Chapter II

REVIEW OF RELATED LITERATURE

This chapter describes the source of review of related literature. The researcher finds out some of the review of literature which could be very supportive and strengthen this study. After going through the available literature, the investigator presented some of the observations and findings of the experts in this area.

The essential aspect of a research is the review of the related literature. In the words of Good, “The key to the vast store house of published literature may open the doors to sources of significant problems and explanatory hypothesis, and provide helpful orientation for definition of the problem, background for selection of procedure, and comparative data for interpretation of results. In order to be truly creative and original, one must read extensively and critically as stimulus thinking.

For any research project to occupy a place in the development of a discipline, the researcher must be thoroughly
familiar with both previous theory and research. The literature related to any problems helps the scholar to discover already known, which would enable the investigator to have a deep insight, clear prospective and a better understanding of a chosen problem and various factors connected to the study. So a number of books, journals, and websites were referred to. In the following pages, an attempt has been made to present briefly a few of the important researchers and studies conducted abroad and in India, as they have significant bearing on the present study.

The literature in any field forms the foundation upon which all future work is built. If the researcher fails to build upon the foundation of knowledge provided by the review of literature, the researcher might miss some works already done on the same topic. The reviews of the literature have been classified under the following headings.

1. Studies on Physical Variables
2. Studies on Psychomotor Variables
3. Studies on Psychological Variables
4. Studies on Performance Variables
1. Physical Variables in Different Playing Positions

Bhanot & Sidhu (1983) studied anaerobic power in relation to field position of 90 Indian hockey players. These players included 10 goalkeepers, 16 backs, 20 half-backs and 44 forwards. The goalkeepers possess maximum and forwards possess minimum anaerobic power while in vertical velocity, the former are the fastest and the latter are the slowest. It was concluded that in body weight the backs are heaviest followed by half-backs, goalkeepers and forwards. Among backs, the lefts are heavier, faster and have more anaerobic power than rights. In half-line players, the centre-half-backs are followed by left-half-backs and right-half-backs both in body weight and anaerobic power, while in vertical velocity, the left-half-backs are the fastest and centre-half-backs are the slowest. Among forwards, the centre-forwards are heaviest with maximum anaerobic power and are followed by inside-forwards and outside-forwards, whereas, in vertical velocity the inside-forwards are fastest followed by centre-forwards and outside-forwards.

Ali & Farrally (1991) sought the suitable methods for obtaining objective data on the time spent by players of different positions during walking, jogging, cruising, sprinting and standing still during match play activities. Computer programs
and filming analyses with a simple notation system based upon symbolic representations of movements have been devised for analysis of individual players' behavior. It was concluded that there are significant differences among the players for different positions on the field, for example the time spent on walking, jogging and standing still differed among attackers, defenders and midfielders. A new method has been developed to obtain reliable information about the players' movement and performance in the game.

Scott (1991) established a data base of physical norms for elite male field hockey players. Direct measurements were made on eight parameters and a further three derived variables were calculated. It was concluded that, grip strength, in both right and left measures was above that of norms for male adults and there was no significant difference between left and right grip strength. The players appeared to have good leg strength with very little variability amongst the players. On the other hand, flexibility was poor and results indicated a wide range of variability in the sample group tested.

Duthie, Pyne Hooper (2003) analysed the game of rugby union. Forwards are typically heavier, taller, and have a greater proportion of body fat than backs. These characteristics are
changing, with forwards developing greater total mass and higher musculaity. The forwards demonstrate superior absolute aerobic and anaerobic power, and muscular strength. Results favor the backs when body mass is taken into account. The scaling of results to body mass can be problematic and future investigations should present results using power function ratios. Recommended tests for elite players include body mass and skin folds, vertical jump, speed, and the multi-stage shuttle run. Repeat sprint testing is a possible avenue for more specific evaluation of players. During competition, high-intensity efforts are often followed by periods of incomplete recovery. It was concluded that the total work over the duration of a game is lower in the backs compared with the forwards; forwards spend greater time in physical contact with the opposition while the backs spend more time in free running, allowing them to cover greater distances.

Scott, Roe, Coats & Piepoli (2003) discussed aerobic exercise physiology in a professional rugby union. Forward and backline players from a team of elite rugby players were tested to evaluate the differences between the two groups. 28 male players, 15 backs and 13 forwards, underwent maximal treadmill cardiopulmonary exercise testing (CPX), lung
spirometry, a 3 km timed run, and body fat measurement. It was concluded that backline players have a higher peak oxygen uptake per kilogram than forwards, although the cardiopulmonary exercise test duration, degree of anaerobic metabolism, and a 3 km run time are not significantly different.

Magalhães, Oliveira, Ascensão & Soares (2004) described and compared isokinetic strength profiles in athletes of different sports and positional roles. Twenty-eight elite volleyball players and 47 pro soccer players (goalkeepers, n = 5; full-backs, n = 7; defenders, n = 10; midfielders, n = 15; forwards, n = 10) were evaluated using an isokinetic dynamometer (Biodex-System 2). It was concluded that soccer and volleyball players do not seem to be different concerning BD although a significant difference was observed in hamstrings at 90 degrees x s(-1). Moreover, our data suggest that specific demands of these sports and the different positional roles in soccer did not induce bilateral leg imbalances.

Newman, Tarpenning & Marino (2004) examined the relationships between leg strength, single-sprint speed, and repeated-sprint ability. Thirty-eight football players from 3 codes (soccer, rugby league, rugby union) completed a 12- x 20-m repeated-sprint protocol and were evaluated for peak isokinetic knee extension and flexion torque at 60 degrees .s(-1), 150
degrees .s(-1), and 240 degrees .s(-1). However, the data suggest that factors other than strength contribute to repeated-sprint ability. This finding provides new evidence in elucidating the relationship between strength and repeated-sprint performance.

Spencer et al (2005) determined the changes in time-motion analysis of 14 elite male field hockey players during three games within a period of four days during an international tournament. In addition, the nature of and any changes in repeated-sprint activity were investigated using a criterion of a minimum of three sprints with a mean recovery duration between sprints of < 21 s. In summary, the results suggest that when elite field hockey players play three games within four days there are significant changes in time-motion analysis.

Elferink-Gemser, Visscher, Van Duijn & Lemmink (2006) underlined the development of interval endurance capacity in talented youth field hockey players in the 12-19 age band. A total of 377 measurements were taken over three years. A longitudinal model for interval endurance capacity was developed using the multilevel modelling program MLwiN. With the model, scores on the interval shuttle run test can be predicted for elite and sub-elite male and female field hockey players aged 12-19 years. It was concluded that during
adolescence, both male and female elite hockey players show a more promising development pattern of interval endurance capacity than sub-elite youth players. Percentage of body fat, additional training hours, and motivation influence this development. However, differences between the individual players are still considerable.

Gabbett (2006) compared the physiological and anthropometric characteristics of specific playing positions and positional playing groups in sub-elite rugby league players. Altogether, 415 sub-elite rugby league players underwent measurements of standard anthropometry, muscular power, speed, agility, and estimated maximal aerobic power. Props were significantly heavier and had a greater skinfold thickness than all other playing positions. Centres, fullbacks, and hookers were faster than props over 40 m. The results of this study demonstrate that few physiological and anthropometric differences exist among individual playing positions in sub-elite rugby league players, although props are taller, heavier, have greater skinfold thickness, slower 10-m and 40-m speed, less agility, and lower estimated maximal aerobic power than other positional groups.
Ostojic, Mazic & Dikic (2006) described structural and functional characteristics of elite Serbian basketball players and to evaluate whether players in different positional roles have different physical and physiological profiles. Five men's basketball teams participated in the study and competed in the professional First National League. According to positional roles, players were categorized as guards (n = 20), forwards (n = 20), and centers (n = 20). It was concluded that guards were older and more experienced as compared with both forwards and centers. Centers were taller and heavier than guards and forwards, whereas forwards had significantly higher height and weight than guards. Centers had more body fat as compared with forwards and guards. Vertical jump power was significantly higher in centers as compared with guards.

Pyne, Gardner, Sheehan & Hopkins (2006) evaluated the utility of fitness assessment and trends in drafting of players in the Australian Football League, we analysed height, mass, skinfolds, 20-m sprint, vertical jump, agility run and endurance assessed in the 495 players attending the annual national draft camps between 1999 and 2004. The result showed that compared with midfield players, ruckmen, tall forwards and tall defenders were decisively taller and heavier, but had poorer
sprint speed, aerobic ability and agility. Finally it was concluded that, fitness assessment is useful for differentiating between player positions and identifying some annual trends in recruitment in Australian football, and that players with a second half birth month have been disadvantaged with lower representation at the national draft camp.

Spencer, Fitzsimons, Dawson, Bishop & Goodman (2006) assessed the reliability of a repeated-sprint test, specifically designed for field-hockey, as it was based directly on the time-motion analysis of elite level competition. The test consisted of 6 x 30-m over-ground sprints departing on 25s, with an active recovery between sprints. Ten highly trained, male, field-hockey players participated in this study. Following familiarisation, the subjects performed the repeated-sprint test on two occasions, 7 days apart. In summary, it is suggested that this field-hockey-specific, repeated-sprint test is very reliable when the results are presented as the total sprint time.

Vescovi, Brown & Murray (2006) determined and compared positional characteristics of Division I college female soccer players. Sixty-four university soccer players volunteered to participate and were evaluated at the end of their spring season. Test items included height and body mass, acceleration (9.14 m),
speed (18.28 and 36.58 m), agility (Pro-agility and Illinois), lower body power (countermovement jump), and estimated aerobic capacity (20 meter beep test). Similar physical and physiological characteristics were found within this sample of Division I female college soccer players.

Elferink-Gemser, Visscher, Lemmink & Mulder (2007) identified performance characteristics that could help predict future elite field hockey players, and they measured the anthropometric, physiological, technical, tactical, and psychological characteristics of 30 elite and 35 sub-elite youth players at the end of three consecutive seasons. Repeated-measures analyses of covariance, with standard of performance and measurement occasion as factors and age as a covariate, showed that the elite players fared better than the sub-elite players on technical and tactical variables. Female elite youth players also scored better on interval endurance capacity, motivation, and confidence. Future elite players appear to have excellent tactical skills by the age of 14. They also have good specific technical skills and develop these together with interval endurance capacity better than sub-elite youth players in the subsequent 2 years.
Gil, Gil, Ruiz, Irazusta & Irazusta (2007) established the anthropometric and physiological profiles of young nonelite soccer players according to their playing position, and determined their relevance for the selection process. Two hundred forty-one male soccer players who were members of the Getxo Arenas Club (Bizkaia) participated in this study. Players were classified into the following groups: forwards (n = 56), midfielders (n = 79), defenders (n = 77), and goalkeepers (n = 29). Anthropometric variables of participants were measured. Also, their somatotype and body composition were calculated. It was concluded that forwards were the leanest presenting the highest percentage of muscle. They were the best performers in all the physiological tests, including endurance, velocity, agility, and power. In contrast, goalkeepers were found to be the tallest and the heaviest players. They also had the largest fat skinfolds and the highest fat percentage, but their aerobic capacity was the lowest. In the selection process, agility and the jump tests were the most discriminating for forwards. In contrast, agility, height, and endurance were the key factors for midfielders. The defenders group was characterized by a lower quantity of fat.

Vaeyens, Lenoir, Williams & Philippaerts (2007) examined the complex interactions between perception, cognition, and
expertise by using a film-based decision-making test. They stratified 40 youth soccer players into groups by using a within-task criterion. They assigned the players to successful or less successful groups on the basis of their performance on a laboratory-based test of tactical skill. Using soccer-specific film simulations, movement-based response measures, and eye movement registration techniques, the authors determined the players' decision-making processes and skill level. The results showed that investigators can use film-based tests to discriminate soccer players of comparable experience and playing level on the basis of their decision-making skills.

Young & Pryor (2007) determined the relationships between selected anthropometric and fitness measures with indicators of performance in elite junior Australian football players. During the pre-season, 485 players from the elite Victorian under-18 Australian Rules football competition were tested for height, body mass, hand span, arm length, standing reach, vertical jump, 5 and 20 m sprint times, agility, predicted VO(2max) and sit and reach flexibility. The top and bottom four teams on the ladder were also compared after eight games. Players were divided into groups on the basis of the above indicators and the groups were compared statistically by
analysis of variance (ANOVA). It was concluded that shorter and lighter players who possess high levels of speed and endurance are more likely to acquire possessions and be awarded votes. However, these attributes do not guarantee team success. The small relationships between agility and flexibility to performance might be explained by the choice of tests used to assess these qualities.

Aziz, Mukherjee, Chia, & Teh, (2008) examined the construct validity of the running repeated sprint ability (rRSA) test to discriminate performances between various playing positions teams of different level of competitiveness, in trained soccer players. Clubs' players participating in the top local professional league. Comprised professional and semiprofessional players from the National Under-23 and Youth squads respectively, and amateur-level players from a University team. The rRSA test protocol consisted of either 6 or 8 repetitions of 20-m all-out sprints, interspersed with a 20-s active recovery period. The rRSA is a specific physical or fitness attribute of an outfield-position player, and may be of greater importance to the forwards' position. Performance in the rRSA also seems to be associated with a higher level of competitiveness and/or adaptation to resistance training.
Baker & Newton (2008) compared the lower body strength, power, acceleration, maximal speed, agility, and sprint momentum of elite first-division national rugby league (NRL) players (n = 20) to second-division state league (SRL) players (n = 20) players from the same club. Strength and maximal power were the best discriminators of which players were in the NRL or SRL squads. It was concluded that strength and conditioning specialists should therefore pay particular attention to increasing lower body strength and power and total body mass through appropriate resistance training while maintaining or improving 10-m sprint speed to provide their players with the underlying performance characteristics of play at the elite level in rugby leagues.

Gabbett & Mulvey (2008) investigated the movement patterns of small-sided training games and compared these movement patterns with domestic, national, and international standard competition in elite women soccer players. In addition, they investigated the repeated-sprint demands of women's soccer with respect to the duration of sprints, number of sprint repetitions, recovery duration, and recovery intensity. Thirteen elite women soccer players participated in this study. Time-motion analysis was completed during training (n = 39)
consisting of small-sided training games, domestic matches against male youth teams (n = 10), Australian national-league matches (n = 9), and international matches (n = 12). These findings demonstrate that small-sided training games simulate the overall movement patterns of women's soccer competition but offer an insufficient training stimulus to simulate the high-intensity, repeated-sprint demands of international competition.

Kaplan, Erkmen & Taskin (2009) determine the running speed and agility performance by playing positions of soccer players. The sample included 108 professional male soccer players at the national level and 79 amateur male soccer players at a regional level on teams from 10 clubs in Turkey. The study involved the players being assessed by the 10- x 5-m shuttle run test (10 x 5 SRT) on a soccer field in a soccer season. These results indicate that all soccer players have the same running speed and agility performance in accordance with their different playing positions.

Sporis, Jukic, Ostojic & Milanovic (2009) evaluated whether players in different positional roles have a different physical and physiologic profile. For the purpose of this study, physiologic measurements were taken of 270 soccer players during the precompetitive period of 2005/06 and the
precompetitive period of 2006/07. According to the positional roles, players were categorized as defenders (n = 80), midfielders (n = 80), attackers (n = 80), and goalkeepers (n = 30). It was concluded that there were statistically significant differences between attacker and defenders when measuring vertical jump height by squat jump. Midfielders had statistically significant superior values of relative oxygen consumption, maximal heart rate, maximal running speed, and blood lactate than defenders and attackers. Defenders had more body fat than attackers and midfielders.

Wisbey, Montgomery, Pyne & Rattray (2009) quantified the movement patterns of AFL football and differences between nomadic (midfield), forward and defender playing positions, and determined whether the physical demands have increased over a four season period. Selected premiership games were monitored during the 2005 (n=80 game files), 2006 (n=244), 2007 (n=632) and 2008 (n=793) AFL seasons. Players were fitted with a shoulder harness containing a GPS unit. GPS data were downloaded after games and the following measures extracted: total distance (km), time in various speed zones, maximum speed, number of surges, accelerations, longest continuous efforts and a derived exertion index representing playing
intensity. It was concluded that nomadic players in AFL work substantially harder than forwards and defenders in covering more ground and at higher running intensities. Increases in the physical demands of AFL football were evident between 2005 and 2008.

2. Psychomotor Variables in Different Playing Positions

Daus, Wilson & Freeman (1989) analysed the predicting success in football. Clinical interviews were held with the rated most successful starting players for each position on a college football team. Mental strategies for motivation, creativity, belief, learning, decision making, and memory were assessed through these observations. Both offensive and defensive winners have a high visual lead. The auditory sensory modality is LEAST utilized. Creativity and decision making are dominated by the visual sense. It was concluded that mental strategies for motivation, belief, and memory were balanced between visual and kinesthetic sensory modalities. This should reduce costs of selection and placement errors caused by hitherto undetected psychological factors.

Teixeira (1999) investigated using five experienced players at soccer. They were required to kick powerfully balls of two sizes under conditions with defined and undefined targets. High-
velocity cameras were used for three-dimensional analysis. Analysis indicated that the defined target condition led to lower movement speeds and shorter movement times, while balls’ sizes influenced only time after peak velocity.

Junge et al. (2000) evaluated the psychological characteristics of a player might influence his way of playing football and also his risk of injury. A group of 588 football players were studied by questionnaire; additionally, reaction time tests were performed. Psychological characteristics were assessed by three established self-evaluation questionnaires: the Athletic Coping Skills Inventory, the State Competitive Anxiety Test, and the State-Trait-Anger-Expression-Inventory. Football-specific characteristics that were investigated included playing experience and positions played, style of play, number of training hours and games, as well as aspects of fair play. Reaction time was tested twice: without the influence of physical exercise and immediately after a 12-minute run. It was concluded that, a significant reduction in reaction time was observed after physical exercise. In high-level players, the reaction time immediately after the 12-minute run was significantly shorter than it was in low-level players. Also fair play is not paid sufficient respect.
Montés-Micó, Bueno, Candel & Pons (2000) investigated the eye-hand and eye-foot visual reaction time among young soccer players and compared those with non-soccer players in order to evaluate possible differences. A vision screening of 53 young male soccer players belonging to the Valencia Soccer Club was done. Soccer players were divided in three categories. An age-matched sample of 60 young male non-soccer players served as a control population. Eye-hand and eye-foot visual reaction times were determined in players and non-players by means of a computer-controlled stimuli device. It was concluded that eye-hand and eye-foot visual reaction times were found to be different between the two populations evaluated. The results show differences between soccer and non-soccer players, with the soccer players demonstrating faster reaction times.

Ando, Kida & Oda (2001) analysed the reaction time of soccer players and non athletes. Visual Reaction Time (RT) was measured by presenting three different sizes of stimulus to the central and peripheral fields of vision in 6 soccer players and 6 nonathletes. An electromyogram was recorded from the flexor digitorum superficialis muscle of the responding forearm. Peripheral visual RT was longer in comparison to central visual RT due to an increment in Premotor Time. It was concluded that
the soccer players showed shorter Premotor Times during central and peripheral visual RT tasks than nonathletes, suggesting that the soccer players are better able to respond quickly to a stimulus presented to peripheral as well as central positions.

Wassmer & Mookerjee (2002) developed a descriptive profile and examined the relationships between grip strength, power and sport specific test performance in 37 elite, female collegiate field hockey players (N=8 backs, N=13 forwards, N=4 goalkeepers, N=8 midfield players, N=4 wings). The tests included circumference and limb lengths, %body fat, Margaria-Kalamen stair test, 50-yard dash test, Queen's College step test, grip strength, Illinois agility test, field hockey specific skills tests, and a coordination test. It was concluded that there are similarities amongst the defensive and offensive players with international level field hockey players, and that measures of power and sport specific tests are significantly correlated.

Dane & Erzurumluoglu (2003) studied left hand visual reaction times were in 270 right-handed and 56 left-handed young handball players. Reaction time was assessed by a software package. All visual reaction times were longer in women than in men. In the eye-dominant hand and the left eye- left hand visual reaction times, the left-handers had a superiority
over the right handers, but there was no difference between the right eye-right hand visual reaction times of the right- and left-handers. In right-handers, all visual reaction times were longer in women than in men, but there was no sex difference in left-handers. The results suggest that left-handed players have probably an intrinsic neurological advantage.

Zisi, Derri & Hatzitaki (2003) analysed the ground reaction forces developed on the supporting foot during instep kicking to investigate the relation between specific perceptual and motor abilities and the performance of this skill. 45 young soccer players participated in a series of laboratory tests assessing simple, choice, and discrimination reaction time, sustained attention, depth perception, and sense of kinesthesis. Kicking performance measured by the amount of impulse developed on the supporting foot during kicking. The result indicated the significant relation between kicking impulse and measures concerning speed of information processing, and suggests that processes associated with fast response selection may play an important role in instep-kicking performance.

Dawson, Hopkinson, Appleby, Stewart & Roberts (2004) discussed the player movement pattern and game activities recorded in two games each in the 2000 season. The main
findings were: full forward/full back were most different from the other positions, as they were seen to stand more and jog and fast-run less: ruckmen and midfielders were involved in more game activities than the other positions; for all positions, there were more than 150 high intensity movements (fast-run plus sprint) in the game, but these accounted for only 4-6% of total movement time. Improvements in specific pre-season and in-season training practices for different positions should be possible after careful interpretation of these findings.

Sillero Quintana, Refoyo Román, Lorenzo Calvo & Sampedro Molinuevo (2007) evaluated visual abilities such as distance visual acuity, binocular horizontal visual field, simple and choice visual reaction times, and stereoscopic vision in skilled basketball players participating in a 15-day summer training camp. On a test battery, visual abilities were monitored in 473 players of the Spanish Basketball Federation over a 5-yr. period. The players showed outstanding scores on distance visual acuity and stereoscopic vision, and good visual reaction times and horizontal visual fields. When scores were compared by sex and age, significant differences on certain visual measures were observed. Many layers showed crossed eye-hand dominance.
Bretigny, Seifert, Leory & Chollet (2008) compared the upper-limb kinematics and coordination of the short grip and classic drives in field hockey. Ten elite female players participated in the experiment. The VICON system was used to record the displacement of markers placed on the stick and the players' joints during five short grip and five classic drives. Kinematic and coordination parameters were analyzed. The ball's velocity was recorded by a radar device that also served as the drive target. Kinematic differences were noted between the two drive conditions, with shorter duration and smaller overall amplitude in the short grip drive, explained by the shorter lever arm and the specific context in which it is used. It was concluded that no differences were noted for upper-limb coordination. In both types of stick holding, an interlimb dissociation was noted on the left side, whereas the right interlimb coordination was in phase.

Erkmen (2009) evaluated the accuracy and coordination of heading in professional soccer players of different positions. A total of 243 professional soccer players were examined for the study. The Federation Internationale de Football Association Medical Assessment and Research Center (F-MARC) test battery was used to evaluate heading in soccer players. In conclusion,
the reason for the heading of goalkeepers being worse than the others, goalkeepers use their hands in both training and matches, whereas for forwards and defensive players being better than goalkeepers depends mainly on their positions in soccer.

Gstöttner et al (2009) evaluated balance abilities and electromyographic (EMG) latency times of the preferred and nonpreferred leg in soccer players. Whereas side differences between the two legs in force, kicking speed, and joint laxity have been demonstrated in athletes in previous studies, no data are so far available on balance differences. Twenty-one amateur soccer players were tested. Two different balance test instruments were used. For the evaluation of muscle latency times, EMGs were recorded by means of the EquiTest system. The result indicated that the investigations of balance function and muscle response in amateur soccer players did not reveal significant differences between the preferred and nonpreferred leg in the current study.

Schorer & Baker (2009) determined whether the perceptual-motor abilities of highly skilled performers in dynamic, time-constrained sports exhibited the same pattern of age-related decline seen in other areas. The sample for this study
involved five age-specific groups of handball goalkeepers. Each participant completed an eye-tracking task, a temporal occlusion task, and an eight-choice reaction time task. Results revealed age-related declines in motor performance but not perceptual performance. Skilled perception appears resistant to normal age-related declines over time through the use of compensatory mechanisms.

Young & Willey (2009) evaluated a reactive agility test by determining the relationships between the total time recorded for the test and various components. A tester used side-step movements to provide a stimulus for the athlete to change direction. By using electronic timing and high speed video analysis of the test, three times were recorded. These were the time taken for the tester to display the stimulus to change direction (tester time), the time taken by the participant to respond to the stimulus (decision time), and the time taken by the participant to change direction and sprint to the left or right (response movement time). Thirty-one semi-professional Australian Rules football players were assessed by analysing the mean of eight trials of the reactive agility test. It was concluded that perceptual skill as measured by decision time is an important component of the reactive agility test and the tester
time should be controlled by using high speed video recordings to isolate its influence.

3. Psychological Variables in Different Playing Positions

Komaki & Barnett (1977) discussed the improving play execution of offensive backfield on a youth football team. The players, all nine- or ten-year-old males, were members of an offensive backfield on a Pop Warner football team. Three frequently-run offensive plays were broken down into a series of five behaviorally defined stages, permitting construction of checklists suitable for observing the players during both game and scrimmage sessions. The intervention consisted of the presentation and explanation of the appropriate checklist, and frequent contingent reinforcement in the form of feedback and recognition for instances of desired play execution. The results suggest that behavioral specification and positive reinforcement of desired play execution is a viable approach to the coaching of football.

Jones & Swain (1992) examined differences in intensity and direction of symptoms of competitive state anxiety in high and low competitive subjects from the sports of rugby union, basketball, soccer, and field hockey. The 69 men were dichotomized via a median-split into high and low competitive
groups based on their scores on the Sport Orientation Questionnaire. All subjects completed a modified version of the Competitive State Anxiety Inventory-2 30 minutes prior to competition. It was concluded that there were no significant group differences on intensity of cognitive anxiety or of somatic anxiety or on direction of somatic anxiety; however, the highly competitive group of 34 subjects reported their anxiety as more facilitative and less debilitative than the low competitive group.

Ebbeck & Becker (1994) examined the extent to which perceived social, contextual, and personal factors predicted the goal orientations of youth sport participants. The sample consisted of 166 male and female adolescent soccer players, who completed self-report measures at the end of a 7-week competitive season. It was concluded that higher scores on perceived soccer competence, perceived parent task orientation, and particularly perceived parent ego orientation were primarily associated with higher scores on player ego orientation. In addition, higher scores on perceived soccer competence, perceived parent task orientation, and perceived mastery climate, as well as lower scores on perceived performance climate were associated with a higher level of player task orientation.
Losier & Vallerand (1994) studied the relation between the two constructs on a longitudinal basis and in natural settings. Canadian male adolescent hockey players (N = 64) in their first year at an elite level completed a questionnaire in two weeks into the hockey season (T1) and at the end of the regular season (T2), assessing perceived competence and self-determined motivation at both times. The results partially support the hypothesis that over time perceived competence determines motivation but does not exclude the possibility that with time motivation may also influence perceptions of competence.

Slater & Sewell (1994) assessed by using the Group Environment Questionnaire, whether team cohesion in university-level field hockey was a cause for, or an effect of, successful performance. A quasi-experimental longitudinal design with cross-lagged correlational analysis was adopted and measures of cohesion and performance were taken midway and later in the season. The results imply that cohesion-performance relationships should be examined within a circular model, in which cohesion and performance are interdependent.

Terry & Youngs (1996) analysed the effect of psychological state measures in predicting selection during field hockey trials. Field hockey players (N = 128) completed the Competitive State
Anxiety Inventory-2 and the Profile of Mood States about 45 min. before a British Universities trial. The result indicated no significant differences between selected and nonselected players for any preperformance mood or anxiety measure.

Wiggins & Brustad (1996) examined expectations of performance and the directionality of anxiety. Directionality refers to the facilitative or debilitative aspects of anxiety. Subjects were 91 athletes competing in soccer, swimming, and track and field. The Competitive State Anxiety Inventory-2 with an added Facilitative/Debilitative scale and Expectation of Performance scale was employed. Analysis showed that athletes with lower scores on cognitive and somatic anxiety, and higher scores on self-confidence perceived their anxiety as more facilitative of performance. These athletes also had significantly higher scores on the Expectation of Performance scale.

Duffy & Hinwood (1997) assessed whether scores on anxiety among professional soccer players differed when playing a match at home or away. The Illinois Self-evaluation Questionnaire was administered to 30 professional soccer players from the English league (mean age 25) one hour before a match at home and away. Analyses showed no significant differences between scores on anxiety measured before matches.
at home or away. The implications of these findings are discussed.

Gréhaigne, Bouthier & David (1997) examined the contribution of the systemic approach to the analysis of play in team sports. They first focused on the theory of dynamical systems and considered the interactions between the main variables of the different components of systems and subsystems in soccer. In team sports, these variables represent fluctuating conditions, which momentarily constrain the organization of action for the players. Thus changes in the momentary configuration of the game have to be examined in the light of previous configurations, the outline of the defensive strategy and the tactical choices involved. It was concluded that to illustrate the use and benefit of the analytic procedure, two goals are described in terms of dynamic configurations of play and opportunity of choices made by attackers.

Feltz & Lirgg (1998) examined both the pattern of team and player efficacy across a season of competition and the relationships among player efficacy, team efficacy, and team performance in collegiate ice hockey. The team and player efficacies of hockey players from 6 teams in a midwestern collegiate hockey league were assessed prior to 32 games. Official
game statistics were factor-analyzed to produce one useable performance measure, performance outcome. A consensus analysis demonstrated that players held homogeneous beliefs regarding their own and their teams' abilities to perform successfully. Also, when team wins and losses were analyzed across the season, team efficacy significantly increased after a win and significantly decreased after a loss, but player efficacy was not affected.

Terry, Walrond & Carron (1998) investigated the relationship between game location and precompetition psychological states. Male rugby players (N = 100) completed the Competitive State Anxiety Inventory-2 and the Profile of Mood States approximately one hour before a home and an away game. The result indicated that significant differences between home and away locations. Participants scored higher on Vigor and Self-confidence, and lower on Tension, Depression, Anger, Fatigue, Confusion, Cognitive Anxiety, and Somatic Anxiety when competing at home.

Jones, Mace & Williams (2000) examined the relationship between the emotions experienced by 15 international hockey players, both immediately before and during competition, and their performance levels. Data were collected on the players'
emotional states using a revised version of the Feelings Scale of Butler, which was completed retrospectively after the match was played. The results indicate that emotions fluctuate over the competition period, and in long duration sports assessment of emotion during competition predicts variation in performance better than assessment prior to competition.

Reilly, Williams, Nevill & Franks (2000) applied a comprehensive test battery to young players with a view to distinguishing between elite and sub-elite groups on the basis of performance on test items. Thirty-one (16 elite, 15 sub-elite) young players matched for chronological age (15-16 years) and body size were studied. Test items included anthropometric (n = 15), physiological (n = 8), psychological (n = 3) and soccer-specific skills (n = 2) tests. Variables were split into separate groups according to somatotype, body composition, body size, speed, endurance, performance measures, technical skill, anticipation, anxiety and task and ego orientation for purposes of univariate and multivariate analysis of variance and stepwise discriminant function analysis. The most discriminating of the measures were agility, sprint time, ego orientation and anticipation skill. They concluded that the test battery used may be useful in establishing baseline reference data for young
players being selected onto specialized development programmes.

Papadimitriou, Aggeloussis, Derri, Michalopoulou & Papas (2001) evaluated the offensive behaviour of the four elite teams (France, Brazil, Croatia, and Holland) using data from the semifinals of the 18th World Soccer Championship in France in 1998. Twenty eight videotaped soccer games were observed, 7 for each team. The result showed the teams' plan was significantly different only in playing the ball back to the goalkeeper. This last action, used more often by Holland than by the other teams, indicated its restrained offensive behavior, which may be one of the reasons for its defeat in some games.

Smith, Driver, Lafferty, Burrell & Devonport (2002) examined the relation between social desirability bias and responses to the direction modified Competitive State Anxiety Inventory-2 for male soccer players who completed the inventory and Reynolds' 13-item short form of the Marlowe-Crowne Social Desirability Scale one hour prior to a competitive match. Intraclass correlations were calculated to assess the relation between the two sets of scores. These results indicate that scores on both the Intensity and Direction subscales of this anxiety
inventory are significantly related to the tendency to self-report socially desirable answers.

Justin Carré, Cameron Muir, Joey Belanger & Susan Putnam (2006) investigated pre-competition physiological and psychological states of elite hockey players in the home and away venues. Physiological measures included salivary cortisol and testosterone, which were assessed using enzyme immunoassays. In addition, pre-competition psychological states were assessed using the Competitive State Anxiety Inventory-2. Physiological measures indicated that the players had significantly higher pre-game testosterone when playing in their home venue as compared to their opponents' venue. The result showed that there were differences in pre-competition hormonal and psychological states that may play a key role in the ‘home advantage’.

Thomassen & Halvari (2007) conducted a hierarchical achievement motivation approach model tested in relation to effort regulation among 55 male high level soccer players. The motive to achieve success was expected to be positively associated with the mastery goal, which would be positively associated with playing time close to the lactate threshold in the first soccer match period, and this positively associated with the
same magnitude of effort in the second period. The result indicated unexpected significant nonlinear associations between the motive to avoid failure and effort regulation.

Meyers, Stewart, Laurent, Leunes & Bourgeois (2008) examined athletic and pain coping skills of U. S. ODP soccer athletes not previously investigated. Following written informed consent, 70 males completed the Athletic Coping Skills Inventory and the Sports Inventory for Pain. Data were analyzed by competitive level (U-14, U-15), and skill position (goalkeeper/defense, midfield/foward). In conclusion, older, more experienced athletes revealed more positive athletic and pain coping skills than younger, less experienced athletes, although athletes in skill positions requiring spontaneous decision-making skills and split-second adjustment in a constantly changing sport environment (forwards, midfielders) did not exhibit more positive athletic and pain coping skills than those positions requiring reaction and protection (defenders, goalkeepers).

Munroe-Chandler, Hall & Fishburne (2008) proposed that imagery is one way to enhance confidence. Therefore, the purpose of the present study was to examine the relationship between imagery use and confidence in soccer (football) players.
The participants included 122 male and female soccer athletes. Athletes completed three questionnaires; one measuring the frequency of imagery use, two assessing generalised self-confidence, and three assessing self-efficacy in soccer. These findings suggest that if a youth athlete, regardless of competitive level, wants to increase his/her self-confidence or self-efficacy through the use of imagery, the MG-M function should be emphasised.

Sage & Kavussanu (2008) examined the temporal stability and reciprocal relationships among task and ego orientation, task- and ego-involving climates, and prosocial and antisocial behaviour in youth football. Male (n = 156) and female (n = 24) footballers (mean age 14.1 years, s = 1.8) completed questionnaires towards the beginning and end of a regular season. Questionnaires measured goal orientation, perceived motivational climate, and frequency of prosocial and antisocial behaviours. The result indicated moderate covariance stability between the beginning and end of the season. In the cross-lagged analyses, prosocial behaviour at the beginning of the season positively predicted task-involving climate at the end of the season. Task orientation at the beginning of the season
negatively predicted ego-involving climate at the end of the season.

4. Performance Variables in Different Playing Positions

McLean & Tumilty (1993) investigated the characteristics of asymmetry in two types of soccer kick. A low drive and a chip kick from both the left and right foot of 12 elite junior soccer players were analysed. Kick velocity, kick accuracy, position of the plant foot from the ball centre, and time from foot plant to ball contact were measured for each kick. Knee extension and flexion strength were also determined for each leg at 60 degree on a Cybex II Isokinetic Dynamometer. The results showed that this group had strength dominance at all speeds tested on the right side and better drive kick performance with their right leg as determined by mean (s.d.) velocity and accuracy. There was no difference in these parameters between sides for chip kicks.

Williams, Davids, Burwitz & Williams (1994) investigated skill-based differences in anticipation and visual search strategy within open-play situations in soccer. Experienced (n = 15) and inexperienced (n = 15) subjects were required to anticipate pass destination from filmed soccer sequences viewed on a large 3-m x 3-m video projection screen. It was concluded that inexperienced players fixated more frequently on the ball and the
player passing the ball, whereas experienced players fixated on peripheral aspects of the display, such as the positions and movements of other players. The experienced group fixated on significantly more locations than their inexperienced counterparts. This resulted from using 11 on 11 film sequences, which were never previously used in visual search research. The increased frequency of eye fixations was regarded as being more advantageous for anticipating pass destination during open play in soccer.

Levanon & Dapena (1998) gained a better understanding of the mechanics of the inside-of-the-foot passing shot used in soccer ("pass kick"). The motions of the pass kick were compared with those of the full-instep kick ("full kick"). The study followed an inverse dynamics approach, using three-dimensional cinematographic techniques. It was concluded that impact of the ball with the medial aspect of the foot in the pass kick, the player orients the pelvis, the right leg, and the foot more toward the right and introduces a medial component of foot velocity. However, most of the speed of the foot is still generated through knee extension.

Bauer, Thomas, Cauraugh, Kaminski & Hass (2001) manipulated to quantify impact forces and neck muscle activity
in elite female soccer players. The 15 participants were Division I intercollegiate soccer players. Impact forces were measured by a 15-sensor pressure array secured on the forehead. The electromyographic (EMG) activity of the left and right sternocleidomastoid and trapezius muscles was recorded using surface electrodes. Maximum impact forces and impulses as well as the EMG data were analysed with separate repeated-measures analyses of variance. The result showed greater activity before ball contact. The trapezius became active just before ball contact and showed greater activity after ball contact.

The increased muscle activity observed in the neck during the jumping approach appears to stabilize the connection between the head and body, thereby increasing the stability of the head-neck complex.

Nunome, Asai, Ikegami & Sakurai (2002) identified the kinetic aspects of side-foot and instep soccer kicks to understand the different mechanics underlying the two kicks. The motions of both kicks were captured using a three-dimensional cinematographic technique. The kicking leg was modeled as a three-link kinetic chain composed of thigh, shank, and foot, from which joint torques and angular velocities were computed. These results indicated that to hit the ball with the
medial side of the foot, a complicated series of rotational motions are required for the side-foot kick. The hip external rotation torque dominantly exhibited in the side-foot kick caused the clockwise rotation of the thigh-shank plane at the later stage of kicking.

Quarrie & Hopkins (2002) analysed coded videotape recordings of the first match in each Bledisloe Cup series played between Australia and New Zealand from 1972 to 2004. Also analysed the stature and body mass of players. Effects associated with professionalism, weather conditions, and time were estimated with a simple generalized linear model and standardized for interpretation of magnitude. The sample size permitted confident conclusions about effects that were of at least moderate magnitude. Increases in passes, tackles, rucks, tries, and ball-in-play time were associated with the advent of professionalism, whereas there were reductions in the numbers of lineouts, mauls, kicks in play, and in mean participation time per player. Overall, there have been major changes in international rugby match activities and player size over the past three decades.

Cameron & Adams (2003) analysed the kicking footedness and movement discrimination by elite Australian Rules
footballers. This was assessed in 20 Australian Football League players. Assessment of movement extent discrimination of the swinging leg was made while standing on the other leg. An automated device accurately set a stop plate to five different positions and each subject was asked to swing the leg to the plate, and make a non-visual judgment of the movement extent. Forty forward and forty backward swings of each leg were assessed, and based on a subject’s responses, non-parametric signal detection analysis resulted in a movement extent discrimination score. It was concluded that left-foot kickers to have higher movement discrimination ability with their dominant leg, and this may be related to their on-field kicking ability.

Grant et al. (2003) examined how three methods of ball carrying influenced sprinting speed: using both hands, under the left arm and under the right arm. These methods were compared with running without the ball. Their aim was to determine which method of ball carrying optimizes sprinting speed. Altogether, 48 rugby union players were recruited. The players performed twelve 30-m sprints in total. Each sprint consisted of a 10-m rolling start, followed by a 20-m timed section using electronic timing gates. It was concluded that running with the ball in both hands led to the greatest
decrement in sprinting performance, although carrying the ball under one arm also reduced the players' sprinting ability. The results indicate that to gain a speed advantage, players should carry the ball under one arm.

Jackson (2003) examined the consistency of pre-performance routines in international rugby union goal kickers on kicks of varying difficulty and under different amounts of situational pressure. Concentration times and physical preparation times were calculated from video recordings of the 572 place kicks taken during the 1999 Rugby Union World Cup. Analysis of the effect of situational pressure determined by the difference in score before the kick revealed that players tended to have longer concentration times and shorter physical preparation times when the scores were close. It was concluded that there were no differences between the best and worst kickers in the tournament on routine time, consistency or rhythmicity.

Keogh, Weber & Dalton (2003) developed an effective testing battery for female field hockey by using anthropometric, physiological, and skill-related tests to distinguish between regional representative (Rep, n = 35) and local club level (Club, n = 39) female field hockey players. Rep players were significantly
leaner and recorded faster times for the 10-m and 40-m sprints as well as the Illinois Agility Run (with and without dribbling a hockey ball). These results indicate that %BF, sprinting speed, agility, dribbling control, aerobic and muscular power, and shooting accuracy can distinguish between female field hockey players of varying standards. Therefore talent identification programs for female field hockey should include assessments of these physical parameters.

Dawson, Hopkinson, Appleby, Stewart & Roberts (2004) compared the training activities and game demands in football. The movement patterns and game activities of players (from five different positions) during matches in the 2000 Australian Football League. Using lapsed-time video analysis, the same individual players (n= 11) as filmed in matches were also monitored during 21 in-season, main training sessions conducted by their clubs in order to assess the degree to which training activities matched game demands. It was concluded that while some game demands were adequately replicated at training, others were not closely simulated suggesting that after careful interpretation of these results, some improvements in training practices could be made.
Elferink-Gemser, Visscher, Lemmink & Mulder (2004) determined the relationship between multidimensional performance characteristics and level of performance in talented youth field hockey players, elite youth players were compared with sub-elite youth players on anthropometric, physiological, technical, tactical and psychological characteristics. Multivariate analyses with performance level and gender as factors, and age as the covariate showed that the elite youth players scored better than the sub-elite youth players on technical (dribble performance in a peak and repeated shuttle run), tactical (general tactics; tactics for possession and non-possession of the ball) and psychological variables (motivation). It was concluded that in the guidance of young talented players to the top as well as in the detection of talented players, more attention has to be paid to tactical qualities, motivation and specific technical skills.

Elferink-Gemser, Visscher, Richart & Lemmink (2004) evaluated the developmental of the tactical skills inventory. Nineteen trainers and 415 competitive youth field hockey and soccer players selected by their age, sex, and performance status participated, was to develop a practical, reliable, and valid measure of tactical skills in sports. With trainers, 34 questions were formulated involving tactical skills. Factor analysis yielded
the Tactical Skills Inventory for Sports. Scales were labeled Positioning and Deciding, Knowing about Ball Actions, Knowing about others, and Acting in Changing Situations, covering all aspects of tactical skills regarding Declarative versus Procedural knowledge and Attack and Defense. It was concluded that elite players scored better than nonelite players supporting construct validity.

Lemmink, Elferink-Gemser & Visscher (2004) determined the reliability of two field hockey specific tests: the shuttle sprint and dribble test (ShuttleSDT) and the slalom sprint and dribble test (SlalomSDT). The shuttle sprint and dribble performances of 22 young male and 12 young female field hockey players were assessed on two occasions within 4 weeks. Twenty one young female field hockey players took part in the slalom sprint and dribble test twice in a 4 week period. It was concluded that Shuttle SDT and the Slalom SDT are reliable measures of sprint and dribble performances of young field hockey players.

Duthie, Pyne & Hooper (2005) quantified the movements of Super 12 rugby players in competition because information on elite rugby players' movements is unavailable. Players were categorized into forwards [front (n = 16) and back row (n = 15)] and backs [inside (n = 9) and outside backs (n = 7)] and their
movements analysed by video-based time motion analysis. The total time, number and duration of individual activities were assessed. In conclusion, after nearly a decade since becoming professional, elite rugby union is still characterized by highly intense, intermittent movement patterns and marked differences in the competition demands of forwards and backs.

Ford, Hodges & Williams (2005) determined attentional focus manipulations in soccer dribbling. 10 skilled and 10 less skilled soccer players dribbled a ball after receiving instructions directing attention to an internal, skill-relevant feature (foot); an internal, skill-irrelevant feature (arm); or a skill-irrelevant task (word-monitoring). Performance was evaluated in relation to a no-attentional-focus control condition. For skilled performers, an internal focus on the arms and feet interfered with performance. It was concluded that no significant differences were observed across the three attentional manipulations when the skilled performers used the nondominant foot. The results generally supported the deautomization of skills hypothesis.

James, Mellalieu & Jones (2005) constructed a valid and reliable methodology for the analysis of performance profiles of individual playing positions within rugby union. Twenty-two matches were sampled from the domestic season of a
professional male rugby union team. Key performance indicators for individual positions were developed and notated using a computerized behavioural analysis system. Performance profiles of playing positions containing data from one or more individuals were then constructed to compare intra-positional differences. The findings suggest that while general positional performance profiles appear to exist, intra-positional differences may occur due to variations in an individual's style of play, the decision-making demands of the position and the effects of potential confounding variables.

Malina et al (2005) estimated the contribution of experience, body size and maturity status to variation in sport-specific skills of adolescent soccer players. The participants were 69 players aged 13.2-15.1 years from three clubs that competed in the highest division for their age group. Height and body mass were measured and stage of pubic hair development was assessed at clinical examination. Years of experience in football was obtained at interview. Six football skill tests were administered: ball control with the body, ball control with the head, dribbling with a pass, dribbling speed, shooting accuracy and passing accuracy. Multiple linear regression analysis was used to estimate the relative contributions of age, stage of sexual
maturity, height, body mass and years of formal training in soccer to the six skill tests. In conclusion, age, experience, body size and stage of puberty contributed relatively little to variation in performance in four of the six soccer-specific skill tests in adolescent footballers aged 13-15 years.

Masuda, Kikuhara, Demura, Katsuta & Yamanaka (2005) examined relationships between muscular strength and ball velocity with respect to three different approach angles and focussing on both the kicking leg and the supporting leg among soccer players of different skill levels. Fourteen university soccer players were divided into two groups (superior group, average group), and kicked the ball with maximal effort towards a target 15 m away. The angles of approach to the stationary ball varied in three directions (free, 1.57, 2.36 rad to the kick direction). Mean ball velocity and the success rate of striking the target with the ball were measured. Maximal isokinetic and concentric muscular strength was measured in terms of motions of the knee Ext/Flex, hip Ext/Flex and hip Abd/Add using an isokinetic dynamometer. It was 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.

Shan & Westerhoff (2005) defined the characteristics of the maximal instep soccer kick by male soccer players and parameters related to kick quality also and explored 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.

Gissis et al (2006) compared maximal isometric force, force-time curve characteristics, pedaling rate, vertical jump, and sprint performance among young soccer players from different competition levels. Fifty-four young soccer players were divided into three groups according to competition level: the elite group (n=18) consisted of soccer players from the national youth soccer team of Greece, the subelite group (n=18) consisted of youth soccer players who participated in the local championship, and the recreational group (n=18) consisted of recreational
soccer players. All groups were evaluated for maximal isometric force, explosive force at 100 msec, peak force relative to body mass, rate of force development, squat and drop jump heights, 10 m sprint time, and pedaling rate. The findings of the present study suggest that the elite young soccer players can be distinguished from subelite and recreational young soccer players in strength and speed characteristics.

Kerr & Ness (2006) determined those variables that significantly affect push-in execution and thereby formulate coaching recommendations specific to the push-in. Two 50 Hz video cameras recorded transverse and longitudinal views of push-in trials performed by eight experienced and nine inexperienced male push-in performers. Video footage was digitized for data analysis of ball speed, stance width, drag distance, drag time, drag speed, centre of massy displacement and segment and stick displacements and velocities. Experienced push-in performers demonstrated a significantly greater stance width, a significantly greater distance between the ball and the front foot at the start of the push-in and a significantly faster ball speed than inexperienced performers. In addition, the experienced performers showed a significant positive correlation between ball speed and playing experience
and tended to adopt a combination of simultaneous and sequential segment rotation to achieve accuracy and fast ball speed.

Markovic, Dizdar & Jaric (2006) assessed the reproducibility of performance of standing kick, instep kick and drop kick. Male physical education students (n=77) were tested on maximum kicking performance by means of a standard Doppler radar gun. It was concluded that due to a high reliability, relative simplicity, and a small number of participants needed to detect worthwhile changes, the evaluated kicking tests could be highly recommended for sport specific profiling and early selection of young athletes, as well as for the assessment of training procedures and other interventions applied on individual teams of elite soccer, rugby or American football players.

Nunome, Lake, Georgakis & Stergioulas (2006) captured the lower limb kinematics before during and after ball impact of soccer kicking by examining the influence of both sampling rate and smoothing procedures. Nine male soccer players performed maximal instep kicks and the three-dimensional leg movements were captured at 1000 Hz. Angular and linear velocities and accelerations were determined using four different processing
approaches. The results indicate that the procedures used by some previous studies may have been insufficient to adequately capture the lower limb motion near ball impact.

Smith, Dyson, Hale & Janaway (2006) concluded that ground reaction force values in successive footstrikes would allow an understanding of the contribution of each limb's movement to motion in a curved path. For ecological validity to field games, two natural-turf covered force platforms were located outdoors in a field. Six males wearing standard six-stud soccer boots performed straight and curved trials at velocities of 4.5 and 5.5 ms(-1). Ground reaction force measures were collected on successive footstrikes at 500 Hz, whilst kinematics of the lower extremity was measured at 50 Hz. It was concluded that in curved motion all vertical force measures were greater for the outside leg, with anterior-posterior forces showing the outside leg provided greater propulsion forces and impulse. Improvement in performance in curvilinear motion should therefore be focused at the outside limb.

Brophy, Backus, Pansy, Lyman & Williams (2007) quantified phase duration and lower extremity muscle activation and alignment during the most common types of soccer kick-the instep kick and side-foot kick. A second purpose was to test the
hypothesis that different patterns of lower extremity muscle activation occur between the 2 types of kicks and between the kicking limb compared to the support limb. Thirteen male soccer players underwent video motion analysis and electromyography (EMG) of 7 muscles in both the kicking and supporting lower extremity and 2 additional muscles in the kicking limb only. Five instep and 5 side-foot kicks were recorded for each player. It was 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.

Deutsch, Kearney & Rehrer (2007) quantified the movement patterns of various playing positions during professional rugby union match-play, such that the relative importance of aerobic and anaerobic energy pathways to performance could be estimated. Video analysis was conducted of individual players (n=29) from the Otago Highlanders during six "Super 12" representative fixtures. Each movement was coded as one of six speeds of locomotion, three states of non-running intensive exertion, and three discrete activities (kicking, jumping, passing). The results indicated significant demands on all energy systems in all playing positions, yet implied a greater
reliance on anaerobic glycolytic metabolism in forwards, due primarily to their regular involvement in non-running intense activities such as rucking, mauling, scrummaging, and tackling. The result indicated that while the greatest differences existed between forwards and backs, each positional group had its own unique demands. Front row forwards were mostly involved in activities involving gaining/retaining possession, back row forwards tended to play more of a pseudo back-line role, performing less rucking/mauling than front row forwards, yet being more involved in aspects of broken play such as sprinting and tackling. While outside backs tended to specialize in the running aspects of play, inside backs tended to show greater involvement in confrontational aspects of play such as rucking/mauling and tackling.

Di Salvo et al (2007) analysed the performance characteristics according to playing positions. Three hundred top-class outfield soccer players were monitored during 20 Spanish Premier League and 10 Champions League games using a computerized match analysis system. Total distance covered in five selected categories of intensity, and the mean percentage of playing time spent in each activity were analyzed according to playing position. It was concluded that midfield players covered
a significantly greater total distance than the groups of defenders and forwards did. It provides a detailed description of the demands placed on elite soccer players, according to their positional role at different work intensities, which may be helpful in the development of individualized training programs.

Kawamoto, Miyagi, Ohashi & Fukashiro (2007) identified critical kinetic variables that lead to increased ball velocity during a side-foot passing kick in soccer. Seven experienced male soccer players and eight inexperienced players participated in the experiment. They were instructed to perform side-foot kicks along the ground with maximum effort with an eye on the target line. It was concluded that to increase ball speed during a side-foot passing kick, the generation of hip-flexion torque during the earlier stage of kicking is critical.

Walsh, Young, Hill, Kittredge & Horn (2007) discussed the several ways of carrying the ball in rugby union, which could influence the speed at which a player can run. They assessed 52 rugby players (34 males, 18 females) during a maximum sprint over 30 m without the ball, with the ball under one arm, and with the ball in both hands. Timing gates were used to measure time over the initial 10 m and the last 20 m. The male and female players were divided into two groups: a "beginner" group
that consisted of players in their first or second season and an "experienced" group that was composed of players who had played for more than two seasons. The results of this study suggest that practising sprints while carrying a ball benefits the early phase of sprinting while carrying the ball.

Ball (2008) examined technical aspects that contribute to achieving maximal kick distance. Twenty-eight elite players kicked for distance while being videoed at 500 Hz. Two-dimensional digitized data of nine body landmarks and the football were used to calculate kinematic parameters from kicking foot toe-off to the instant before ball contact. Longer kick distances were associated with greater foot speeds and shank angular velocities at ball contact, larger last step lengths, and greater distances from the ground when ball contact occurred. It was concluded that to increase kicking distance, increasing foot speed and shank angular velocity at ball contact, increasing the last step length, and optimizing ball position relative to the ground and support foot are recommended.

Bell, Snydmiller & Game (2008) determined the types and frequency of their movements during actual games. A secondary purpose was to compare these movements across the three periods of game play and between 2 NHL seasons (2003-04 and
2005-06) as a result of several rule changes between seasons. Goaltenders played the puck less frequently during the final period of the game than during the first two periods and more frequently between the two different NHL seasons after certain rule changes. It was concluded that NHL goaltenders moved most frequently vertically, laterally, and out of the net to play the puck. In addition, goaltenders moved out of the goal area to play the puck less often in the third period but more frequently after several league rule changes designed to reduce this movement.

Chalabaev, Sarrazin, Stone, & Cury (2008) investigated stereotype threat effects on women’s performance in sports and examined the mediation of this effect by achievement goals. The influence of two stereotypes-relative to the poor athletic ability and the poor technical soccer ability of women-were studied. Fifty-one female soccer players were randomly assigned to one of three conditions, introducing the task as diagnostic of athletic ability, technical soccer ability, or sports psychology. Next, they filled out a questionnaire measuring achievement goals and performed a soccer dribbling task. Results showed that compared with the control condition, females’ performance significantly decreased in the athletic ability condition and tended to decrease in the technical soccer ability condition.
Moreover, participants endorsed a performance-avoidance (relative to performance-approach) goal when the stereotypes were activated.

Gabbett (2008) investigated the influence of fatigue on tackling technique in rugby league players and determined the relationship between selected physiological capacities and fatigue-induced decrements in tackling technique. Eight rugby league players underwent a standardized one-on-one tackling drill in a 10-m grid. Players performed the one-on-one tackling drill before strenuous exercise and following game-specific repeated-effort exercise of progressively increasing intensities in order to induce fatigue that was representative of match conditions. Video footage was taken from the rear, side, and front of the defending player. Tackling technique was objectively assessed using standardized technical criteria. These findings suggest that strength and conditioning programs designed to develop endurance, change of direction speed, and anticipation skills may reduce fatigue-induced decrements in tackling technique. Furthermore, any defensive drills designed to improve tackling technique should be performed before and under fatigue.
Gabbett, Kelly & Pezet (2008) investigated the physical performance, anthropometric, and skill characteristics of specific playing positions in sub-elite rugby league players. Ninety-eight sub-elite rugby league players participated in this study. Players underwent measurements of anthropometry, muscular power, speed, change of direction speed, and maximal aerobic power. In addition, two expert coaches independently assessed the skill of players using standardised technical criteria. It was concluded that hit-up forwards were heavier and had greater skinfold thickness than the adjustables and outside backs positional groups. Hit-up forwards had a significantly greater ability to 'hit and spin' than both adjustables and outside backs. The evasion skills of adjustables and outside backs were significantly greater than hit-up forwards. Adjustables had significantly greater skills under physiological game stress than hit-up forwards and better catching, ball carrying, and basic passing skills than the hit-up forwards and outside backs.

Iosia & Bishop (2008) determined the exercise-to-rest ratios of a televised National Collegiate Athletic Association (NCAA) Division IA college football competition. Measured the duration of a play, rest, intervals between plays, and series of plays. It was concluded that, durations may have been influenced by the style
of offense. Style of play for this study was determined to be running (RUN), passing (PASS), or balanced (BAL). There was no significant difference between style of play and duration of rest between plays or series.

Mohr, M., Krustrup, P., Andersson, H., Kirkendal, D., & Bangsbo, J. (2008) studied the physical demands and match performance of women soccer players. Nineteen top-class and 15 high-level players were individually videotaped in competitive matches, and time-motion analysis were performed. The players changed locomotor activity >1,300 times in a game corresponding to every ~4 seconds and covered 9-11 km in total. In conclusion, for women soccer players (1) top-class international players perform more intervals of high-intensity running than elite players at a lower level, (2) fatigue develops temporarily during and towards the end of a game, and (3) defenders have lower work rates than midfielders and attackers.

Orloff, Sumida, Chow, Habibi, Fujino & Kramer (2008) compared the kinetics and kinematics of the plant leg position between male and female collegiate soccer players during instep kicking. Twenty-three soccer players (11 males and 12 females) were filmed in both the sagittal and posterior views while performing a maximal instep kick. Plant leg kinetic data were
also collected using an AMTI 1000 force platform. It was concluded that there were no significant differences between the sexes in plant leg position, but females had significantly greater trunk lean, plant leg angle, and medial-lateral ground reaction force than the males. Males showed higher vertical ground reaction forces at ball contact, but there were no significant differences in ball speed at take-off between the sexes. Ball speed at take-off was inversely related to peak anterior-posterior ground reaction force.

Sterzing & Hennig (2008) discussed the influence of soccer shoes on kicking. Soccer shoes enhance the traction required by the stance leg but decrease the quality of the ball contact during full-instep kicking. Shoe features that influence ball velocity include traction, foot protection, foot rigidity, and toe box height. Upper material and general comfort potentially affect ball velocity. In contrast, shoe weight and outsole stiffness do not influence ball velocity.

Taskin (2008) evaluated sprinting ability, density of acceleration, and speed dribbling ability of professional soccer players with respect to their positions. A total of 243 professional soccer players were examined. These soccer players are playing in different leagues of Turkey. The F-MARC test battery, which
was designed by FIFA, was used for soccer players. In conclusion, this study, which was done during the training season, shows that there is a similarity between the abilities of professional soccer players for 30-m sprint and four-line sprint tests. Therefore, it is believed that there must be fast players in all positions in terms of sprint ability. There is a similarity among defenders, midfielders, and forwards in terms of speed dribbling ability; in contrast, the speed dribbling ability of goalkeepers is different from the players in those three positions.

Young et al (2008) determined if a 2x2min time trial running protocol influenced short KA in elite Australian football. Another aim was to identify if endurance, playing experience and position were related to any exercise-induced KA changes. Twenty-seven professional footballers performed a KA test by kicking at a bullseye on a target projected onto a screen. The mean error from the centre of the target was the KA score. The players were assessed on the KA test, and then performed a 2x2min time trial with a 3-min recovery between runs. The total distance covered was used as a measure of endurance fitness, and the test also served as an exercise bout designed to impose some physiological stress. Immediately following this test, the players walked into the laboratory and performed the KA test
again. The midfielders were 8.2% better than the forwards/backs in KA.

Clagg, Warnock & Thomas (2009) determined the effect of plant leg and approach condition on the torques of the hip, knee, and ankle in soccer kicking tasks, nine female collegiate soccer players performed a series of kicking tasks from three different approach conditions. Kinematic data of the hip, knee, and ankle were recorded and joint torques of the plant leg was calculated. These results indicate that participants use greater pulling torques and smaller braking torques in the dominant plant leg compared with the non-dominant plant leg. Thus, even in collegiate athletes who train to be able to kick efficiently with either leg, differences in peak joint torques emerge between the dominant or non-dominant plant legs, particularly when participants kick from an off-axis approach.

King, Jenkins & Gabbett (2009) analysed movement patterns of professional rugby league players during matches played as part of Australia’s National Rugby League (NRL) competition. The movement patterns of one player from each of the three positional groups (hit-up forwards, adjustables, and outside backs) during three competition matches were examined using time-motion analysis. It was concluded that the mean for
the outside backs and hit-up forwards are adjustable. However, such ratios did not reflect the most demanding periods of the game, which included repeated high-intensity efforts interspersed with recovery periods of short duration. These periods of repeated high-intensity exercise often occurred at crucial phases of the game, when players were either attacking or defending the try-line.