Chapter II

REVIEW OF RELATED LITERATURE

The purpose of the study was to analyze the performance of Indian basketball team in the FIBA-ASIA women championship, Chennai 2009. In order to facilitate such a study, knowledge and evaluation of similar works becomes essential. Hence the investigator went through textbooks, magazines, journals, research quarterlies available in the libraries and internet in an effort to locate literature related to the selected study.

STUDIES ON BASKETBALL

Ziv Gal, Lidor Ronnie and Arnon Michal (2010) analyzed on-court performances (e.g. free-throw shots, two-point shots, defensive and offensive rebounds, and assists) of basketball players during actual games which are typically used by basketball coaches and sport journalists not only to assess the game performance of individual players and the entire team, but also to predict future success (i.e. the final rankings of the team). The purpose of this correlation study was to examine the relationships between 12 basketball on-court performance variables and the final rankings of professional basketball teams, using information gathered from seven consecutive seasons and controlling for multicollinearity. Data analyses revealed that (a) some on-court performance statistics can predict team rankings at the end of a season; (b) on-court performance statistics can be highly correlated with one another (example two-point shots and three-point shots); and (c) condensing the correlated variables (example all types of shots as one category) can lead to more stable regression models. It is recommended that basketball coaches limit the use of individual on-
court statistics for predicting the final rankings of their teams. The prediction process may be more reliable if on-court performance variables are grouped into a large category of variables.

Mavridis, et. al. (2009)^2 studied the inside game and its determinants in both European and NBA game. The elements analyzed were offensive tactics, the position of the pass maker, the kind of in pass, the frequency of players in post up position, the area of out pass. For the game analysis, the computer program used was the “sport scout”. The program used for the statistical analysis was the statistic packet SPSS and the non-parametric, chi-square distribution. The findings revealed that the dominant pass to centers in Europe was the bounce pass while in NBA, the overhead pass. In Europe, the center of a team had the biggest percentage of receiving a pass in post up position on the other hand, in NBA, ore players of the main team were found in post up position.

In Europe 72.7% of the control offense concerned the outside game while in NBA, only 55.0% of the offence concerned the outside game. The registration of the offensive behavior of high level Basketball teams could offer coaches a valuable aid at defining their aims in offense.

Sampaio, et. al., (2006)^3 examined the differences in game related statistics between basketball guards, forwards and centers playing in three professional leagues: National Basketball Association (NBA, superior level) in the USA, Association club of Baloncesto (ACB, one of the best European leagues) in Spain and Liga club of Basketball (LCB, inferior level) in Portugal. Archival data was gathered for the 2000-2001 play-off final series of the NBA (Five games), ACB (three game) and LCB (four games). For players in each league, discriminate
analysis was able to identify game-related statistics that maximized mean differences between playing positions (p<0.05). The interpretation of the obtained discriminate functions was based on examination of the structure coefficients greater than 0.30. In the LCB league, centers and guards were discriminated mainly in terms of defensive tasks, with emphasis on blocks (SC=0.35) and defensive rebounds (SC=0.43) and a de-emphasis on unsuccessful three-point field-goals (SC=0.37). In the ACB, centers and guards were discriminated by offensive tasks, with emphasis on assists (SC=0.52) and 3-point field-goals, both successful (SC=0.35) and unsuccessful (SC=0.35), and a de-emphasis on offensive rebounds (SC=-0.44). Finally, in the NBA league guards and centers were discriminated by offensive tasks, with emphasis on offensive rebounds (SC=0.31) and a de-emphasis on assists (SC=-0.37) and unsuccessful 3-point field-goals (SC=-0.34). These three analyses provided high overall percentages of successful classification (86% for the LCB league, 74% for the ACB and 85% for the NBA).

Generally, the player’s game-related statistics varied according to playing position, probably because of the well-known differences in the players a characteristics anthropometric charavteristics that conditioned the distance they play from the basket. Coaches can use these results to reinforce the importance of relying on different player’s contributions to team performances and evaluate player’s game performances according those playing positions. The results showed that these discriminate models could help in player recruitment and improve training programmers.

Deng, et. al., (2004)\(^4\) reviewed the use of three points shot of different teams in some important basketball games in the world and found that three point shot strategy had been overvalued. They viewed statistic data posted on NBA, FIBA, CBA official websites and data collected after world Basketball
championship for Men 2000 Olympic Basketball game. After analyzing the three point shot usage in NBA games from 1988 to 2003, world Basketball Championship of 2001 to 2003 and China Basketball Association League of 1995 to 2003 compared the performance of three point shot of different kind of teams, they made the following findings.

The use of three-point shot in NBA games grows fast currently for each game in regular season, the three point field goals attempted (3 FGA) count for 18% of field goals attempt (FGA), average three-point field goals made (3FGM) is five, average three-point field goal percentage (3FG%) is 35% which is 16% of total field goals made (FGM).

In world level games of recent years average 3FGA is above 30% of all FGA, average three-point FGM is eight, average three-point FG% is 35% which count for nearly 30% of FGM. The average 3FGA and the proportion of FGA, and average 3FG% of weak teams are much higher than that of powerful teams while 3FG% of powerful teams is significantly higher than that of weak teams.

In Chinese Basketball Association league three field goal average is 30% of all FGA, 3FG% is 34% which is 24% of total field goal made. Powerful teams have higher 3FG% than weak teams.

The results of the study indicate that world top teams hold high three Point Field-Goal percentage and that interior strength continues to be the determinant of a powerful team.

Alvarez, et. al., (2009) analyzed the different defensive performance indicators in Basketball, analyzing the difference in relation to success (efficient
and non-efficient defenses) and the game result (win or loss). All half court offenses form the quarterfinal, semi-final; consolation game and final of the 2008 Olympic Games were analyzed. In each defense phase, the following variables were analyzed with regard to the team on defense. (1) Type of defense used, (2) Pressure in offense transition, (3) defensive switches, (4) Helping on defense, (5) Inside passes, (6) Degree of opposition when shooting, (7) Points allowed, (8) Final result of the game and (9) Defensive efficacy.

The results showed that

(a) the type of defense that was most used was quarter-court man-on-man, but the one that was most effective was the half court zone defense.

(b) Transition pressure was used in 23.83% of the game phases.

(c) Defensive switches were done in 7.85% of the game phases.

(d) Helping on defense was used in 60% of the game phases.

(e) Inside passes were taken in 30.9% of the game phases.

(f) 38.9% of the shots were done with high opposition.

(g) Points were scored 42.28% of the game phases, such that winning teams allowed the opponents to score in 38.8% of the game phases and losing teams in 45.77%.
The results of the study demonstrated that man-to-man defenses are more often used by both winning and losing teams, with quarter court man-to-man being the most common. However losing teams use zone-defenses a lot and further they alternate more between different defenses due, possibly, to the fact that since they are coming from behind, they use all possible resources to catch up.

Sergio, et. al., (2009)\(^6\) analyzed the shot performance by executing a multifactorial study of the difference in this technical action between two competition levels, professional teams (experts) and amateur teams (in experienced players). The shots taken during 60 games from two competition levels, the amateur basketball league (30 games) and the professional league (30 games) were studied. A total of 10212 shots were studied of which 5161 corresponded to the ABC league and 5051 corresponded to the EBA league. After an exploratory analysis, an inferential non-parametric analysis to assess whether the two samples of shots were equivalent was used.

The results clearly showed that the different in free-throw between professional and amateur teams were only found in the distribution of the shots by quarter. The field goals taken in the two competitions are different with regard to the defensive pressure that the players receive before shooting. The professionals have a greater command of the game than the amateurs, they maintain a higher defensive intensity from the beginning of the game they are able to find shot positions in which the defensive pressure is less, they use more collective actions to look for better shot positions (pass) and they can shoot from greater distances.

The results make clear that shot characteristics are different with regard to competition level of the players. Coaches should know the specific characteristics
of their competition to adequately prepare their players. The knowledge of these differences should help orientate the formational process of the inexperienced players in order to facilitate their transition to peak performance.

Professional players have a greater command of the game than armature players, maintain a higher defensive intensity from the beginning of the game, find shot positions in which defensive pressure is less, utilize more collective actions to better look for short positions (passes) and shoot from greater distances.

Csataljay, et, al., (2009) to prepare team for baseball games, to build up the best tactics, to make good decisions during game, coaches need to know which elements of matches are the most crucial ones. Especially at close games where there is small difference between the performances of two teams. The main purpose of this study was to identify those critical performance indicators that most distinguish between winning and losing performances within matches. The statistical analysis of basketball games can lead to the identification of many significant performance indicators, not all of which can be analyzed in real time. Therefore, a smaller subset of critical performance indicators can be identified by analyzing close matches only. Data from 54 matches were gathered from the official score sheets of the European Basketball Championship 2007. Cluster analysis was used to classify the matches into three types such as tight games, balanced games and unbalanced games. There were 28 of these matches that were close matches where the differences between the two teams were 9 points or less. Wilcoxon signed ranks tests were used to compare 18 performance indicators between the winning and losing teams within each type of match. There were 13 significant performance indicators for the full set of matches. This was reduced to 6 critical performance indicators when only the close matches were considered.
The analysis of tight matches explored that the winning teams had significantly less 3 point attempts (p<0.05) with higher shooting percentage (p<0.01). The number of successful free throws (P<0.01), the free throw percentage (p<0.001) and the number of defensive rebounds (p<0.01) also contributed to achieve a higher number of scored points and consequently determined success.

Gomez, et. al., (2009)\(^8\) identified the game-related statistics that allow discriminating between starters and nonstarter players in women’s basketball when related to winning or losing games and best or worst teams. The sample comprised of 216 regular season games from the 2005 Women’ National Basketball Association League (WNBA). The game-related statistics included were 2- and 3-point field-goals (both successful and unsuccessful), free-throws (both successful and unsuccessful), defensive and offensive rebounds, assists and block, fouls, steals, turnover and minutes played. Results from multivariate analysis showed that when best teams won, the discriminate game-related statistics where successful two-point field-goals (SC=0.47), successful free-throws (SC=0.44), fouls (SC=-0.41), assists (SC=0.37), and defensive rebounds, (SC=0.37). When the worst teams won, the discriminate game-related statistics where successful two-point field-goals (SC=0.37), successful free-throws (SC=0.45), assists (SC=0.58), and steals (SC=0.35). The results showed that the successful two-point field-goals, successful free-throws and the assists where the most powerful variables discriminating between starters and nonstarters. These specific characteristics helped to point out the importance of starter’s players shooting and passing ability during competitions.

Chelvan Panneer (2001)\(^9\) conducted a study on "Match Analysis of Indian Team performance in the VII South Asian Federation Basketball Competition. "For
purpose of the study four national teams namely India, Pakistan, Bangladesh and Sri Lanka were selected for the descriptive analysis. They are 1.Total performance 2.Field goals 3.Free throws 4.Offensive rebound 5.Defensive rebound. To compare the variables chosen among the countries one way ANOVA statically technique was employed. The following results were found out The Indian team players were good in fundamental skills. They were also good in offensive and defensive rebounds besides physical qualities.

Jukie, I., Milonovic, D., and Vuleta, D., (1999) conducted a study on "Analysis of changes in indicators of functional and motor readiness of female Basketball players within one-year training programmed cycles". The basic goal of this work was the evaluation of the functional and motor preparedness of 13 top female Basketball players during a one-year training cycle. Across of the six time points the preparedness of the subjects was measured by means of the twelve-test battery measuring the basic and specific motor and functional abilities. The experimental training programmed was the yearly training macro cycle with all its components and duration. The differences among individual measurements in the space of twelve basic and specific functional and motor variables were analyzed by the statistical procedures in the frame work of discriminate analysis. In comparison to the first measurement, the players achieved better results in the second, third, fourth, fifth and sixth measurements. On the multivariate level, only the analysis of differences between the first and the third measurements indicated statistically significant differences. It can be concluded that the training process executed during the course of the preparation and competition periods (the transitional period was excluded from the analysis) induced positive changes.
Gomez, et, al., analyzed the importance of defensive systems used by winning and losing basketball teams in their possessions, trying to study their influence in offensive success. To achieve this, 1450 ball possessions were registered from eight close games of the Spanish Basketball play-offs series, from 2004-2005 seasons. The ball possessions were registered by systematic observation with Cohen’s Kappa for each observational category coefficients > 0.09; the variables registered were final classification (winner and loser), type of defensive system (man-to-man half court, man to man pressure, zone in half court, zone pressure and mixed), points scored, number of passes and duration per ball possession. Statistical analyses used were non-parametric (chi-square) test and a student t-test for independent samples. The results showed the following conclusions. The winning teams made more ball possessions versus different types of defensive systems than losing teams while the lost ones generally made their ball possessions versus man-to-man and zone in half court. The winners got more points scored per ball possessions versus different defensive systems, while the losers usually made their ball possessions without scoring versus half court defensive systems (zone and man-to-man). The winning teams made more number of passes and spent more time duration their possessions of the ball versus different defensive systems than losing teams. This profile helps the coach to prepare practices and tasks to this specificity of defensive systems, and allow him to be ready to control these variables during the game in special situations.

Gabor et. al. (2009) conducted a study to identify critical performance indicators that distinguish between winning and losing performances within matches. The statistical analysis of basketball games can lead to the identification of many significant performance indicators which can be analyzed in real time. Therefore, a smaller subject of critical performance indicators can be identified by
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Evangelos and Nikolaos (2004)\(^\text{13}\) conducted a study to register the rebound possession zones in Basketball and the frequency of their occurrence in a sum of Basketball games, so as to determine the probable direction of the ball after unsuccessful shots. To achieves this one hindered and thirty (n=130) games of men teams organized by FIBA in various leagues during the periods (1999-2002) were recorded. Sixty games (n=60) of National teams and seventy (n=70) of club level were analyzed by the computer programmed sport scout.

The defense area was divided into five zone and the direction of the ball after unsuccessful attempts were recorded. For the statistic analysis of data the command crosstabs and chi-square test and the correspondences and classification were employed the results suggested the following.
The ball after unsuccessful shots from zones one or five is headed in the vast majority (69%-79%) to zones one or five and in half the cases to the zone across where the shot was taken.

The ball after successful shots from zones two or four in 70% of the cases is headed after bouncing to zone two and four and 85% of unsuccessful shots from zone three return to zone three. These results determine the probable directions of the ball after bouncing and after important information coaches.

Garefis, et. al., (2007)\textsuperscript{14} evaluated the offensive effectiveness of fast breaks in high level basketball teams. Twenty five games of A1 Greek professional teams, and twenty five games between national teams in the European Championship were recorded and fast breaks were evaluated using video analysis in connection with different parameters such as success, initiation, type, player completing the fast break and conditions of execution. Although no significant statistical differences were recorded between the two differences were recorded between the two different levels of basketball in fast-break completion, significant differences were recorded in the type of fast-break, with the A1 teams recording greater four on three (13.8%) while national teams tended to prefer one on one fast-break (14.3%). A significant statistical difference in success rates with the four on two was revealed since, national teams succeeded in 91.4% of attacks and clubs in 67.4%. The results indicate that emphasis should be given to completing transition from the three point area and practice one on one primary and four on three secondary transitions to enhance the effectiveness of fast-breaks in these stations.

Mexas, et. al., (2005)\textsuperscript{15} compared the offensive effectiveness of teams participating in high level basketball. The evaluation was established in relation to
type of defense, the position of the athlete initiating the offensive effort, the area by which the offence was released and the conditions under which the shot was attempted. The sample constituted of 25 games of the A1 Greek National Championship and 25 games of the European Championship. The results showed that offensive attacks from the region of the three point region present the higher rate of use and success. Man-to-man defense represents the most usual form of defense in modern European basketball, while the perimeter players are responsible for the majority of offensive efforts compared to the post players. The difference in effectiveness between national teams and basketball clubs were not statistically significant. The results demonstrate that the offensive effectiveness of Greek basketball clubs is equivalent to this played by the leading European national teams.

Sporis, et, al., (2006)\textsuperscript{16} studied the latent structure of standard indicators of situational efficiency in the game of basketball. Data was collected from 134 basketball matches played in the regional Goodyear League 2002/03 season. The sample of variables included 13 standard situational efficiency indicators recorded during a basketball match. The principle components method was employed and the number of significant factors was determined using the Guttman-Kaiser Criterion. The initial co-ordinate system was transformed through a non-orthogonal rotation according to the Oblimin criterion. Six inter-independent latent dimensions explaining 67.5\% of total variance were determined: basic offensive efficiency, the three-point play, errors in posting the defense and realization from the free throw line, defensive aggressiveness on the player in possession of the ball and offensive aggressiveness of the player in possession of the ball, basic defensive efficiency and defensive/offensive back line efficiency. The obtained latent structure provided good interpretation of the continuance and functional dependence of 13 standardized indicators of player performance. However, these
indicators are considered inadequate for explaining the complexity of the game. Additional player performance indicators should be included in future scientific analysis.

Rai et. al., (1984)\textsuperscript{17} analyzed selected basketball matches of men team during Asaid ’82. Matches played by seven teams were recorded with a video camera at normal speed. For the analysis purpose, the parameters observed were frequency and types of shots, frequency of passes and interceptions, violations, ball possessions and rebounding.

It was found that top teams were able to secure more number of free throws and also had good percentage of their conversion. As far as field goals were concerned, top teams used more percentage of lay-up shots than the poor teams. In passes, two hand chest pass was used maximum times than other types of passes. Top teams had more number of ball possessions and less number of violations and in rebounding; more number of successful defensive rebounds than the offensive rebounds.

Sampaio J. And Janeira M. (2003)\textsuperscript{18} investigated the discriminatory power of game statistics between winning and losing teams in the Portuguese professional basketball league. The results showed that in unbalanced and balanced games, losing teams performed poorly in all game statistics. In contrast, results from close games, allowed us to identify different team performance profiles according to game type and location. Globally regular season profile was best discriminated by successful free-throws, whereas play offs profiles was best discriminated offensive rebounding. On the other hand home wins were best discriminated by committed fouls whereas successful free throws discriminated away wins. Coaches and
players should be aware of these different profiles in order to increase specificity at the time of game planning and control.

Fernando and Nubio (1999)\textsuperscript{19} described and compared the offensive process in basketball. The subject population was high performance level junior men teams based on the qualitative and quantitative technical and tactical variables. The sample comprises four teams- Spain, USA, Croatia, Brazil observed during 6\textsuperscript{th} world championship of men juniors, Portugal 1999. From a total of 21 games he analyzed set offenses, fast break and recorded their frequency, duration and outcome actions. Descriptive and non-parametric statistics were used for data analysis techniques. The results of the study allowed the following conclusions.

1. The main game method of all teams is set offense (76.6\%) while fast break is the second game method (24.5\%).

2. About $\frac{3}{4}$ of set offenses have duration between 13 and 18 seconds.

3. The duration of the fast break is 70\% between 13 to 18 seconds.

4. The shooting area with better performance indicators that differentiated the teams are mean points scored, percent of success of free throws, number of fouls made on number of suffered fouls and offensive rating.

**STUDIES ON BASEBALL**

Allen (1991)\textsuperscript{20} measured the kinematic variables of successful high school, college and professional baseball hitters. The ages of the subjects ranged from 16 to 20 years and all the subjects were considered successful based upon the previous
batting averages. The purpose of the study was to compare the 3 groups in an attempt to identify the differences in the bat velocities. Each subject was videotaped in the transverse plane and these tapes were analyzed for kinematics variables with a peak performances technology system. The results inferred that there was no significant statistical difference between school, college and professional hitters.

STUDIES ON NETBALL

Miller and Edbrooke (1984)\textsuperscript{21} studied the parallel-processing performances of an international netball team and a school girls side. The variables were assessed from video tape recordings of three matches played at each level of competition. The dependent variable was passing accuracy and the independent variable was the level of defensive pressure under which the passes were made. Due to the parallel-processing demands inherent in the activity, it was hypothesized that passing accuracy would deteriorate under increased defensive pressure and this trend would be exaggerated at the school team level. A two way anova failed to establish significant difference between levels of participation or defensive categories (P<0.05).

STUDIES ON VOLLEYBALL

Patsiaouras, et. al., (2010)\textsuperscript{22} examined the technical skills that emerged as statistically important for volleyball men teams' progress into the qualification round, semi-final and final in the Beijing Olympic Games of 2008. Collection of data included the use of the statistical recording program Data Volley 2 Professional (2005) for games evaluated. Additional statistical analyses included the use of SPSS 15.0. Kruskal-Wallis nonparametric test use revealed statistically
significant differences among the teams concerning the “attack errors following bad receptions” factor. Additional statistical analyses using Mann-Whitney U test showed statistically important differences between the teams playing in each semi-final and the final with the qualification round teams regarding the “attack errors following bad receptions” factor. Statistically important differences were also noticed in the “attack after bad reception” between qualification round teams and teams playing in the final (Brazil-USA).

Asterios, et. al., (2009)\textsuperscript{23} studied to determine the technical elements that could lead to a prediction of winning or losing a match by taking into account the differences of the technical elements recorded among the teams that participated in the Japan world volleyball championship (pool B). The sample consisted of 6 national men’s teams who competed in the frames of world championship during the 2006 period. The recording was made by using the official statistical logistic package of the European Confederation (CEV). Additional statistical analysis of the results took place by using the SPSS 11 statistical package. Discriminate analysis was conducted to select which subset to the measured variables significantly contributed to the prediction of winning or losing a match. Results showed”, led to the prediction of the match outcome (winning or losing a match) whereas “attack after reception” and “quick ball attack” emerged as the decisive factors for team qualification.

Michalopoulou, et. al., (2005)\textsuperscript{24} assessed the effectiveness of technical and tactical elements in Greek Beach Volleyball by evaluating difference between the winning and the defeated teams. The sample in this study included 3416 game phases that compose all the games played by the 10 higher-ranking teams in the Men’s Greek Beach Volleyball League for the year 2000. Data collection was
performed with the use of Assess. The following performance parameters were being recorded: 1) final game outcome, 2) serve effectiveness, 3) reception effectiveness, 4) set effectiveness, 5) attack effectiveness, 6) block effectiveness 7) fake block effectiveness, 8) defense effectiveness, 9) free-ball effectiveness, 10) effectiveness of defense without block, 11) effectiveness of set for counter attack and 12) counter attack effectiveness. A 4-point scale was used for the serve effectiveness and the attack effectiveness performance parameters and a 3-point scale was used for the rest. The statistical analysis of the data included one-way ANOVA, Frequency analysis and Chi-square (NPAR TEST). According to the results of this study effectiveness in serve and attack were the two technical-tactical elements that were significantly higher for the winning when compared to the defeated teams. Significant differences in effectiveness between the winning and the defeated team were revealed for the variables of lost serves resulting directly in lost points and successful attacks resulting directly in gaining points.

Drikos, et. al., (2009)\textsuperscript{25} examined the overall performance of a volleyball team depends on many factors that lead immediately to winning or losing the rally. These are lost serves, aces, killattacks, attack errors and kill-blocks. The analysis of these skills in relation to team performance, as expressed by the ratio of sets won to the total number of sets, lead to the formation of two new correlates. These are the serving efficiency ratio (SER), defined as the ratio of lost serves to aces, and the attack efficiency ratio (AER), and defined as the number of kill attacks divided by the sum of attack errors and kill-blocks. Analysis of the data collected from all the matches of the male A1 volleyball professional league of 2005-2006 in Greece proved that the two efficiency ratios were better predictors of the teams overall performance than the five original variables. The findings lead to clear-cut definitions of norms both for the serving and attack efficiency ratio. The leading teams had a SER of around two and an AER of around three. These criteria are
valuable tools especially for Volleyball coaches in deciding for the appropriate tactics of their teams.

Palao (2004)\textsuperscript{26} studied the effect of a team’s level on the performance of skills (serve, reception, spike, block and dig) in high level volleyball. Thirty-three male matches and 23 female matches of the Olympic Games of Sydney 2000 were recorded and analyzed. The performance of skills was evaluated in relation to the success and options that these skills give to one’s team and to the opposite team. The team’s level was established in relation to the final classification of the team in the competition. Ten observers participated in the study. Inter-and intra-observer reliability coefficients of the studied variables were calculated after training and during the analysis. In males, the results show a significant difference between team’s levels for the skills of spiking and blocking. The block is the skill that differentiates the teams of level one with the teams of level two. A reduction of error in relation to the level of the team is observed. In females, we found a significant difference in the performance of the spike in the teams of level 1. An increase in success of reception, spike, block and dig in relation to the level of the team is observed.

Bergeles, et. al., (2009)\textsuperscript{27} studied the relationship between Olympic-level volleyball male (M) and female (F) players. A three-member group of expert coaches assessed the players’ actions in set and attack in 16 volleyball games (M=8, F=8) of teams competing in the final phase of the 2004 Olympic Games. Assessment was based on a five-point rating scale (Eom and schutz, 1992) and included actions that composed as set of two contacts in Complex I (M=1007, F=1248). A cross tabulation statistical procedure with level 4x5 calculated performance percentages and frequencies; $X^2$ criterion was used to examine
possible differences in the distribution of performance assessment in attack for every performance assessment in set Z criterion was used to compare percentages of performance assessment in set and Z criterion was used to compare percentages of performance assessment between genders. Results showed that the higher the performance of setters, the higher the performance of attackers in both genders. Significantly (P<0.05) lower percentages of male compared to female attackers’ average and very good performance were found after receiving good and excellent quality sets, whereas significantly (P<0.05) higher percentages of good performance were shown in favour of male attackers after receiving excellent quality sets.

Palao, Santos and Urena (2007)\textsuperscript{28} studied to find out the common tendencies of peak performance spikes and its effects (type of spike, zone and direction) on spike performance. A total of 4968 spikes from 33 men’s matches and 2450 spikes from 23 women’s matches of the 2000 Olympic Games were analyzed. The variables studied were spike performance, type of spike, zone of the court from which spike was done, spike direction, rally phase, gender and team level. The results show that the use of fast tempo spikes and the use of the line spike both increase spike performance, and the ball contacting the block reduces spike performance. The zone most used by males and females was zone four (left side of the net) both inside-out and in counter-attack. Player’s participation is different depending on gender.

Han and Schutz (1992)\textsuperscript{29} conducted a study to investigate the playing ability and characteristics of international men’s volleyball team performance. The specific purposes were (a) to examine differences in playing characteristics that is, the set and spike, between the attacks and the counter attacks (b) to examine
changes in playing characteristics as a function of team success (c) to determine the best predictor or a set of predictors of team success among the selected skills. Seventy two sample games from the III federation of International volleyball cup men’s competition were recorded, using a computerized system. Six main skills in volleyball namely, serve, serve reception, set spike, block and dig were selected as key elements that represent team performance. To quantify the effectiveness of each skill performance a five point rating scale with zero representing an error and four representing a perfect execution was used. It was observed that the significant differences between standing and game outcome were due to better performance on those skills used in the counter attacks. Among the six selected skills, the block and spike were the most important, in determining the team performance. To quantify the effectiveness of each skill performance a five point rating scale with zero representing an error and four representing a perfect execution was used. It was observed that the significant differences between standing and game outcome were due to better performance on those skills used in the counter attacks. Among the six selected skills, the block and spike were the most important, in determining the team performance.

**STUDIES ON HANDBALL**

Yiannakos, et. al., (2005) studied to describe an alternative approach in order to estimate the level of specific endurance (stamina) via video-analysis in handball athletes, which is required during the whole game. One thousand five hundred three (1503) attacks from 15 matches of eight teams participating in the first division of the 2003 National Men’s Handball Championship were studied. For the analysis, all attack were recorded and categorized based on the type of fast break. Furthermore, for each type of attack the outcome of the shot (goal, riposte,
missed goal) and the offensive errors were recorded. All the fast break attempts (successful ones or not) were taken into consideration. The data analysis was conducted using Cross tabulation and Chi-square tests. The results revealed that, during the first half, the first and second wave were used in a percentage of 45.9% and 54.1%, respectively (p<0.05), although during the second half the percentage of each type was 63.3% and 36.7%, respectively (p<0.05). The third wave of fast break was not recorded. The number of successful attempts of fast break in the first half (77.1%) was greater than in the second half (66.9%) (p<0.05). During the first half the frequency of the first wave (45.9%) was lower than that in the second wave (54.1%) (p<0.05). However, during the second half the first wave’s frequency (63.3%) was greater compared to the second wave’s (36.7%) (p<0.05). The form of analysis which was used to record, research and compare the frequency of appearance of fast break showed a reduction of fast break in the second half compared to the first half. There was also a significant difference between the two half times regarding the successful and unsuccessful fast breaks. The results indicated some influence of training specificity and provide suggestions to coaches regarding the organization of handball training drills that will possible lead to an increase in explosive power.

**STUDIES ON HOCKEY**

Vizcaya, et. al., (2008) Conducted a study on "Specific strength training of the flick in Field Hockey through over-weighted balls"

The purpose of this study was to discover the effect of the specific strength training, using over – weighted balls, on the start speed of the ball, and to verify that the increase is higher when technique and strength training are combined. A
specific strength training cycle was carried out for four weeks using different resistance devices (standard, +5%, +10%, +15% and +20%), with two subjects who belong to the Spanish elite. On the other hand, the technical execution of each shooting was analyzed by a qualitative observation of the technique with the aim of verifying the effects of this type of strength training on the subjects’ technical execution. The results of the study showed an increase in the start speed of the ball up to a highest of 7.41% (female player), and 21.96% (male player), and an improvement in the perception of the technical execution after the training cycle, which proved the efficacy of the training carried out.

Sukumar (2002)\(^\text{32}\) conducted a study on “Descriptive analysis of performance of India Men Hockey Team in Sydney Olympic games 2000” six teams in Group ‘B’ namely Argentina, Australia, India, Poland, South Korea and Spain which qualified to play in the Sydney Olympic games 2000 were chosen the following variables were chosen for descriptive analysis, 1.Fundamental Skills (passes, dodge, tackling, trapping) 2.Goal keeping 3.Penalty Corner 4.Penalty Stroke 5.Attack 6.Defense 7.Total Performance. For the purpose of comparing the chosen variables among the competing teams, one way analysis of variance statistical techniques was employed. To find out the relationship between the total performance and the selected variables, Pearson’s Product Moment Correlation was employed Partial and Multiple Correlations were also employed to find out the combined contribution of all variables with the total performance for each team separately. To find out the agreement between the tournament ranking of each team in the Sydney Olympic Games and the ranking of total performance Spearmans rank order correlation was employed. The following results were found out:
1. Australian Hockey team was found better in attack.

2. Australian Hockey team was found better in the execution of trapping.

3. Spanish Hockey team was found poor in trapping and execution of passes in defense area.

4. South Korean Hockey team was found better in executing successful passes in defense area.

5. Indian Hockey team was found better in executing successful passes in the midfield area.

6. South Korean Hockey team was found poor in executing dodges in the matches.

7. Indian Hockey team was found weak in tackling.

8. All the teams in Group ‘B’ which participated in Sydney Olympics were found equal in goal keeping.

9. Australian Hockey team was found better in the total performance.

Ganesh (2000)\textsuperscript{33} conducted a study on "Descriptive analysis of performance of Indian Hockey Team in Champions Trophy Hockey Tournament 1996". For the purpose of the study, six Hockey teams namely India, Australia, Germany, Netherlands, Pakistan and Spain were chosen. The following variables were selected for the descriptive analysis. They are 1. Fundamental skills (Passes, Dodge, Tackling and Trapping) 2. Goal Keeping 3. Penalty corner 4. Penalty
stroke 5. Attack  6. Defense   7. Total performance. For the purpose of comparing the chosen variables among the competing teams, one way analysis of variance statistical technique was employed. To find out the relationship between variables chosen, Person's Product Moment Correlation was employed for each team. Partial and Multiple Correlation were also employed to find out the combined contribution of all the variables. With the total performance for each team. To find out the close agreement between the tournament ranking of each team and the ranking or the total performance by the experts Rank Order Correlation was employed. The following results were found out.

1. German Hockey team was found better in executing successful passes in defense area.

2. Netherlands Hockey team was found better in executing successful passes in the midfield area.

3. Spain Hockey team was found better in executing successful passes in the attack area.

4. All the competing teams were found equal in executing successful tackling and successful dodges.

5. Netherlands Hockey team was found superior in performing successful trapping.

6. Netherlands Hockey team proved better in committing less number of unsuccessful trapping during the matches.
7. All the team were found equal in goal keeping, penalty corner
8. Conversion, penalty stroke conversion, attack and defense.
9. Netherlands Hockey team was found better in total performance rated by experts with the 10 point rating scale.
10. The combined contribution of all the variables with the total performance showed high correlation.
11. There was a degree of agreement between the tournament ranking and the subjective rating.
12. Indian Hockey team was found poor in executing successful passes in defense, midfield and attack area. Indian Hockey team was found poor in executing successful passes especially in the attack area which is more important in the successful implementation of an organized attack.
13. Indian Hockey team was again found poor in executing successful trapping.
14. Compared to other Hockey teams, Indian Hockey team was found weak in all fundamental skills.

Bhangu (1997) analyzed the performance of Indian Hockey Team in Atlanta Olympics, 1996 out of seven matches played, it was observed that Indian team made 42 attempts on the opponents goal, out of which only nine goals were converted. Tactical analysis showed that the Indians were unable to overcome the
defensive tactics adopted by teams like Argentina, Germany, Pakistan, Korea and Great Britain. In penalty corner, India could convert only two goals out of 25 awarded. Both penalty corner goals were scored, one through direct and one indirect attempt. Indians dept the possession of the ball 257 number of times in their opponents 25 yards area and the opponents entered inside the Indian defensive 25 yard area 239 times. Further, the Indian’s entered into the opponents shooting circle 92 times but attempted only 42 shots into the opponent’s goal. Indians successfully converted all the penalty strokes.

Bose (1999) conducted a study on analysis of physical and performance variables of University and State Men Hockey players playing at different playing surfaces. For the purpose of the study thirty men Hockey players from two universities namely Madras University and Bangalore University who participated in the South Zone and All India Inter University Hockey competitions during the years 1976-97 and 1997-98 and thirty senior men Hockey players from two states namely Tamil Nadu and Karnataka, who participated in the senior National Hockey championship, National Games, Federation Cup and other 'A' grade All India Hockey Tournaments during the same years. The variables chosen for the study were speed, agility, power and endurance under physical variables and dribbling, hitting, trapping and passing under performance variables. The statistical technique one way analysis of variance was used to find out the difference of physical variables, performance variables and total performance. The following results were found out.

1. The total performance of the university men Hockey players was found better in the grass surface.
2. The total performance of state men Hockey players was found better in the artificial surface.

3. The physical variables of university men Hockey players were found better in the grass surface.

4. The state men Hockey player's physical variables performances were found better in the artificial surface and gravel surface.

5. It was also found out that the university men Hockey players were better in the performance variables in the grass surface.

6. Once again it was found out that the state men Hockey players were better in the performance variables in the artificial surface.

7. Further it was found out that the state men Hockey players were better in dribbling in the gravel surface.

8. It was also found out that the state men Hockey players and university men Hockey players were equal in hitting in the gravel surface.

9. Further it was found out that the university men Hockey players were better in trapping and passing in the gravel surface.

Dhanraj (1985)\(^3\) studied the performance of Indian team and other teams in the following four major International Hockey Tournaments namely fifth World Cup Hockey Tournament (1982) Ninth Asian games (1982), Round Robin League matches of champion’s trophy (1993) and league, semifinals and finals of 1984 Olympics. The study was conducted through video analysis. Variables such as
strokes, ball possession, dribbling, tackling attempts at goal, passes and infringements were analyzed. The following conclusions were drawn. India gained ball possession most frequency through interception than other countries; India had more number of dribbling in attack area and had a success rate of 61.21% whereas Pakistan had a lower number of dribbling but with a higher success rate of 67.33%. Though India had the highest frequency of tackles as compared to other countries but the success rate was only 51.88%. India used more push stokes in attack area where as Pakistan had more of hit strokes. Indians mostly used hit strokes in the mid-field whereas push stroke was used by Australia, New-Zealand, West Germany and Holland. India used more flick strokes as compared to other countries, India trapped the ball maximum in the 25 yard defense area as compared to other countries, Australians used the maximum scoop stroke, Indians success rate in return diagonal, through and parallel passes was quite high, Pakistanis success rate in forward and cross passes higher than India, Australia, Germans, New Zealand and Holland had a higher frequency of back passes. Pakistan made the highest goal attempts through field and penalty corners.

Pamila (1996)\textsuperscript{37} conducted a comparative study of performance of Indian hockey team along with other countries in selected International Women’s Hockey Tournaments. For the purpose of the study, the countries namely, India, China, Japan, Singapore, South Korea and Kazakhstan which participated in the Asian championship and Asian Games Hockey tournament were chosen further, the following performance variables were chosen for analysis. They were infringements passes, ball possessions, strokes and attempts at goal. They were infringements passes, ball possessions strokes and attempts at goal. For the purpose of collection of data, the matches were viewed on the video monitor at normal and slow speed as required, to enable the investigator and her colleague to properly
observe. All the matches were recorded by various sport agencies from direct telecast of Doordarshan, New Delhi and Prime spots of star TV network. To compare each team on the chosen variables one way anova was employed. On the basis of statistical analysis, she found that India committed less number of infringements when compared to other countries, India frequently gained a lost ball possession through interceptions as compared to other countries. Pushing skill was used frequently by India in 25 yards attacks are whereas South Korea used hits more in this area. India used hit frequently in mid-field whereas other countries used push in mid field. Flick stoke was commonly used by India as compared to other countries. Other countries used more back passes to retain the ball possession than India. India gained maximum number of penalty corners and penalty strokes than other countries but the successful conversion rate was less for India than other countries. India was poor in mid field play whereas other countries build up the game from the mid field.

**STUDIES ON FOOTBALL / SOCCER**

Hughes and Wells (2002)\(^{38}\) analyzed the performances of the penalty takers and goalkeepers in penalty shoot-outs taken from the FIFA World Cup finals and also the finals of the European Champions League, and present these data so that a successful profile of optimal performance can be defined.

A notation system was designed to input data directly into Access, 129 penalties were notated with an intention to analyses the time in preparing the shot, the number of paces taken to approach the ball, their relative pace, the pace of the shot, its placement and the outcome. The results showed the following conclusions
1. One in five saved (20%; 3/15), one in fifteen missed (7%; 1/15) and three in four scored (73%; 11/15).

2. 25% of shots a fast run are saved because the player then tried either 50% or 75% power.

3. Best success nations are from an even run up of 4, 5 and 6 paces.

4. There is no laterality in the success ratios-left footed and right footed strikers have the same success when the frequencies are represented as percentages.

5. No shots above waist height were saved, although 18% of those shots missed.

6. In every case, the goalkeeper moved off the line before the ball was struck.

   There is only a small data set, but the goalkeepers who took a pace forward and stood up while the striker approached the ball, had the best save and miss ratios.

   The profile of Germany’s penalty takers shows a consistent pattern that is very different from the average, indicating analysis and training.

   It was concluded that these data analyses demonstrate that there are optimal strategies in taking and saving penalties. This point to ways of enhancing the individual performance of the players in these closed skills. Coaches in this team
sport will be helped by methods used in individual sports such as golf and racket sports, where the emphasis is on the attainment of expert technique.

Lago-Penas, et. al., (2009)\textsuperscript{39} studied the motion characteristics of top class soccer players, during match play, according to playing position. A total of 127 top-class outfield soccer players were monitored during 18 Spanish Premier League using a computerized match analysis system. Total distance covered in five selected categories of intensity (0-11 km/h (standing, walking, jogging); 11.1-14 km/h (low speed running); 14.1-19 km/h (moderate-speed running); 19.1-23 km/h (high-speed running); >23 km/h (sprinting) and the mean percentage of playing time spent in each activity were analyzed according to playing position. Midfield players covered a significantly greater total distance than the groups of defenders and forwards did. Analyzing the different work rates showed significant differences (p< between 0.05 and 0.001) between the different playing positions. There were no significant differences between halves in the total distance covered at submaximal and maximal intensities. However, significantly more distance was covered in the first half compared to the second in medium intensities (11.1-19km/h). The current findings provide 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.

Jones, et. al., (2004)\textsuperscript{40} investigated the ability to retain possession of the ball for prolonged periods of time by comparing 24 matches involving successful and unsuccessful English premier league teams within the 2001-2002 seasons. Specifically the teams’ possessions were analyzed depending on evolving match status i.e. whether the team was winning, losing or drawing. All possessions less
than three seconds in duration were removed from the data as they were not deemed to include significant events pertaining to a teams’ strategy. Successful teams were found to have significantly longer possessions than unsuccessful teams irrespective of match status i.e. winning (p<0.01), losing (p<0.05) and drawing (p<0.01). However both successful and unsuccessful teams had longer durations of possession when they were losing matches compared to when winning. It was concluded that within elite English football possession is related to successful performance but it is likely this is down to differences in individual player’s skill levels rather than specific team strategy.

Luhtanen et. al., (2001) conducted a study on selected offensive and defensive variables of field players and goalkeepers in the EURO 2000 and to relate the results to the final team ranking in the tournament. All matches (n=31) of the EURO 2000 were recorded using video and analyzed with computerized match analysis hardware and video playback system for game performance analysis using SAGE Game Manager for Soccer software. The quantitative (number of executions) and qualitative (percentage of successful executions) game performance variables were as follows: passes, receiving, runs with ball, scoring trials, interceptions, tackles, goals and goalkeeper's savings. The total and effective playing times were recorded and the game performance results were standardized for 90 minutes playing time. Team ranking in each variable was used as a new variable. The final ranking order in the WC '98 tournament was explained by calculating the rank correlation coefficients between team ranking in the tournament and ranking in the following variables: ranking of ball possession in distance, passes, receiving’s, runs with the ball, shots, interceptions, tackles and duels. Selected quantitative and qualitative sum variables were calculated using ranking order of all obtained variables, only defensive variables and only offensive
variables. The means and standard deviations of the game performance variables were calculated. Ranking order in each variable was constructed. Spearman's correlation coefficients were calculated between all ranking game performance variables.

The average to have the ball in possession in distance was 5.7 km. Holland was superior in ball possession in distance (8.9 km). During the 90 minutes the average amount of passes per team was 369 and the percentage of the successful passes was 78%. Team's average number of receiving's was 267 and the success per cent was 93%. In this tournament the amount of the runs with the ball in a match was on average 38 per team and the percentage of the successful runs was 65%. Shots and headers that lead to a goal scoring opportunity were on average 13 per team in a match. About 9% of them lead to goal. This means 1.2 goals per team in a match. In this tournament, teams tried to intercept on average 113 times per match per team and the percentage of the successful interceptions was 95%. The average number of tackles was 134 per team in a match. The percentage of successful tackles was 47%. The goalkeepers and defenders made on average three savings each. In goal scoring opportunities, the goalkeepers saved with the percentage of 69%. Spearman's correlation coefficients between the tournament ranking and the measured variables were as follows: percentage of the successful passes \((r=1.00, p<.001)\), the percentage of successful goal scoring trials \((r=0.665, p<.01)\). The correlation coefficients of sum variable of all relative offensive success variables and all defensive and offensive variables were 0.633 \((p<0.01)\) and \((.572, p<.05)\).

The presented results showed that there was a variable of successful passes at team level that explained the success in the EURO 2000. France was the best
team in the performance activity of passes, receiving’s, runs with ball and tackles. In percentage of the successful passes, France was the top team. The goalkeeper's saving percentage of was seventh best. The strengths of Italy were in defense. The Italians were best in interceptions and third best in tackles. In the passing activity their position was 15th, but in the percentage of successful passes 2nd. In the overall ranking taking into account all analyzed variables, Italy was 13th. This analysis would give Holland a better place than third. Holland was 1st in ball possession (8.9 km) and 2nd in the amount of passes and shots and also close to the top place in the corresponding successful executions. Because Holland controlled the ball a lot, it didn't have many chances to interceptions or duels. This can be seen in the amount of interceptions and duels. Germany was traditionally strong in having the ball in possession (2nd), in passing play (2nd) and in the number of goal scoring trials (4th). However, the weaknesses were found in defense activity of interceptions (16th) and tackles and duels (15th).

Luhtanen, et. al., (1996)\textsuperscript{42} compared the deficiency of attacking play-off among the participating continent, (Europe, South America, Africa, Asia, North and Central America) in the soccer world cup (USA 94). The video recorded input data included all 52 matches. A game manager analysis system was used. The qualitative attacking variables for 90 minutes were: the number of successful attacking trials (ATRI), scoring chances created in the vital area (SCHA), and goals (Goal). The efficiency (%) was calculated for SCHA (SCHA / ARTI * 1000), STEI (STRI / SCHA * and Goal (Goal / STRI * 100). The differences were not statistically significant in conclusion; each average continental team had their own strength and weakness.
Kaka, Maland and Rai, (1984)\textsuperscript{43} analyzed the selected football matches of Asiad’ 82 and World Cup ’82. The following parameters were considered for analysis. They were: number of passes during a single ball possession, frequency of different types of passes, frequency of successful and unsuccessful dribbles, frequency of attempts, treats, shots and the frequency of different types of fouls. The analysis revealed that the lower frequency of higher number of passes in a single ball possession is suggestive of the fact that the Asiad teams retained the ball possession for a shorter duration as compared to the world cup teams. The world cup teams made more number of passes per math as compared to the Asiad teams. Asiad teams use a higher percentage of forward passes and backward passes. The Asiad teams dribbled less frequently than the world cup teams. The percentage of successful dribbling was marginally higher in case of Asiad teams. The Asiad teams converted less frequently the attempt and threat situating into a shot. The average score of attempts and threats were higher in case of Asiad teams whereas world cup teams had higher average score of shots.

Ali and Farrally (1991)\textsuperscript{44} studied the time spent by players of different positions during walking, jogging, cruising, sprinting and standing skill during match play activities university level player of age group 19-21 were filmed in several matches and the video recording were analyzed using a micro computer. The ration of the time spent for the players were 56% walking, 36% jogging, 4% cruising, 3% sprinting and 7% standing skill. Anova revealed that there were significant differences among the players for different positions on field, for example the time spent for jogging, walking and standing still differed among the attacker’s defenders and mid fielders.
Thomas, (1976) analyzed the video recording for total distance covered in different positional roles of English professional soccer players during the match. By using a stop watch and an elaborately mapped playing surface, they recorded the time taken for the activities such as walking, jumping, running and springing. Their tabulated results illustrated such features as the frequency of occurrence and the overall distance covered in each activity for each player and reported that the defense and forward players covered more distance in walking and sprinting and less in jogging and cruising but the midfield players covered more distance in jogging and cruising and less in walking and sprinting.

**STUDIES ON BADMINTON**

Currie (1992) conducted a study to determine the differences in selected kinematics variables of the shuttle racquet head interaction for players of different ability levels exhibiting the badminton overhead forehand clear. The variables included the resultant velocity of the racquet head at contact and time between peak velocity and contact. He also examined the total horizontal displacement of the shuttle after contact, the angle of deviation of the shuttle, the time of the flight of the shuttle, the angle projection of the shuttle after contact, and the shuttle velocity after contact. Six volunteer male subjects were divided equally into three groups corresponding to their ability, novice, intermediate and advanced. Data were collected using a high speed motion picture camera. The analysis of data did not establish significant difference between the three groups with respect to racquet head velocity at contact, or for the time differences between peak velocity and contact time. However it was found that the angle of projection of the shuttle as well as the flight of the shuttle decreased with ability.
STUDIES ON BOXING

Singh, et. al., (1984) conducted an analysis on selected boxing bouts of Asiad ’82. A total of 49 boxing bouts of different countries were recorded with a video camera. For the purpose of analysis, the parameters considered were straight arm blows, bent arm blows, point and mark, direct attack, counter attack, feint attack and duration of contest. It was observed that the frequency of blows in all the groups increased from round to round. The frequency of straight arm blows were more than the bent arm blows. The frequency of blows on the face was much higher than the frequency of blows on the body. As far as the frequency and type of successful attacks were concerned, the numbers of feint attacks were more than the direct attacks. The counter attacks were minimum. Feint attacks were more in higher weight categories. The mean duration of contest in a round and a bout were between 55 to 100 seconds and three to four and a half minutes.

STUDIES ON TABLE TENNIS

Bootsma and Valk (1984) conducted an experiment on the learning time and movement time of the beginners (n=10) and Dutch top table tennis players (n=5). The beginners were trained for a five-day period for attacking forehand drive in Table Tennis. Felin recording of seven driver ever taken on day one, three and five and were compared for movement time (MT), stroke length and velocity. The analysis of MT the learners revealed a fast MT on day one, increased on day three and stored to decrease on day five. The MT of expert player was significantly faster whereas the variation in MT of the learners did not change significantly over days and remained greater than that of the top players.
STUDIES ON RUGBY

Williams (1988) analyzed and compared the rugby matches of (1986-87) involving the French, Scottish and Irish with English and Wales teams for the different patterns of play by using a computer aided analysis which was designated to note the matches post-event using video tapes. No significant differences were found between patterns of play of successful and unsuccessful teams, although a number of differences were compared to the other two (P<0.05). The groups averaged nearly the same number of possessions per game (66 and 67 respectively), France, Scotland and Ireland passed the ball 87 times while England and Wales passed only 54 times. England and Wales ran with the ball only 17 times compared to 27 times by France, Scotland and Ireland but favored a kicking strategy (45 vs 42 kicks on average). It was found that there was a difference of play between the French, Scottish and Ireland compared to English and Wales with respect to number of passes, runs and number of racks and mauls set up and won.

STUDIES ON SQUASH

Hughes (1984) hypothesized that players of higher standard play further forward on the court than those of lower standard in squash game. The frequency distribution of all the shots of both recreational (n=12) and country (n=16) standard players were analyzed. Distribution of specific shots, drop shots, volleys and volley drops were also examined in an attempt to explain the differences in positional patterns between the two sets of players. No significance difference was founding these cases concept for the recreational players to play further forward than county players.
STUDIES ON SWIMMING, DIVING AND WATER POLO

Rai, Rana and Singh, (1984)\(^{51}\) analyzed selected water polo matches of Asiad 82. The following parameters were considered. They were frequency of total goal attempts, side from which the attempts were made, type of shot distance from which the goal was scored, frequency and type of fouls area of occurrence and the frequency of sprints. It was found that the majority of the shots were made from the front side of the goalkeeper. The conversion rate was also good. Straight shot was the most frequency used shot. Majority of goals were scored using this short. Top teams avoided back hand short. Majority of the goals were scored from the range of 3-4 meters from the goal post. Top teams had good accuracy. Good teams committed larger number of fouls.

Chow, et. al., (1984)\(^{52}\) analyzed the motion picture films of the stroking techniques employed by the finalists in 19 individual swimming events contested in the 1982 British common wealth games (Brihane). To determine selected kinematic characteristics of the turning technique used by elite swimmers in different strokes, to compare the result obtained for male and female swimmers, and to determine the relationship between the characteristics and the race time. Significant results were found between male and female swimmers. In free style events, the distance and the average speed increased as the distance of the race decreased. For the longest free style event, the average speed was significantly correlated with the event time and the order of finishing. In the 100 meters Breast stroke event, the male and female swimmers employed markedly different technique and strategies.
Brown (1984)\textsuperscript{53} made a descriptive analysis of rip entry in competitive diving. He conducted this study at the University of Texas. He attempted to identify the factors which enable certain highly skilled divers to enter the water without apparent splash. Two kinds of rip entries as well as non-rip entries were filmed and analyzed in situation from above the water and under water. It was concluded that rip entry without splash was found to be more effective.

**STUDIES ON TENNIS**

Reid Machar, Mcmurtrie Darren and Crespo Miguel, (2010)\textsuperscript{54} examined the relationship between the rankings and fourteen statistics describing the match performance of the top 100 male professional players in 2007 to determine which statistics were most related to playing success. Partial correlations determined the strength of these associations and selected variables were entered into a stepwise regression procedure to predict professional ranking. Five variables were significant predictors of top 100 ranking while only second serve return points won and second serve points won remained in the final prediction equation, which accounted for 52\% of the variance in professional ranking: predicted men's professional ranking = 548.5 + -666.6 second serve points won + -319.9 second serve return points won. This analysis suggests that second serve points won and second serve return points are among the most relevant statistics commonly available to ATP players.

**STUDY ON CRICKET**

Jason and Nicholas (2010)\textsuperscript{55} examined the batting, bowling and fielding variables associated with success in cricket in the recent Twenty20 World Cup. We compared several key batting and bowling variables of winning and non-winning
teams by comparing the magnitudes of differences (Cohen's effect size). We established several moderate or large differences between winning and losing teams with respect to batting, bowling and fielding variables. The best indicators of success in the tournament can be broken down into general match, batting and fielding variables. The top five indicators for success in the tournament were losing less wickets in the game (ES= −1.66), losing less wickets in the powerplay while batting (ES= −1.22), scoring more runs per over (ES= 1.23), scoring more runs in the middle eight overs (ES= 0.86) and bowling more dot balls (ES= 1.15). Thus it could be concluded that for overall success in Twenty 20 cricket, teams should focus on taking wickets and bowling dot balls whilst fielding, and implementing tactics that encourage 50+ partnerships and boundary hitting batsmen whilst batting.

**SUMMARY OF THE LITERATURE**

The abstracts of research literatures related to the present study were reviewed by the researcher and presented in this chapter and summarized as follows.

As many as fifty five (55) reviews of research studies related to the present study have been included in this chapter.

Selected variables have been analyzed in various competitions for different games and sports.

Four abstracts represent research studies in Basketball, three research studies in Hockey, four research studies in Football and one research study each on Rugby,
Table Tennis, Volleyball, Squash, Netball, Swimming, Diving, Cricket, Water Polo and Boxing.
REFERENCES


26 J.M. Palao “Effect of Team Level on Skill Performance in Volleyball”


45 V. Thomas, “A Motion Analysis of Work-Rate in Different Positional


