive sprinting will not improve, standing broad jump ability as significant as speed, leg strength, muscular endurance and agility.

3. Orthogonal comparison revealed upward trends in improvement of all variables during the six weeks training programmed.⁹

Kusintz conducted a study on the effects of progressive weight training upon running speed and circulo-respiratory endurance. The dependant variables of training speed and endurance were measured before and after a twelve week training period as follows: speed: 50 yard dash, endurance: Mc Cloy endurance quotient and the 300 yards run and muscular strength: the Mc Cloy strength index revision. The experimental group practiced progressive weight training and running while the control group practiced only running. The data were subjected to analysis of variance, two – way factorial analysis of variance and Pearson’s product moment correlation. The conclusion was: progressive weight training and running are more effective than running only in developing running speed and endurance as measured by the 300 yards run: and individuals who began training with initial low strength do not make greater gains in the dependant variables than those with initial high strength.¹⁰

Malhotra et al. conducted a study on physical and physiological stress of playing Hockey on grassy and Astroturf fields. The study was conducted on 12 hockey trainer admitted to NSNIS Patiala, for regular diploma course in coaching. They come to following conclusion, which exhibit the following difference between playing hockey on grassy and Astroturf fields.

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⁹ Giay Dee Panny, “A study of the effects of resistance running on speed, strength, power, muscular endurance and agility” Dissertation Abstracts International 31 (February 1971) : 3937-A.

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

2. Training of players on the Astroturf field is more difficult and time consuming then 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 hard 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 %.\textsuperscript{11}

Amusa selected 46 subjects, who were well conditioned soccer players with at least two year playing experience at the college level. They were tested for running speed, power agility, VO\textsubscript{2} max strength, anaerobic capacity and flexibility. In addition, 11-anthropometric measurements consisting of skin folds and body diameters were taken. Soccer playing ability serve as the criterion and was measured by the rating of three experienced soccer coaches best on selected soccer skill 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, VO\textsubscript{2} max and running speed are considered important

factor in soccer performance. Flexibility, agility lactate concentration and leg power are not considered as valid indicators of playing ability.\textsuperscript{12}

Chakraborty studied the relationship of selected physique characteristics and motor components to the performance in soccer. 20 male soccer players who represented in all Inter University tournaments were selected as subject. Analysis of data 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. Where as in case of height, weight, foreleg length, thigh length, shoulder width, pondoral index, curls index and soccer performance did not seen to have significant relationship.\textsuperscript{13}

Johnson conducted a study to investigate the effects of session of Inter College soccer participation of selected component of physical fitness. The elements of physical fitness measure were agility, cardiovascular endurance, muscular strength of leg and running speed. The subjects were 16 members of Emory University soccer team, 1971. The pre session practice and the competitive session last approximately 10 weeks. It was found that participation in Inter College soccer programme was likely to causes adaptation in the circulatory and respiratory system that would result in increased efficiency on improved cardio-respiratory endurance. It produced

\textsuperscript{12} Latheef O. Amusa “the relationship between soccer playing ability and selected measures of structures and physical physiological performance in college man”, \textit{Completed Research in Health, Physical Education and Recreation} 21 (1979) : 201.

\textsuperscript{13} Debananda Chakraborty, “Relationship of selected motor components and physique characteristics to performance in soccer” (Unpublished master’s thesis, Jiwaji University, 1986).
significant improvement in agility, muscular strength of legs and running speed also.\textsuperscript{14}

Price conducted a study on the relationship of college football players’ strength, speed and agility to the coaches ranking of ability. Playing positions were combined offensive backs, offensive linkman, defensive linkman and to whole group units. The players were further divided into group 1 or group 2. Correlations were then computed between the objective test score and the coach’s subjective evolution. It was concluded that arms strength and agility were not valid, predictors of football agility total strength and total ‘t’ score were moderate predictors of football ability, and leg strength and speed were significant predictors of football ability.\textsuperscript{15}

Dintimen determined whether flexibility training programme, a weight training programme and the combination of both would affect running speed when used as supplementary training programmes to the conventional method of training sprinter. One hundred and forty five hundred subjects were randomly assign to five training group. Groups were tested for flexibility, strength and running speed before and after an eight week training programme. Results shows that both weight training and flexibility training as supplement to spring training increased running speed significantly then by sprint training programme alone.\textsuperscript{16}

\textsuperscript{14} Thomas C. Johnson “The effect of session of intercollegiate soccer participation on selected components of physical fitness” \textit{Dissertation abstract international}: 32 (may 1972). :3355-A.

\textsuperscript{15} N. Gary. Price “The relationship of college football player’s strength, speed and agility to the coaches ranking of agility” \textit{Completed research in health, physical education and recreation} 10 (1968) : P. 130.

\textsuperscript{16} George Blaugh Dintimen “Effect of various training programmes on running speed” \textit{Research quarterly} 35 (December 1964). 456.
Thomson tested five groups of subjects to determine the effect of performance in speed and endurance in swimming, accuracy in basket ball shooting, accuracy in bowling, speed and accuracy in typing and strength of soft ball players. The result showed no improvement as result of informal warm-up immediately preceding testing in swimming, typing or strength formal warm-up did in improved group performance in speed and endurance in swimming, accuracy in basket ball shooting and accuracy in bowling.\textsuperscript{17}

Nolan investigated the effects of warm-up upon the performance of speed, endurance, agility and power. Specific warm-up consisting of stretching type exercise and general warm-up in the form of warm showers upon the performance of speed, endurance, agility and power. 44 occasionally male college students ranging from 17 to 25 years of age were used as subjects for the study. This subject were tested on the side step test for agility, the mile run for endurance, the 40 yard dash for speed and the standing broad jump for power. It was concluded that there wan no over all significance found between the different types of warm-up on the combined performance test of speed, agility, endurance and power.\textsuperscript{18}

Charles conducted a study on the effect of selected explosive weight training exercises upon leg strength, free running speed and explosive power. He took an experimental group of twenty fresh male volunteers who were selected randomly from trampoline and hand ball classes. The experimental group went for a five weeks explosive weight training programme with four sessions per week and three circuits of the exercise per session.

\textsuperscript{17} Hugh Thomson, “Effects of warm up upon physical performance in selected activities,” \textit{Research quarterly} 29 (May 1958) : 231.
The groups were tested before and after the programmes. The experimental group, made significantly greater improvement in leg strength, but not in running speed or explosive power.19

Spielman has conducted the study on the influence of isotonic and isokinetic weight training in vertical jumping proficiency. College males (N=28) where as in a study to investigated this. Isotonic and isokinetic training were assigned to the two excremental groups with the third group serving as control. Training for the exp. groups consisted on isotonic circuit training on a universal weight machine and isokinetic training on a leaper machine. Data analysis included a reliability and reproducibility assessment and ANOVA to determine whether significant. Mean changes had occurred between the groups. Turkey's W-procedure was use to identify the source of significant. (p.05) difference from those of the controls. Although there was no significant difference between mean performances of the two groups, the isokinetic group experienced a higher level of improvement (8.7 percent, 7.3 percent).20

Peter’s study was designed to determine the effectiveness of muscular strength and power development using the external pulley system and free weight training method with slow and fast speed of training, twenty five high school boys and seven girls were randomly assigned to four groups receiving three training sessions per week over a seven week period. Each subject was tested for strength and

18 Clame Nolan Thompson, “The effect of warm up upon the performance of speed, endurance, agility and power” Dissertation abstract international 32 (November 1971) : 2472-A.
Power before and after training programmed. Analysis of co-variance indicate that fast rate of training produced greater improvement in knee extensive strength (p.05) and a fast rate of training produced the best gain in vertical jump performance (p.05).  

Capen conducted a study on the effects of systematic weight training on power strength and endurance. The subjects were divided into two groups of 29 each. Group-A participated in weight training programmed and Group-B participated in conditioning course. Both group met twice a week for 11 weeks. Group-A did arm curl, side bend, two arm press, two hand repetition snatch, stiff leg dead lift, supine press, sit-ups, squat jump, supine pull over, lateral raise, front raise, lateral raise with trunk bent, and lateral raise in supine position (maximum weight times weight added) where as group-B did conditioning exercises like tumbling, bag relays and running for two weeks, lift and carries, hand combats and running for three weeks and conditioning gymnastics for five weeks. Group-A programmed gave greater improvement in muscular strength than did the Group-B programmed. There were no significant differences between the two groups in muscular endurance or in circulo-respiratory endurance. It is of interest, however, to note that Group-A excelled Group-B in all final scores. 

Wilcox compared the vertical leg press method of developing leg strength with a method utilizing bench squats on selected college male students. The subjects were pre tested and post tested for (1) total leg strength, (2) vertical jumping ability, (3) planter flexion (4) knee

21 Lee Kang-Pyung Peter, “The comparison of the Effectiveness of Muscular Strength and power development through training programmed with the external moment forces pulley system and the free weight training method using the slow and fast speeds of training” Dissertation Abstracts International 40 (July 1979): 153-A.

extension, (5) Hip extension and (6) Hip flexion. The experimental period consist of 8 weeks or 16 classes meeting. In conclusion the data seemed to indicate that a vertical leg press method may have produced significant improvement in total leg strength and vertical jump over the method of utilizing bench squat. The result seemed to indicate that there neither a vertical leg press nor a bench squat method will develop leg strength over a short period of time.\textsuperscript{23}

Chui carried out a study on the effect of systematic weight training on athletic power. He conducted his study with 50 subjects divided into two groups namely group A 23 subject and group B 22 subjects. Group A increased the amount of potential power through systematic weight training exercise where as group B did not show much consistent increase.\textsuperscript{24}

Richard studied a two theory of warm-up effects in jumping performance in which eighty girls aged 16 were selected and divided into four sub groups and were given 1, 2, 4 and 6 minutes of stool stepping as a warm-up exercise preceding a 6 trials vertical jump test. It was found that 1 and 2 minutes warm-up improve the performance approximately about 20 \%, while 4 minutes had no effect and 6 minutes improve performance up to 27\%.\textsuperscript{25}

Siridhar studied the 30 male and female volleyball players to see the relationship of selected motor fitness component to playing ability in volleyball. Product movement correlation (zero order) was used to determine the relationship of selected motor fitness components of

\textsuperscript{23} Ronald Jack Wilcox, “A comparison of two weight training method design to develop leg strength” \textit{Dissertation Abstract International} 32 (October 1971) : 1908 – A.

\textsuperscript{24} Edward Chui, “The effects of systematic weight training on athletic power” \textit{Research Quarterly} 21 (October 1950) : 188.

\textsuperscript{25} Doris K. Richards, “A two factors theory of the warm up effect in jumping performance,” \textit{Research quarterly} 39 (May 1966) : 668
playing ability in volleyball and to test the hypothesis the level of significance was set at .05. In the conclusion she found that power was the most significant motor fitness components under laying performance in the game volleyball. Muscular endurance and flexibility also contributed to the volleyball playing ability in a real manner. Agility showed an insignificant relationship to playing ability in volleyball.26

Rosenstein and Frost conducted study of physical fitness of senior high school boys and girls participating in selected physical education programme in Newyork state and found that people’s participation in good programme improved significantly more in physical fitness then participating in poor programme. The greatest improvement was in strength with some genies in agility balance and endurance.27

In a study Buck compared two programs of weight training in regard to their effects upon the development of muscular strength and endurance. Forty nine male college students were tested before and after seven week of weight training, calisthenics and barbell exercises requiring muscular strength and endurance. Upper arm girth measurements were taken with elbow flexed forcefully. Subjects were assigned randomly to a weight group (N=25) training with heavy weight and few repetitions and a rap group (N=24) using lifting weight and more repetitions. Both group made substantial gains in each test. The weight group had greater average in seven of the twelve tests with

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27 Irwin Rosenstein and Ruvban B. Frost, “Physical fitness of senior high school boys and girls participating in selected physical education programme in New York State” *Research quarterly* 35 (October 1964) : 588.
three significant, beyond the 0.02 level of confidence. The Rap Group was significantly superior in none of the testes.28

Corbett compares the exercise frequency after an equal length of time and after an equal number of training sessions. S.H.S. boys (N=28) were assign to one of four groups, three or which were experimental and one control group, one of the experimental groups trained twice a day five days/weeks, a second once a day five days/weeks: the third three times / week. All the three groups used the same basic isotonic programmed to exercise the upper arm muscles. After six weeks of training of the experimental group displayed significant increased in isotonic strength. However no significant difference between any of the experimental groups emerged when compared after and equal length of training time, nor when the experimental groups were compared after and equal number of training periods.29

Oliver conducted a study to determine a comparison of conducting exercise related to performance in rope climbing. The trained one groups with weight twice a week and other with gymnastics three times a week for eight weeks. Both groups make gain in the McCloy athletic strength indexes which were significant at the 0.001 level of confidence. Improvement in rope climbing was slide and non significant although slightly greater in the gymnastics group which had an initial experimental advantage. Weight training exercise

28 Besuard V. Buck, “A comparison of two programmes of weight training in regard to their effects upon the development of muscular strength and endurance” Completed Research in Health, Physical Education and Recreation 5 (1963) : 89.

for the muscles group involve in rope climbing should prove advantageous.30

O’shea determined the most effective method of weight training for the development of muscular strength and muscular endurance required for 400m. Runners 30 students were selected randomly. Following a week conditioning period, the subjects were randomly assigned to specific training groups for eight weeks last period. Form this study it may be concluded that any method of short term progressive weight training involving large muscular groups of the body is effective in improving performance in 400m.run.31

Hansen conducted a study on the effects of three selected weight training programme on muscular strength endurance, girth and cardio vascular endurance. He took thirty fresh man and varsity football players from the 1963 South Dakota state university football teams were randomly divided into three groups. One group used a modification of the Delorme – wetkins methods of training, the second group followed the traditional strength training method, while the third followed a circuit training programmed. Training covered a period of seven weeks, three times a week. Test for muscular strength endurance and girth were administered before the programmed began, at the end of three weeks of training, and at the conclusion of training programmed. All groups significantly improved on all the parameters and there was no significant difference between the groups.32

Balamani investigated the strength, endurance and flexibility variation resulting from a three-set volley ball match played on different surface. The study was conducted on 12 male volley ball players of Lakshmibai National College of Physical Education, Gwalior. She comes to the following conclusion:

1. Muscular endurance and cardio-vascular endurance showed significant increase after playing three set volley ball matches on beaten earth surface and on sand court, whereas for strength and flexibility no significant variations were observe.

2. Volley ball matches (3-set), played on different surface resulted in significant variation in endurance ability but for strength and flexibility no significant difference were observe.33

Stockton studied 9th and 10th grades girls at Billingnan High School and were randomly assigned to four different conditioning programme; Calisthenics or Aerobic (N = 19), Aerobic (N = 26) Calisthenics or shuffling (N = 31) and Calisthenics (N = 26). The effectiveness of this conditioning programme in developing cardio-vascular efficiency as measure by Cotton Modified step test and muscular strength and muscular endurance as measure by the Oregon simplification of the PFI was determined statistical procedures include ANCOVA, Scheffe’s post hoc analysis and ‘t’ ration. Conclusions were Aerobic conditioning produced significant performance (P = 0.05) in cardio-vascular strength, calisthenics

33 B. Balamani, “Strength endurance and flexibility variations resulting from a 3-set volley ball match played on different surface” (Unpublished Dissertation of Master of Philosophy in physical education, Jiwaji University, 1995).
conditioning produce greatest performance (P = 0.05) in muscular strength and muscular endurance.34

Edward conducted a study on the effects of circuit training, weight training and interval training on circulo-respiratory endurance. 51 college male from department of physical education classes at the University of Mexico were randomly assign to one of the three exercises programmed. The subjects trained for a ten week period at their respective exercise programmed. Pre-test and post-test measures of circulo-respiratory endurance were administered under some experimental condition. The analysis of variance showed no significant different between the three exercise programme in the measure of circulo-respiratory endurance.35

Ann has conducted a comparative study on the bio-mechanical and physiological responses of suspended deep water running (SDWR) to hard surface running (HSR). 10 subjects were filmed at incremental speed (3 – 9 mph) (96 m. minl – 288 m. minl – 1) on the treadmill and at increase leg alteration (80 – 164 mph) in the pool. A cinematographically analysis was undertaken to compare faint angles of the two running moods. 20 subjects performed a maximum oxygen uptake taste on a treadmill and running suspended in deep water. Variable analyzed were oxygen uptake, heart ventilation, substrate utilization and lactic Acid production. Significant difference in joint angles was 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

34 Rallis Stockton, “A comparison of three programme and their effect on five physical fitness components” Completed Research in Health Physical Education and Recreation 8 (1966) : 120.
bio-mechanical then HSR. One cannot work as hard during SDWR as compared to HSR and RPE training level for SDWR do not equate to HSR.36

Sharma conducted study on effect of interval training on endurance and playing ability of soccer players. He selected 60 students as subject randomly of Kendriya Vidyalaya, Gwalior who were studying in the 10th, 11th and 12th standards pre and post test was conducted on 12 minutes run or walk test for endurance and McDonald soccer test for performance measure. He conducted interval training (without ball) and interval training (with ball) for experimental groups. The result of this study reveals that interval training group performs with ball proved to be a better method in order to improve the endurance and playing ability of the soccer players.37

Dabie investigated the effectiveness of a conditioning programme on selected tennis skills and the cardio-vascular efficiency of 22 women intercollegiate tennis players. They were ranked 9 matched by the Hewitt tennis achievement tests and randomly placed into control and experimental groups. Both groups participated twice a week in a continuous and strenuous 20 minutes conditioning programme. At the beginning and again in the end of the tennis training session, the Skubic-Hodgkins cardio-vascular efficiency test was given. The Hewitt tests were given at the beginning and end of the training session. The paired ‘t’ test was used to analysis the data. Both group improvement significantly in cardio-vascular efficiency. But there was no significant difference between them. Only the


experimental group improved significantly more than the control group.38

In the study Hess randomly divided the soccer team members (17) in 'to a control group and an experimental group that used progressive resistance exercises to develop hip flexion and knee extension strength for seven weeks. All subjects were proficient in kicking a stationary ball with the instep. All subjects had pre-post test for kicking distance (average of five longest of twenty kicks) and leg strength (sum of the hip flexion and knee extension strength).

Analysis of co-variance showed that the experimental group improved significantly more in kicking distance at the 0.01 level. The ‘t’ ratio showed a significant increase in leg strength at the 0.01 level for the experimental group but not for the Control group.39

Boyer determined the effect of weight training in the development of leg strength and growth velocity of ball in soccer. He divided 21 college soccer players into two groups on the basis of kicking velocity as determined from a measured and time kick leg strength was calculated as the sum of knee extension and hip flexion cab’s tensiometer strength score. An experimental group of 11 subjects participated in a five weeks training programmed of half squat knee bend, knee extension and hip flexion exercises were performed three times a week. At the end of the period all the subjects were retested for the kinking velocity and for the leg strength. Analysis of covariance showed that the experimental group improvement in leg

strength was significantly greater than that of the control group. The gain in velocity of the kicked ball by the experimental group was significant (0.05) superior to that by the control group.\textsuperscript{40}

Willet measured the influence of an in-season weight training program on the strength levels of inter collegiate football players. 31 students from S.D.S.U. formed the experimental group. While 43 students from Sioux Falls College served as control. The experimental group participated in an in-season weight training program. Four parameters were tested three times during the season. Testing involved performance of four maximal lifts, including bench press, leg press, neck press and reverse arm curl. To determine with in the group differences in changes at each test interval, the Dennett’s “t” was used. One way ANOVA was used to assess between group differences. Significant differences in performance during several time intervals were observed for the experimental group. All changes for the experimental group represented an increase in strength. For the control only one difference was significant and this revealed a decrease in performance. No significant group and time interaction was observed with the ANOVA. There was a very significant difference, however at all time intervals between strength level of control group and experimental group. It was included that the use of an in-season weight training program of 15m. In duration, conducted twice weekly was sufficient to maintain the strength of the football players through out the season.\textsuperscript{41}

Baver states that on wet, slippery and icy surface it is best to use safe, short, accurate passes to your team mates ‘feet’. The man

\textsuperscript{40} Robert A. Boyer , “A study of determine the effect of weight training in the development in soccer” \textit{Completed Research in Health, Physical Education and Recreation} 6 (1964) : 89.

with the ball tries to be 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, and uncomplicated kick and rush game using a lot of space is often preferable.\textsuperscript{42}

Shaji conducted a study of performance variations on selected soccer skills on different ground conditions. The study was delimited to only three ground condition, grassy ground non grassy hard ground and muddy ground. The finding showed there were significant difference on selected soccer skills when perform on these different ground condition. 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.\textsuperscript{43}

2.2 Extracts of the previous study and critical estimate of does not closely related studies have been presented below

Helixon investigated the effect of a heavy resistance Ruining programmed upon running and jumping .performance of first, year high school trackmen. Twenty-four subjects were randomly assigned either to an experimental group which engaged in weight training, five days a week for six weeks or to a controlled. II' group which engaged in no weight training. Result showed no significant difference between the experimental and control group at the conclusion of the experiment.\textsuperscript{44}

\begin{footnotesize}
\begin{enumerate}
\item \textsuperscript{42} Gerhard Baver, \textbf{How to succeed at soccer} (London : Orbis Publishing, 1982), P.88.
\item \textsuperscript{43} P. Shagi, “performance variations in selected soccer skills on different ground condition”, [Unpublished Master Degree thesis, LNUPE, Gwalior 1996).
\item \textsuperscript{44} Patricks Helixon, “The Effect of Progressive Resistance Exercise Using. Near-Maximum Strength on the Running and Jumping Ability of First. Year High
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Mendez investigated the relative effectiveness of two training programmed i.e. progressive resistance exercise and sprint training in the improvement of sprinting velocity was determined. Two random groups (N=31) were formed: group 1 (N=16) participated in a weight training programme using the universal real runner a passive resistance exercise machine while group II (N=15) participated in sprint training programme. Subjects were pre and post tested on 60 yards dash, each time allowing one practice run by each student. The duration of the experiment was seven weeks, which included 20 periods of exercise. ANCOVA was used to determine significance of difference between the two groups (P.05). No significant difference was detected between the weight training and sprint training programmed. Both training programmed showed small but non-significant decrease in mean times for sprinting 60 yard.45

Edward revealed through his study the effects of isometric and dynamic weight training exercise upon strength and speed of movement. Ninety- six students were divided into two groups. One group of students did no weight training while the other group used isometric contractions, rapid, or slow contractions in six barbells exercises, performed three day a week for nine weeks. Initial and final strength scores and speed of movement scores against no resistance were obtained; gains in strength were accompanied by gain in movement speed with and without resistance but the difference between the exercise groups were not significant at the 0.05 level.46

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