Chapter II

REVIEWS OF RELATED LITERATURE

The investigator reviewed the relevant literature available in the library of Sports Authority of India, Lakshmibai National College of Physical Education, Trivandrum, Netaji Subhas National Institute of Sports, Patiala, Lakshmibai National Institute of Physical Education, Gwalior, the personal collection of foreign literature available with the experts serving in these institutes and collected a good number of direct research studies on soccer technique, isokinetic and isotonic strength training. The collected materials are presented in chronological order under different headings.

Biomechanics Applied to Kicking

There are a wide range of skills which form the foundation of Soccer performance. Those which have been the subject of biomechanical analysis are the more technical ones, which are concerned directly with scoring. For example, in soccer, shooting at the goal is an aspect of kicking and is the means by which goals are scored. Similarly, heading the ball and throwing can be important
elements of attacking play, while goalkeeping skills are important in preventing the goals.

The kicking action is quite complex and may be divided into four phases; phase one, priming the thigh and leg during back swing; phase two, rotation of the thigh and leg laterally and flexion of hip; phase three, deceleration of the thigh and acceleration of the leg; and finally stage four, the follow through.

During phase one, the hip of the kicking leg is rapidly extended by the action of the gluteals and the pelvis is rotated backwards. The knee is flexed by the hamstrings and the anterior tibialis dorsi flex the ankle. These actions are limited by the hip flexors and adductors which often become overstretched in many players, the harder the subsequent kick, the further the stretch on these muscles. During phase two, the psoas and iliacus contract and the hip flexes to move the thigh, and leg forwards and the pelvis rotates forwards. Phase three involves the hamstrings acting to decelerate the thigh and the quadriceps rapidly extends the knee joint. The position of the ankle joint during ball strike is dependent upon the type of kick performed. In addition, the adductors will contract to pull the leg towards the body. This is especially relevant during a side kick or push pass. Phase four begins
after the ball has lost contact with the foot. The leg and thigh will follow through due to the momentum of the thigh, leg and foot. This causes a stretch on the muscles opposing these actions, especially the hamstrings as they pass over two joints (De Proft et al., 1988). The muscles of the non-kicking leg act in a similar fashion to their behavior during the stance phase of running. However, they act mainly to stabilize the body to provide a stable platform on which the kicking leg may act. This leg is usually abducted and rotated. Again the muscles of the arms and trunk work to maintain posture and balance and provide a counter balance to the kicking leg, thus providing more control and speed.

Brophy et al. (2007) concluded that certain lower extremity muscle groups face different demands during the soccer instep kick compared to the soccer side-foot kick. Similarly, the support limb muscles face different demands than the kicking limb during both kicks. Better definition of lower extremity function during kicking provides a basis for improved insight into soccer player performance, injury prevention, and rehabilitation.

Shan et al. (2005) conducted a study to understand fundamental soccer skills, most focusing on kicking. However, a full picture of an
efficient kick remains incomplete owing to constraints of test designs and difficulties that arise in synchronizing and analyzing information generated by multiple assessment techniques. Previous scientific studies may be generally categorized as: two-dimensional kinematic analysis using high-speed cameras, muscle activity studies using electromyography, three-dimensional analysis of the kicking-leg using a partial-body model, and kinetic studies using force measurements and modelling. No existing inquiries have used full-body three-dimensional motion capture and modelling to examine kicking. The current study remedies this deficiency and defines a full-body model capable of revealing more detailed characteristics of kicking. Additionally, it reveals effects of long-term training by comparing novices with skilled athletes and explores new parameters that have potential to aid quantitative evaluations of skill. Results show effective upper-body movement to be a key factor in creating better initial conditions for a more explosive muscle contraction during kicking. It permits a more powerful quasi whip-like movement of the kicking leg. Finally, the timely change of distance between the kick-side hip and the non-kick-side shoulder provides a quantitative means of measuring kick quality.
Dorge et al. (1999) conducted a study to develop a method to record intramuscular electromyogram (EMG) from the iliopsoas muscle and to relate this activity to the kinetics during the soccer place kick. Seven skilled soccer players performed 3 maximal velocity place kicks. The kicks were filmed with a high-speed camera (400 Hz) and EMG recordings were obtained from 5 muscles of the kicking leg, including wire electrodes inserted into the m. iliopsoas. The EMG signals were compared to the kinetics of the kicking leg, which were calculated from the digitised film. The results showed hardly any torque reversal about the hip joint before impact. Angular deceleration of the thigh segment did not increase the angular velocity of the shank (work -3.57 to 0.0%). M. iliopsoas was active during the entire kicking motion (average EMG 65.1-100.9%), even in the period when the thigh was decelerating. Wire electrodes can successfully be applied to EMG recordings of fast unloaded movements.

Kicking is without doubt the most widely studied in soccer. The mature form of kicking skills has been described by Wickstrom (1995). It is characterized by placement of the supporting leg at the side and slightly behind the stationary ball. The kicking leg is first taken backward and the leg flexes at the knee. The forward motion is
initiated by rotating around the hip of the supporting leg and by bringing the kicking leg thigh forwards. The leg is still flexing at the knee at this stage. Once the initial action has taken place, the thigh begins to decelerate until it is essentially motionless at ball contact. During this deceleration the shank vigorously extend about the knee to almost full extension at ball contact. The leg remains straight through ball contact and begins to flex during the long follow through. The foot will often reach above the level of the hip during the follow through.

**Bloomfield et al. (1979)** analyzed the kicking action of young boys from age of 2-12 years. They looked at various indicators of performance and were able to characterize six levels of developments. Isokava and Lees (1988) investigated the effect of changing the angle of approach on foot and ball velocities. Six male subjects were required to take one step approach in order to kick a stationary ball from angle of 0°, 15°, 30°, 45°, 60° and 90°. Although there was no significant difference between the approach direction, the trend in the data suggested that the maximum swing velocity of the ball was achieved with an approach angle of 30° and the maximum ball velocity with an approach angle of 45°. Therefore, an approach angle between 30° and 45° would be considered optimum and agrees with practical
observations. The explanation for this finding is that with an angular approach, the leg also is angled to the ball in lateral plane, and so can be placed more under the ball and make a better contact. It was noted that a more solid impact position would produce higher ball velocities.

Levanon and Dapena (1998) compared the instep with the side-foot kicks and reported that during the side foot kick for right-footed players, the player orientates the pelvis, the right leg and the foot move towards the right. Although the velocity of the foot at impact in the side foot kick is lower than the instep kick, most of the speed of the foot in both cases is generated by knee extension.

A punt kick and drop kick have been compared by McCrudden and Reilly (1993). They found that the mean range of the best drop kick was 36.1m while for the punt kick the range was 40.1m. They did not measure velocities or angles of projection and so the reason for the superior range in the punt may well be due to angle of projection rather than higher ball velocity.

Elliott et al (1980) investigated the developmental nature of the punt kick. They found similar results to those reported by Bloomfield
et al (1979) in terms of level and age of development of the punt kicking skill.

Browder et al. (1991) described selected 3D characteristics of the instep kick of female players including data for pelvic rotation and hip adduction. They demonstrated that when comparing a fast to a slow kick, the pelvic showed greater rotational range of motion (ROM) for the faster kick than for the slower kick (18° compared to 13°). This suggests an important role for the rotation of the hip in producing high velocity kicks. The authors suggested that pelvic rotation might be a method by which female players enhance the speed of their kick, rather than relying on joint extension at the hip and the knee.

Tant et al. (1991) also claimed that in the performance of maximal velocity of instep kick, males used greater range of motion at the hip and knee while females exhibited greater pelvic rotation.

Lees and Nolan (2002) also showed that increased ball speed was associated with increased range of motion at the hips and increased angular velocity of the knee and hip joints, all of which appeared to be associated with the length of the stride before the kick was made.
Relation between Kicking and Goal Scoring

In a match, kicking at goal is perhaps regarded as the most important feature of the soccer game. Grant et al. (1998), after analyzing the 1998 reported that the most common techniques used were the inside and instep of the foot, 36.3% of goal scored per category. The instep was the most successful technique employed for goal scoring during open play. Headed goals accounted for

18.6 % of the goals scored and was most successful technique during set plays. However in the 1990 World cup, 24.4% of goals were scored via header. The reduction in headed goal in this World Cup may reflect a change in the playing style, possibly due to an increased emphasis on controlled possession play as opposed to more ‘risky’ crosses and long passes. The inside of the foot was used to score 16 out of 17 goals from penalty kicks (excluding missed penalties and shoot outs). This suggests an emphasis on placement rather than power by successful penalty taker in the 1998 World Cup. The successful shooting techniques used were inside 36.3%, outside 5.3%, instep 36.3%, trunk 2.9%, head 18.6% and toe 0.6%.
Jinshan et al. (1993) after analyzing the 14th World Cup reported that the successful shooting techniques used were inside of the foot that accounted for 24.4%. Front, 18.3%; Instep 28.7%; outside, 1.7%; toe kick, 0.8%; heading, 24.4%; sliding, 1.7%. Among various shot at the goal, 8.7% of the total goal were volleyed, these included volley with sharp turnoff of the body. In this competition, 32 goals resulted from an attack down the wing (27.8%), most of which were completed by a cross; long crosses from midway of the field of play.

Olsen (1988) after analyzing 52 matches of Mexico World Cup, 1986, reported that most goals were scored with one touch on the ball. More than 90% of the goals were scored with a kick from within a distance of 16m from the goal.

Importance of Kicking in Set Plays in Modern Soccer

Scoring from a set play is defined as a score accounting to less than 5 seconds after a restart as it is by a direct kick. FIFA (2002) reported that 161 goals were scored in this World Cup at an average of 2.51 per game, which represent a significant drop in comparison to France ‘98’(171 goals, an average of 2.67). However such a difference could have been predicted after the group stage (130 goals, average of
2.71) as opposed to 126 (average f 2.63) at the same stage of four years previously. Likewise the number of successful set pieces also fell from 62(36.3%) to 45(28%). On the other hand, off that number, goals scored from direct kick rose to 11(24.4%), compared to the 6 (9.7%) scored in the France 1998. A total of 18 penalties were awarded, as in the previous World cup. Goal scored after a corner kick 16 (35.6%), free kick 5 (11.1%), throw in 0(0%); direct kick 11 (24.4%), penalty 13(28.9%).

Grant et al. (1998) reported that 24.6% was scored from set plays. Set plays and penalties combined accounted for 34.5% of goals scored, an increase on 1986 (27.3%) and 1990 (33.9%) World cup. Olsen (1988) reported that 34 goals in Mexico World Cup matches occurred from set play situations (set pieces).

Hughes (1980) estimated that 40 % of the goals scored at international matches were scored from set plays (set pieces) which is significantly higher than the 25% figure provided by 1986 World Championship.

Jinshan (1986) reported that the goals scored from set play accounted for 26% of the total goals scored in the 12th World Cup,
27.3% in the 13th World Cup and 32.2% in the 14th World Cup. There is an increasing tendency to take advantage of set plays mainly from free kicks near the penalty area, corner kicks and penalty kicks. In these competitions, except for 5 goals direct shot from pivot instep kick and 13 goals from penalty kick, 19 goals were executed from free kicks and corner kicks assists. In term of the methods, there were not only the simple, powerful accurate "one push-one shot", "flexible" one pass-one shot tactics, but also tactical-free kicks," were employed. All these help to provide many scoring chances.

**Effect of Strength Training**

*Manolopoulos et al. (2006)* conducted a study on ten soccer players constituted the experimental group and ten players served as a control group. The experimental group followed a 10-week soccer-specific training program combining strength and technique exercises. All participants performed an instep soccer kick using a two-step approach while three-dimensional data and EMG from six muscles of swinging and support legs were recorded prior to and after training. Maximum isometric leg press strength, 10-m sprint performance and maximum speed performance on a bicycle ergometer were also measured. The present results suggest that the application of the
training programs using soccer-specific strength exercises would be particularly effective in improving of soccer kick performance.

Christou et al. (2006) concluded that soccer training alone improves more than normal growth maximum strength of the lower limps and agility. The addition of resistance training, however, improves more maximal strength of the upper and the lower body, vertical jump height, and 30-m speed. Thus, the combination of soccer and resistance training could be used for an overall development of the physical capacities of young boys.

Manolopoulos et al. (2004) conducted a study to examine effects of lower limb strength training on physical conditioning and kinematic characteristics of instep kicking in 16 young amateur soccer players who participated in initial and final laboratory tests. In addition to their standard preseason soccer program, 8 players comprised the experimental group, who performed an 8-wk. strength-training program. Maximal and relative isometric force of the lower limbs were significantly improved. Moreover, toe and ankle linear velocity during ball contact, ball velocity, as well as ankle, knee and hip angular velocities of the kicking leg were significantly increased. It is concluded that conditioning and kinematic indices of the kicking
performance could be improved after strength training of the lower limbs.

Ahtiainen et al. (2002) conducted a study with eight male strength athletes and eight physically active, but non-strength athlete as subjects. The experimental design comprised a 21-week strength-training period. He concluded that isometric force increased by 4.1±10% and 20±22% during the training period in strength athletes and non-athletes respectively. Maximal isometric force to muscle CSA ratio measured by MRI was greater in strength athletes than in non-athletes. There was no significant change in serum basal hormone concentrations. Significant acute decrease occurred in isometric force after heavy resistance exercise, but no difference was observed between the groups or the loading at 0 and 21 weeks. However, the response in total and free testosterone and growth hormone tended to attenuate after the training period in strength athletes. Basal testosterone concentration and changes in isometric force after the 21 weeks period correlated with each other in strength athletes. The changes in the acute testosterone response between weeks 0 and 20 and changes in muscle CSA during the 21-week training correlated with each other in non-athletes.
Dutta et al. reported that Isokinetic strength training for six weeks improved the maximum strength (peak torque) and explosive strength (torque acceleration energy) of flexors and extensors of hip joint, flexors of knee joint and dorsiflexors and plantar flexors of the ankle joint.

Ahtiainen et al. (2002) concluded that the hypertropic resistance exercise led to acute neuromuscular fatigue observable with large acute decreases in maximal force and EMG associated with increased blood lactate concentrations. The protocol also led to acute changes in plasma volume and thickness as well as in muscle architecture observable with increased pennation angle. This study indicates that acute decrease in force production of the activated muscles after intensive resistance exercise is caused by neural and metabolic factors. However, the acute changes in muscle’s architecture may also partly contribute to the fatigue associated the decrease in muscle performance via mechanical factors, since the increase in PAN leads to decrease of effective contractile force exerted onto the aponeurosis.

Blazevich et al. (2002) conducted a study with seven untrained men and 8 women and concluded that changes in knee extension
torque are rapid (2-5 wk) in previously non-strength trained subjects. The relatively greater increase in eccentric strength compared to concentric strength suggests a greater window of adaptation exist in eccentric phase. These changes are not mirrored by adaptation in muscle architecture. Nonetheless, muscle size was related to strength after, but not before, training, which implicates neural mechanisms as a factor affecting strength changes. Thus, while rapid architectural adaptation may occur in well-trained athletes, such adaptation appears not to occur in previously untrained subjects.

Coserotti et al. (2002) concluded that changes in velocity determinants seemed to be the main contributor to the changes observed in peak power and probably in jump height. Surprisingly, force at peak power did not exhibit any increase after the training but rather a negative trend. The ability to accelerate the body mass during acceleration eccentric phase and ability to decelerate it during the eccentric deceleration phase also showed a negative trend after training. However, this result may be interpreted as more efficient use of the counter movement. When a lower body pre stretch load is applied. Thus the subject may have more optimally used the
potentiating effect of the eccentric phase after the training in to produce higher jump.

**Relationship between Strength and Kicking**

Various studies have focused on the effectiveness of strength training for soccer players. *Dutta et al.* (2002) reported that isokinetic strength training of lower limbs muscles for six weeks improved performance of kicking in soccer with respect to distance and accuracy.

*Masuda et al.* (2005) concluded that different approach angles would alter the requirement on muscle strength potential of both kicking and supporting leg during kicking. Especially an angled approach to the kick direction could require greater hip extension and abduction strength on the supporting leg for a higher capability for stabilizing body balance. Besides, skill level may alter the importance of muscle strength requirement to kick performance.

*Aagaard et al.* (1993) conducted a study with twenty-four soccer players who participated in a strength-training programme involving knee extension - flexion with either high resistance (HR), low resistance (LR), loaded kicking movement with ball (FU) or served as controls (con). The entire training activity was surveyed and
controlled. It was reported that kicking performance was not improved by any of the groups and concluded that the lack of transfer from the gain in muscle force and muscle power in enhanced functional performance could be due to hip muscles being more important in kicking performance than the quadriceps muscles as reported by Robertson and Mosher (1983) and Narci et al. (1988).

Some studies have indicated a relationship between dynamic muscle performance in laboratory and field contexts. Asami and Togari (1968) reported a significant correlation between knee extension power and ball speed in instep kicking, both increase with experience in the game.

Cabri et al. (1988) worked on eleven players and a control group of ten adult non-soccer players. Strength of both extensor and flexors at the knee joint and the hip was measured by means of an isokinetic dynamometer (Kin Con) and kicking performance was measured with standard technique. Kick performance was found to be greater in soccer players that lead to the conclusion that greater muscular strength will result in a greater kick performance. The finding of the studies confirmed the statement that kick performance correlates significantly with concentric strength of knee extensors and eccentric
strength of knee flexors. Reilly and Drust (1997) also observed high correlations between peak muscle torque and angular velocity (at a range of velocities up to 6.98 rads^-1) in female soccer players. Monolopoulus et al. (2002) conducted a study with twenty amateur soccer players. They were divided into two groups, each consisting of ten subjects. Group A followed a 10 week soccer specific power training programme which combined soccer drills with jumping, sprinting and explosive exercises, Group B served as the control group. It was concluded that soccer specific training resulted in significant increase in linear velocity of the foot, ankle and thigh as well as linear velocity of the ball. There were no significant training effects on angular velocity of the hip, knee and ankle.

The relation between leg strength and kick performance implies that strength training could be effective in improving the kicking abilities of soccer players. Given a certain level of technique, it seems that strength training, when added to the normal soccer training improves both muscular strength and kicking performance (DeProft et al. 1988). However, such reports are not always mirrored in the recent literature. For example, Aagaard et al. (1996) have shown that a mix of generic and movement specific resistance training techniques
to improve knee flexor strength produced no concomitant change in the ball velocity after 12 weeks of training. Helgerud et al. (2001) reported no significant change in the ball velocity after an 8 week programme of training while Cometti et al. (2001) reported that high levels of isokinetic knee extensor strength between professional and amateur players were not reflected in ball velocity.

Effect of Different Mode of Strength Training on Performance in Kicking

The strength of knee extensors in isolation is not the sole determinant of ball velocity. Kinematic analysis of kicking actions highlights the complex synergy between the hip and the lower leg movement pattern initiated during striking of the ball. (Nunome et al. 2002). Where this synergy is disrupted due either to non specific methods of strength training or assessment, any potential relationship inherent between lower limbs strength development and ball velocity will be disrupted. Improved rates of force development and improved coordination are potential antecedents to improve the development of kicking velocity (Almasbakk Hott, 1996) as such motor control factors may override muscular strength in well-trained soccer players and obscure potential relationship.
De Proft et al. (1988) conducted a study with 22 male soccer players and eleven soccer players, who were asked to participate in a strength training programme, consisting of multiple repetitions at 80% of the maximal voluntary effort of different leg muscles in addition to the normal training. Comparing strength before and after the training period, the strength-training group of the soccer players showed a significant increase not only in concentric and eccentric strength, but also in kicking performance.

Cabri et al. (1988) reported that isokinetic strength training could be effective in increasing the kicking performance of soccer players.

Trolle (1993) conducted a study on twenty-four soccer players. The subjects performed either hydraulic strength exercise at high resistance (RR) or low resistance (LR) or trained functionally in a load kicking movement without ball. The training consisted of 36 sessions over a period of twelve weeks. Only with high resistance training group (HR) there resulted a significant improvement in knee extension strength but no significant change in the ball velocity was observed from any of the groups.
Narci et al. (1988) conducted a study on eleven male subjects of which three of them were fifth division soccer players while the others were unaccustomed to this game. They reported that high correlation exists between maximal ball velocity and isokinetic torque produced by hip flexor and knee extensor muscles. The hip flexor proved to play an important role in kicking than knee extensor even if their contribution appears to be lower than that found by Haung et al (1982) and Robertson and Mosher (1983). The findings of this study suggest that strength training should be particularly focused on hip flexors.

Poulmedis (1988) investigated the correlation between initial ball velocity and two physical characteristics relative isokinetic torque of the lower extremity and muscle contraction velocity. Initial ball velocity correlated significantly with relative isokinetic muscle torque at different angular velocities. Initial ball velocity was significantly correlated with muscle contraction velocity. These results indicate that physical qualities, i.e., relative isokinetic torque and muscle contraction velocity are significant variables related to soccer ball velocity, which is considered to be an important factor of soccer kicking performance.
Taiana et al. (1993) conducted a study with a goalkeeper, 5 defenders, 5 midfielders, and 4 forwards to see the influence of maximum strength training of lower limbs of soccer players on their physical and kick performance and reported that the progress achieved was better in most explosive exercises which were closest to the skill required in soccer. The whole group progressed significantly in the kick test.

Comparison of Effect of Isotonic Strength Training and Isokinetic Strength Training on Various Muscle Groups

Sentilles (1980), while working with seventeen female intercollegiate Volleyball and basketball athletes reported that isotonic measures were superior to isotonic procedure in developing or maintaining strength fitness in elbow flexion shoulder flexion and shoulder abduction. There was a significant improvement in the shoulder press, quadriceps lift and hamstring curl within the isokinetic group. Isotonic training procedures were found to be superior to Isokinetic method for maintaining and developing strength fitness in female athletes.
Roy (1987) studied six male subjects who performed exercise regimen of repeated knee extension exercises in an attempt to induce size and strength changes in the quadriceps muscle. Training was performed 3 days/week for a period of eight weeks. He reported that girth measurement created for subcutaneous fat and expressed as thigh volume, showed significant improvement in hypertrophy before training; No significant difference was found in muscle hypertrophy between pre and post isokinetic training.

Tests

Stone (1994) used IRM technique for strength testing and muscular endurance. Tests consisted of maximum repetitions either at a designed resistance or at a percentage of IRM in order to assess “strength/endurance effect” from three resistance training protocols that employed progressive resistance training protocols with fifty college women to one of the three resistance training protocols that employed progressive resistance with high resistance/low repetitions, medium resistance and medium repetitions and low resistance/high repetitions. There were significant pre/post strength increases in upper and lower body tests and also absolute muscular endurance increased significantly.
Ben-Sira (1995), in his study used a starting load of 65% of 1-RM with 3 sets of 10 repetitions, twice weekly for 8 weeks. The load was increased by 5% every two weeks to assess the effect of different type of strength training on concentric strength in women, super maximal eccentric training and conventional training improved concentric strength significantly.

De Renne (1996), in his study to see the effect of training frequency on strength maintenance, conducted strength test prior to a IO-RM in the core of exercises to be done during the pre and in season training periods. The boys were evaluated for 1-RM in criterion exercises of supine bench press and leg press. The 1-RM bench press was measured using the concentric strength supine bench press test as reported by Gillian (1981) and I RM leg press was assessed using the leg press test as reported by Ramsay et al (1990). The evaluations were conducted before and after 12 weeks of preseason training session and at the end of the l2-week season training session.

Burley et al (1961) conducted a study on 7th, 8th, 9th grade girls for evaluation of their power, speed and flexibility and to determine the relationship between power and flexibility and speed and certain anthropometrics measures. The 9th grade girls broad jumped
farther than 7th and 8th grade girls. However, no significant relations were found in the other items studied.

**Malhotra et al (1981)** designed standards for evaluating general physical fitness of Indian National Sportsmen. A Battery of tests for measuring factors like strength, speed, endurance, agility, and flexibility. For strength they conducted the bent knee sit-ups, push-ups and standing broad jump.

**Bosco et al (1981)** reported that in their research work the subject performed training following the programme consisted of exercise with weight, drop jumps and practice session including jumping and 70-90 jumps per session for three weeks and the subject improved vertical jumping ability by 4.8 cms.

**Bosco and Pittera (1982)** carried out a research in which subjects were trained 3 sessions per week for 8 weeks. The subjects performed regular jumping exercise with additional weight, drop jumps and practice sessions including jumps. The subjects did 100-170 jumps per session and were found to have an improvement of 9.4 cms in vertical jumping.
Malone (1988) the Cybex 340 is the newly released isokinetic system that is a multiple step up from the older model the Cybex II that is also used to test strength of the muscles of various joints. The system includes improved computer, enhancement, electronics, mechanical features and stabilization. The Cybex 340 software now gives clinical information in color graphic with speed, versatility and multiple capabilities. As per Compendium of Isokinetic testing (1987), strength is defined as any velocities at or below 60°/sec. Therefore, if one is testing strength in an individual, the preset speed should be at or slower than 60°/sec; commonly used speeds are 30°/sec, 45°/sec, and 60°/sec and the test faster than 60°/sec are considered to be power test.

Optimal Number of Repetitions to Be used with Isokinetic Training

Bindle (1987) conducted a study with 23 females in order to assess the optimal number of repetitions to be used with kinetic testing. The groups were: Group I-Control; Group II-3x5 rep; Group III-3 x10 rep; Group IV-3x15 rep; Group V-3x20 rep. All the subjects trained with full range isokinetic knee flexion and extension 3 days/week for 6 weeks at 180°/sec. The most important patterns were the significant improvement of 5 and 10-repetition group in the strength measures,
and 15 and 20 repetitions group in endurance parameter. Overall, 10 rep group showed the most consistent improvement in all measures.

**Optimal Number of Repetitions to be used with Isokinetic Training to Increase Average Power**

Davis (1987) worked with female subjects and randomly assigned them to training groups of varying repetitions. All experimental subjects trained with full range of motion isokinetic knee flexion and knee extension 3 days/week for 6 weeks at 180°/sec. All the subjects had their quadriceps and hamstring pre and post tested on Cybex II dynamometer at 60°, 120°, 180°, 240° and 300°/sec for average power. Two experimental groups 10 rep x 3 sets and 20 repetitions x 3 sets significantly improved with training. Both these group improved at and below the training velocity at 180°/sec demonstrating a specificity response. So he concluded that in isokinetic training the repetition should be specific to body weight if power has to be improved.
Optimal Number of Repetitions to be used with Isokinetic Training to Increase Peak Torque

Davis (1986) conducted a study to determine the optimal number of repetitions necessary to maximal effectiveness for isokinetic training. Subjects were randomly assigned to training groups of varying repetitions. (1) Control Group. (2) 5 rep x 3 sets. (3) 10 rep x 3 sets. (4) 15 rep x 3 sets. (5) 20 rep x 3 sets. All experimental subjects trained with full range of knee motion for hamstring and quadriceps 3 days per week for six weeks at 180°/sec. Results of the testing for peak torque showed that only the groups 3 and 5 significantly improved with training. Both these groups improved at and below the training velocity of 180°/sec. It was concluded that in isokinetic training the repetition should be specific to the body weight ratio to improve peak torque.

Isotonic Tests, Optimum Repetitions and Intensity

Most of the studies have found that RM that allows for six or fewer repetitions (i.e. Low RM) provides the most strength and power benefits; that weight based 6 RM-12 RM provide moderate strength, power and endurance gains and that weight based on RM of 20 repetition and above provide primarily muscular endurance gains with
no strength gain, Fleck (1987); Pauletto (1988); and Simmons (1988). High intensity is usually considered 90% of the given RM or higher, moderate intensity at 70% to 90% of the RM, and low intensity at below at below 70% of the RM. Tesch (1982 and 1984); Stone (1988).

Tests for Measuring Football Skill Abilities

An early battery of soccer skills for girls was described by Vanderhoof (1932) which was not scientifically devised, covered important element in soccer, including dribble, trapping, place kick for accuracy, dropped ball kick for distance, volley for distance with forehead, shoulder, hip or knee; throw down securing ball from opponent within a 6 yard circle, tackling, corner kick and goalkeeper’s test.

The first scientifically devised soccer skill test was constructed by Heath & Rogers (1932) for fifth and sixth grade boys and girls based on teachers analysis of the game.

Neilson and Cozen (1934) described four tests dribble, kick for distance, place kick for accuracy, the throw for distance - complete
with achievement scales for boys and girls in elementary and junior high school.

Cozen et al. (1937) devised a battery of tests for high school and college girls involving place kick for distance, punting, dribbling, the throw in and the goal kick. Score tables are available and satisfactory validity and reliability are reported.

Bontz (1942) constructed test and practice technique for children in fifth and sixth grades, consisting of a series of skill administered in consecutive orders. Validity is reported as .92 with subjective criterion and reliability is .93 by odd even method.

Shaufele (1940) constructed a soccer test for ninth and tenth grade girls, which included volleying, passing and receiving, judgment in passing.

McDonald (1951) proposes a soccer wall volley test to predict game efficiency.

Johnson (1963) devised a soccer wall-volleying test with college men at the University of British Columbia.
Crawford (1958) constructed a battery of skill test yielding a multiple correlation of .80 with the criterion of judges rating. The tests are dribbling, foot passing and receiving and receiving, passing and trapping.

Warner (1950) proposed a test of the fundamental skills of soccer based upon evaluation of items by soccer coaches relative to their importance and learning difficulty. The test item includes: kicking for distances right and left foot; corner kick; heading; throw-in for distance; penalty kick; and speed dribble.

Kuhn (1978) constructed test comprising the five tasks. Goal kicking for accuracy, passing for accuracy, slalom dribble, juggling, a circuit task, combining dribble and goal kick (timed). Task (a) and (b) are carried out by preferred as well as non preferred foot; the score is sum total of across both feet.

Van Roussum and Wijbenga (1993) modified the Kuhn test and constructed soccer test includes: Goal kicking for accuracy, passing for accuracy (ground) passing for accuracy (air), dribbling, juggling, and juggling-1 and juggling-2.
Conclusion

After reviewing the literature researcher came to the conclusion that kicking is one of the important skills in football and players mainly in to two forms that is kicking with instep of the foot and kicking with the inner instep of the foot. The strength of lower extremities is found to make positive contribution for speed and accuracy in goal kicking and passing. Different methods and means are used for developing the power of lower extremities. The effect of power training through isokinetic programme is found to differ from the effect obtained through isotonic programme. Experts were found to differ in their opinions as regards to strength training and the role of strength for accuracy in kicking.