CHAPTER II

REVIEW OF THE RELATED LITERATURE

A careful study and exploration of the selected literature for present study is essential to have insight into work already done within the field. In our country, very little research work has been done as compared to other countries in relation to volleyball. The scholar has given a deep thinking to those studies and has gained valuable methodological hints from their procedure and findings which were of great importance in the formulation of the research problem.

A review of literature related to the study Anthropometric and Motor Performance as Predictor variables of spike jump and block jump in volleyball available in the library of Netaji Subhas National Institute of Sports, Patiala, Lakshmibai National College of Physical Education, Thiruvananthapuram, Netaji Subhas Southern Centre, Bangalore, Lakshmibai Deemed University of Physical Education, Gwalior, Dr. Sivanthi Adithyanar College of Physical Education, Thiruchendur, M G University Kottayam have been presented in this chapter in abstract form to provide the background material to evaluate the significance of this study as well as to interpret its significance.
Mielgo-Ayuso J., et. al., (2015) found that, anthropometric profile, specifically body composition, plays a crucial role in the physical performance of volleyballers. Since there are varying positions in volleyball, it is likely that differences exist in anthropometric and physical performance profiles among players due each role's specific physical requirements. The aims of this study were to analyze the anthropometric and physical performance profiles of elite female volleyballers, to determine any differences in these features among different playing positions. A further aim was to examine any relationship between anthropometric measures and measures of performance. This study assessed 42 female professional volleyball players (Age: 27.2±5.4 years). Players were categorized according to playing position: middle blockers (n=12), opposite hitters (n=6), outside hitters (n=12), setters (n=8), and liberos (n=4). Anthropometric measurements assessed were: height, weight, fat mass (5 skinfolds) musculoskeletal mass (5 corrected girths). Additionally, the physical performance parameters examined were: jump tests (vertical-jump and spike-jump), speed, agility, and strength tests (crunches test and overhead medicine ball throw). In terms of height middle blockers were the tallest (186.5±1.4 cm), while liberos were the shortest (166.7±8.1 cm). There were significant differences in body mass among positions.
Palao JM, Manzanares P, Valadés D, (2014) was to study the ranges in height, weight, age, spike reach, and block reach of volleyball players in relation to the player position and the level of their respective teams in peak performance. The analysed sample included 1454 male and 1452 female players who participated in the volleyball competitions of the Olympic Games and World Championships in the 2000-2012 period. A descriptive, correlational, and longitudinal design was used. The variables studied were: the player position, body height, weight, body mass index, spike reach, block reach, age, and team level. The results show differences between body height, spike and block reaches, and the age of the players by their position. These differences are related to the needs of the different positions with regard to the actions they execute. Middle-blockers, outside-hitters, and opposites have the characteristics that are most suitable for blocking and spiking, and the setters and liberos appear to have characteristics conducive to setting and receiving as well as digging, respectively. The differences found in the studied variables with regard to the playing position are related to players' needs regarding the actions they perform. Player's age was a variable that differentiated first teams at this level of competition for males, and physical capacities (body height, weight, spike reach, and block reach) were variables that differentiated first teams at this level of competition for females.
Martín-Matillas M., et al., (2014) This study aimed to describe morphological characteristics of elite female volleyball players from the highest Spanish league, with special focus on differences by performance level and playing positions. Nearly all female players playing in the highest Spanish volleyball league during season 2003/2004 participated in this study (N=148 elite players, 92% of the total). Anthropometric, body composition and somatotype parameters according to performance and playing positions were analysed. The players' characteristics were as follows; body mass 72.3 ± 8.4 kg; stature 179.8 ± 7.1 cm; body fat 24.0 ± 3.1% and skeletal muscle mass 27.3 ± 2.9 kg. Mean somatotype was 3.1 ± 0.7; 3.4 ± 0.9; 3.1 ± 0.9 characterised as central with a tendency to balanced mesomorph. Top level players (whose teams were better classified in the team performance ranking) were taller, had higher skeletal muscle mass and ectomorphy, and had a lower level of adiposity markers, compared with lower level players. Players selected for their respective National teams (individual performance) were taller, heavier, had higher muscle mass and lower endomorphy than non-selected players. Differences according to playing positions were found. This study provides a complete set of reference data on anthropometry, body composition and somatotype of elite female volleyball players. Morphological differences have been identified according to performance level and playing position.
Athletes' kinanthropometric profiles are widely addressed in the scientific literature. Such profiles are particularly important in volleyball because absolute size contributes a significant percentage of total variance associated with athletic success. As in other team sports, volleyball players' kinanthropometric attributes correlate with the game's tactical demands. From 1992 through 2000, the Cuban women's volleyball team achieved top global performance, winning first place in three successive Summer Olympic Games. Describe the kinanthropometric profiles of Cuban women Olympic volleyball champions during 1992-2000 and compare these by position played. Carvajal W., et al., (2012) were taken measurements of body composition, somatotype, proportionality and several anthropometric indicators in 41 Cuban women volleyball players, grouped by playing position. All were members of the national team that participated in the Summer Olympic Games in Barcelona (1992), Atlanta (1996) and Sydney (2000). Mean and standard deviations were calculated for all study variables. Analysis of variance was used to compare means for different positions for the variables weight; height; percent adipose, muscle and bone mass; body mass index; and muscle-to-bone ratio. Discriminant analysis was performed to identify anthropometric dimensions differentiating playing positions (center, spiker and setter), using p<0.05 as significance threshold. Results were
presented in tables and figures. Centers presented greater absolute size and higher average adipose (22.8±1.7 kg) and bone (7.1±0.6 kg) mass. The mean somatotype of all volleyball players was balanced mesomorphic (2.7-3.6-2.9). Classified by position, centers (2.9-3.4-3.4) and spikers (2.8-3.6-2.9) presented an average mesomorphic-ectomorphic somatotype, and setters (2.6-3.7-2.6) were balanced mesomorphic. On assessing Somatotype Attitudinal Mean (SAM), centers and spikers showed more intrapositional homogeneity than that of setters. Centers were significantly taller (187.1±2.5 cm) than players in other positions. Centers’ percent adipose tissue mass (28.9±2.7%) was significantly higher than that of setters (24.3±2.7%), who were leanest of all positions. The kinanthropometric profile of Cuban women Olympic volleyball champions was defined by considerable muscular-skeletal development, with a predominantly mesomorphic somatotype and low endomorphy. Height and body composition varied significantly by playing position.

Kevin Till et.al., (2011) examined the factors influencing selection within talented junior Rugby League players is limited. The aims of this study were firstly to determine whether differences existed for anthropometric and performance characteristics between regional and national selection in high performance UK junior Rugby League players, and secondly to identify variables that discriminated between these
selection levels. Regional representative (n = 1172) selected junior players (aged 13-16 years) undertook an anthropometric and fitness testing battery with players split according to selection level (i.e., national, regional). MANCOVA analyses, with age and maturation controlled, identified national players as having lower sum of 4 skinfolds scores compared to regional players, and also performed significantly better on all physical tests. Stepwise discriminant analysis identified that estimated maximum oxygen uptake (VO2max), chronological age, body mass, 20m sprint, height, sum of 4 skinfolds and sitting height discriminated between selection levels, accounting for 28.7% of the variance. This discriminant analysis corresponded to an overall predictive accuracy of 63.3% for all players. These results indicate that performance characteristics differed between selection levels in junior Rugby League players. However, the small magnitude of difference between selection levels suggests that physical qualities only partially explain higher representative selection. The monitoring and evaluation of such variables, alongside game related performance characteristics, provides greater knowledge and understanding about the processes and consequences of selection, training and performance in youth sport.

Ferreira, LC, Weiss, LW, Hammond, KG, and Schilling, BK, (2010) conducted an investigation to determine if relatively small manipulations of
squat load and the inclusion of selected morphologic variables might augment the explained variance in vertical jump (VJ) displacement. Fifty-two university students (27 women and 25 men) with weight training experience served as subjects. All were assessed for body fat percentage (BF%), height, body weight (BW), leg length (LL), ankle range of motion, and quadriceps angle (Q-angle). Additionally, subjects performed drop vertical jumps (DVJs) and both countermovement jump (CMJ) squats and static jump (SJ) squats at 20, 30, and 40% of their back squat 1 repetition maximum (1RM). A preliminary analysis revealed that DVJ_{om} for all subjects (28.1 ± 6.64; mean ± SD) was most highly correlated with both CMJ @ 30%, 1 RM (CMJ30PP) and SJ @ 20% 1 RM (SJ20PP) (r = 0.84, p < 0.001). Forced multiple regression was then used to determine which variables contributed to VJ displacement. The greatest variability explained (83%) used a CMJ: DVJ_{cm} = 20.311 + (0.008) (GMJ30PP) — (0.346) (BW). When the same variables were used to calculate separate gender-based regressions, the explained variance in DVJ_{cm} (men = 33.0 ± 5.34 cm; women = ± 3.79 cm) was 68% for men and 64% for women. These findings suggest that jump squat peak power at a light load is a good predictor of VJ and that its training-induced augmentation would likely improve VJ. The addition of BW to the equation explained slightly more variability in DVJ_{cm} than in BF%. Because excess amounts of either would
be an additional load to be moved against gravity (fat in general or skeletal muscle in the upper torso), it follows that relatively high levels of either might be expected to attenuate VJ performance.

Sassi, RH, Dardouri, W, Yahmed, MH, Gmada, N, Mahfoudhi, ME, and Gharbi, Z., (2009) evaluated the reliability of a modified agility T-test (MAT) and to examine its relationship to the free countermovement jump (FCMJ) and the 10-m straight sprint (1 OmSS). In this new version, we preserved the same nature of displacement of the T-test but we reduced the total distance to cover. A total of 86 subjects (34 women: age = 22.6 ± 1.4 years; weight = 63.7 ± 10.2 kg; height = 1.65 ± 0.05 m; body mass index = 23.3 ± 3.3 kg-m^2; and 52 men: age = 22.4 ± 1.5 years; weight = 68.7 ± 8.0 kg; height = 1.77 ± 0.06 m; body mass index = 22.0 ± 2.0 kg-m^2) performed MAT, T-test, FCMJ, and 10mSS. Our results showed no difference between test-retest MAT scores. Intraclass reliability of the MAT was greater than 0.90 across the trials (0.92 and 0.95 for women and men, respectively). The mean difference (bias) ± the 95% limits of agreement was 0.03 ± 0.37 seconds for women and 0.03 ± 0.33 seconds for men. MAT was correlated to the T-test (r = 0.79, p < 0.001 and r = 0.75, p < 0.001 for women and men, respectively). Significant correlations were found between both MAT and FCMJ, and MAT and 10mSS for women (r= -0.47, p < 0.01 and r= 0.34, p < 0.05, respectively). No significant
correlations were found between MAT and all other tests for men. These results indicate that MAT is a reliable test to assess agility. The weak relationship between MAT and strength and straight speed suggests that agility requires other determinants of performance as coordination.

Batista, G Ricarte; Araujo, R Freire de; and Guerra, R Oliveira (2008) were compared the anthropometric profile and the vertical jumps of two groups of Brazilian male high performance beach volleyball players. The sample consisted of 38 male beach volleyball players from the Brazilian Beach Volleyball Circuit of 2006, allocated to two groups according to national ranking of their teams. Anthropometric measures and performance in vertical jumps were assessed using a specific methodology. The anthropometric results of the groups showed no statistically significant differences. The players of group 1 (G1) were better in the spike jump (P<0.01), block jump (P<0.01) and block difference (P<0.01) than the players of group 2 (G2). The prediction model of the spike jump for G2 included body mass and standing spike reach (adjusted R2=0.77) while for the block jump model it was body mass and standing block reach (adjusted R2=0.73). The regression models for G1 were not statistically significant. It is likely that vertical jump height (spike and block) influences the performance of beach volleyball players, and consequently the performance of their teams, since the present study found higher values in G1 than in G2.
for the spike jump, block jump and block difference. However, an athlete’s success is not related only to the variables investigated in this study; technical skill, tactics, psychology and physical conditioning can also play a role.

Jeremy M. Sheppard et.al (2008) was to examined the potential strength, power, and anthropometric contributors to vertical jump performances that are considered specific to volleyball success: the spike jump (SPJ) and counter-movement vertical jump (CMVJ). To assess the relationship among strength, power, and anthropometric variables with CMVJ and SPJ, a correlation and regression analysis was performed. In addition, a comparison of strength, power, and anthropometric differences between the seven best subjects and the seven worst athletes on the CMVJ test and SPJ test was performed. When expressed as body mass relative measures, moderate correlations (0.53-0.65; p < 0.01) were observed between the 1RM measures and both relative CMVJ and relative SPJ. Very strong correlations were observed between relative (absolute height-standing reach height) depth jump performance and relative SPJ (0.85; p< 0.01) and relative CMVJ (0.93; p £ 0.01). The single best regression model component for relative CMVJ was the relative depth jump performance, explaining 84% of performance. The single best predictor for relative SPJ was also the relative depth jump performance (72% of per-
formance), with the three-component models of relative depth jump, relative CMVJ, spike jump contribution (percent difference between SPJ and CMVJ), and relative CMVJ, spike jump contribution, and peak force, accounting for 96% and 97%, respectively. The results of this study clearly demonstrate that in an elite population of volleyball players, stretch-shortening cycle performance and the ability to tolerate high stretch loads, as in the depth jump, is critical to performance in the jumps associated with volleyball performance.

Marques, MC, van den Tillaar, R, Vescovi, JD, and Gonzalez-Badillo, JJ., (2008) recommended that in-season training programs aim to maintain muscular strength and power developed during the off-season. However, improvements in performance may be possible with a well-designed training regimen. The purpose of this case report is to describe the changes in physical performance after an in-season training regimen in professional female volleyball players in order to determine whether muscular strength and power might be improved. Apart from normal practice sessions, 10 elite female volleyball players completed training sessions per week, which included both resistance training and plyometric exercises. Over the 12-week season, the athletes performed 3-4 sets of 3-8 repetitions for resistance and plyometric exercises during each training session. All sessions were supervised by one of the investigators as well as by the team.
head coach. Muscular strength and power were assessed before and after the 12-week training program using repetition maximum bench press and parallel squat tests, an overhead medicine ball throw (BTd), as well as unloaded and loaded countermovement jumps (CMJs). Strength improved by 15% and 11.5% in the bench press and parallel squat, respectively (p<0.0001). Distance in the BTd improved by 11.8% (p < 0.0001), whereas unloaded and loaded CMJ height increased between 3.8 and 11.2%. The current findings suggest that elite female volleyball players can improve strength and power during the competition season by implementing a well-designed training program that includes both resistance and plyometric exercises.

Court sports often require more frequent changes of direction (COD) than field sports. Most court sports require 180° turns over a small distance, so COD in such sports might be best evaluated with an agility test involving short sprints and sharp turns. Barnes, J.L., B.K. Schilling, M.J. Falvo, L.W. Weiss, A.K. Creasy, and A.C. Fry, (2007), conducted a study to (a) quantify vertical and horizontal force during a COD task, (b) identify possible predictors of court-sport-specific agility performance, and (c) examine performance difference between National Collegiate Athletic Association Division I, II, and III athletes. Twenty-nine collegiate female volleyball players completed a novel agility test, countermovement (CM)
and drop jump tests, and an isometric leg extensor test. The number of athletes by division was as follows: I \((n = 9)\), II \((n = 11)\), and III \((n = 9)\).

The agility test consisted of 4 5-meter sprints with 3 180° turns, including 1 on a multiaxial force platform so that the kinetic properties of the COD could be identified. One-way analysis of variance revealed that Division I athletes had significantly greater countermovement jump heights than Division III, and the effect size comparisons (Cohen’s d) showed large-magnitude differences between Division I and both Divisions II and III for jump height. No other differences in performance variables were noted between divisions, although effect sizes reached moderate values for some comparisons. Regression analysis revealed that CM displacement was a significant predictor of agility performance, explaining approximately 34% of the variance. Vertical force was found to account for much of the total force exerted during the contact phase of the COD task, suggesting that performance in the vertical domain may limit the COD task used herein. This study indicates that individuals with greater CM performance also have quicker agility times and suggests that training predominantly in the vertical domain may also yield improvements in certain types of agility performance. This may hold true even if such agility performance requires a horizontal component.
Gabbett, T., and B. Georgieff (2007) investigated the physiological and anthropometric characteristics of junior volleyball players competing at the elite, semi-elite, and novice levels and to establish performance standards for these athletes. One hundred and fifty-three junior national (JV = 14 males; N = 20 females), state (N = 16 males; N = 42 females), and novice (N = 27 males; JV = 34 females) volleyball players participated in this study. Subjects underwent measurements of standard anthropometry (body mass, height, standing reach height, and sum of 7 skin-folds), lower-body muscular power (vertical jump and spike jump), upper-body muscular power (overhead medicine ball throw), speed (5-m and 10-m sprint), agility (T-test), and estimated maximal aerobic power (multistage fitness test) during the competitive phase of the season, after obtaining a degree of match fitness. Significant differences (p < 0.05) were detected among junior national, state, and novice volleyball players for height, standing reach height, skinfold thickness, lower-body muscular power, agility, and estimated maximal aerobic power, with the physiological and anthropometric characteristics of players typically improving with increases in playing level. Male players were taller, heavier, leaner, and had greater standing reach height, speed, agility, muscular power, and estimated maximal aerobic power than female players. These findings provide normative data and performance standards for junior volleyball players.
competing at the elite, semi-elite, and novice levels. Given the improvements in lower-body muscular power, agility, and estimated maximal aerobic power with increased playing level, and given the importance of these qualities to competitive performances, conditioning coaches should train these qualities to improve the playing performances of junior volleyball players.

Despite the important role of agility in successful performance in many team and racket sports, little is known about their physiological and muscular basis. Markovic, G., (2007), examined the relationship between the leg extensor strength and power and agility performance. Male physical education students (n=76) were assessed by means of 3 typical agility performance tests (lateral stepping, 20-yard shuttle run, and slalom run). Six tests of leg extensor strength (isoinertial squat, isometric squat, and one-leg rising) and power (squat jump power, hopping power, and standing long jump distance) were also obtained. The correlations between strength and power, and each agility performance were generally low. As a consequence, the multiple correlation coefficients between strength and power predictors and agility, albeit significant (P<0.01), were also rather low (r=0.33,0.44, and 0.35 for the lateral stepping, 20-yard shuttle run, and slalom run, respectively). The highest relationship with each of the agility tests was revealed by the one-leg rising test (r within -0.3 and -0.44;
P<0.02). The results of the present study suggest that most of the multijoint leg extensor strength and power measures are poor predictors of agility in physically active men. Thus, the effects of interventions aimed towards the improvement of functional movement performance may not require evaluation by means of the common tests of muscular strength and power. A more specific approach including both the functional strength tests and functional movement performance tests could be recommended instead.

Tim Gabbetta, Boris Georgieff & Nathan Domrow, (2007) conducted a study to determine whether physiological, anthropometric, and skill test results could discriminate between junior volleyball players of varying ability. Twenty-eight junior volleyball players competed for selection in a talent-identification volleyball programme. Participants underwent measurements of stature, standing reach stature, body mass, skinfold thickness, overhead medicine ball throw, vertical jump, spike jump, 5-m and 10-m speed, “T” test agility, maximal aerobic power, and passing, setting, serving, and spiking technique and accuracy. A discriminant analysis was conducted on the selected and non-selected groups to obtain a regression equation that could be used to predict selection in junior volleyball squads based on the dependent variables. Passing and serving technique were the only significant variables included in the discriminant analysis. Cross-validation results showed that 17 of 19 selected players
(89.5%) and 5 of 9 non-selected players (55.6%) were correctly classified into selected and non-selected groups, respectively, providing an overall predictive accuracy of 78.6%. The results of this study demonstrate that selected skill test results (i.e. subjective coach evaluations of passing technique and serving technique), but not physiological and anthropometric data, discriminate between successful and unsuccessful talent-identified junior volleyball players. These results demonstrate the importance of developing passing and serving technique in talent-identified junior volleyball players.

Bayios IA., et. al., (2006) conducted a study to determine the anthropometric profile, body composition and somatotype of elite Greek female basketball (B), volleyball (V) and handball (H) players, b) to compare the mean scores among sports and c) to detect possible differences in relation to competition level. A total of 518 female athletes, all members of the Greek first National League (A1 and A2 division) in B, V and H sport teams participated in the present study. Twelve anthropometric measures required for the calculation of body composition indexes and somatotype components were obtained according to the established literature. Volleyball athletes were the tallest (P<0.001) among the three groups of athletes, had the lowest values of body fat (P<0.001) and their somatotype was characterized as balanced endomorph (3.4-2.7-2.9).
Basketball athletes were taller (P<0.01) and leaner (P<0.001) than Handball players, with a somatotype characterized as mesomorph-endomorph (3.7-3.2-2.4). Handball athletes were the shortest of all (P<0.01), had the highest percentage of body fat (P<0.001) and their somatotype was mesomorph-endomorph (4.2-4.7-1.8). In comparison with their A2 counterparts the A1 division players were taller (P<0.001) and heavier (P<0.01), but at the same time leaner (P<0.001), and exhibited higher homogeneity in somatotype characteristics (P<0.05). Anthropometric, body composition and somatotype variables of Greek female elite teamball players varied among sports; selection criteria, hours of training and sport-specific physiological demands during the game could explain the observed differences. More data are certainly needed to define the anthropometric profile of B, V and H female athletes internationally.

Raini Stamm and Mcclis Stamm (2004) discusses the relations between the body build of 46 young female volleyballers (age 13—16 years, 51 characteristics including 11 skinfolds) and the results of nine physical ability tests. The tests included four jump tests, endurance, trunk strength, flexibility, speed and medicine ball throwing tests. Correlation of basic anthropometric characteristics with test results showed that all the tests except the trunk strength test and the flexibility test were to a greater or smaller extent related to body measurements. Body fat content had a
negative impact on jump tests, and on endurance and speed tests. The
endurance test correlated negatively with body measurements; smaller
players had greater endurance. In regression analysis, to show the
dependence of physical ability test results on body build, two models were
used: 1) height, weight and age; 2) other anthropometric characteristics.
The second model predicted the variability of tests results within 48-89%.
In all cases the model of height, weight and age yielded somewhat less
significant results. The tests results were placed in a 5 SO classification of
weight and height. The classification showed that jumping ability improved
gradually from the small to the medium to the big class; leptomorphs could
jump higher than pycnomorphs. In speed tests leptomorphs were more
successful than pycnomorphs.

Stamm (2003) utilized a number of tests for female volleyball
players’ physical performance. These tests included: jumping ability
(standing vertical jump and reach and running vertical jump and reach);
maximum aerobic endurance (20 m shuttle run); trunk strength (sit-up test);
flexibility test (the extent of bending forward from sitting position); agility
and speed (a zigzag run test); and upper body and arms strength (medicine
ball throwing test), and reported that four of these tests showed a significant
correlation with game proficiency. The aerobic endurance was measured
by 20 m shuttle run, flexibility was measured by the extent of bending
forward from sitting position, agility and speed of movement was measured by a zigzag run test, and upper body strength was measured by the medicine ball throwing test. The upper body and arms strength was found to contribute to 22% of the efficiency of attack (Stamm et al. 2003).

Ugarkovic et al. (2002) examined anthropometric measures, maximal vertical jump, maximal isometric voluntary force, and force development of hip and knee extensors of 33 elite male junior athletes to predict maximal vertical jump performance. Standard anthropometric and body composition measures included height, lean body mass, as well as the percentage of fat and muscle tissue. Except maximal isometric forces, all correlation coefficients between the selected variables and jump heights were insignificant. As a consequence, the corresponding multiple correlation coefficient, $R=0.71$, also suggested a moderate predictability of jumping performance by the standard strength tests and anthropometric and body composition variables. The results are in line with the concept that a reliable performance assessment in homogeneous groups of athletes requires predominantly movement specific testing.

Johnson, Doug L., and Bahamonde, Rafeal (1996) devised a simple mechanical power formula for both peak and average power using a countermovement jump and reach test from a force platform. College athletes (49 females and 69 males) were measured for height, weight, thigh
circumference, thigh skin fold, thigh length, and fore leg length. A Vertec was used to measure vertical jump height, and the force platform was used to help determine power output. Eight anthropometric measurements, vertical jump height, and gender were used in a stepwise multiple regression to develop the prediction equations. Vertical jump height, mass, and body height were significant variables selected by stepwise multiple regression to predict both peak and average mechanical power, accounting for 91 and 82 % of the variance in peak and average power output, respectively.

Hartmann et.al, (1991) investigated the success of utilizing a variety of different motor and physical ability measures to predict volleyball performance in a game situation. Eighteen female volleyball players were assessed for reaction time, response time, visual activity, contrast sensitivity, anaerobic capacity and power, agility, vertical jumping ability and basketball throwing ability. These predictor variables were tested within one week prior to the first day of competition and all tests were collected in a single session. Performance evaluation was carried out over a period of four weekends of tournament play. Volleyball match play was videotaped and later evaluated by an evaluator. A five point index and evaluation was constructed for the skills of serving, setting, blocking, attacking, serve reception, and digging. The physical and motor ability measures were entered into a stepwise multiple regression to assess the strength of predicting each of the volleyball
performance variables. Significant prediction equations (p<0.05) were developed for the skills of serving (R=0.53), blocking(R=0.74), attacking (R=0.69), digging (R=0.59), and serve receiving (R=0.64). No significant prediction equation could be constructed for the skill of setting. Visual contrast sensitivity was found to be the single best predictor for the performance of digging and the maximum vertical block jump was the best predictor for blocking success. Success in attacking, serve receiving, and serving was best predicted using results from the anaerobic capacity and power test (Wingate protocol). These findings suggest that there are specific parameters which might be used to predict success in women’s volleyball at the collegiate level.

Yuan (1982) suggested some other anthropometric characteristics for juvenile volleyball players identification, such as longer toes (especially the second toes), longer hands and feet, narrower pelvis and ankles, high flexibility, and the growth showing a promising taller height. Qu (2007) measured the anthropometric profile of women volleyball players in the 26th Olympic Games, and made a comparison between the Chinese players and players from other countries. He also collected data for the anthropometric variables of 287 women players in the 15th World Women Volleyball Tournament. It is obvious that elite volleyball players have their specific anthropometric characteristics, such as stature, the length of arm,
palm, fingers, and Achilles’ tendon, the girth of ankle, calf, thigh, forearm and upper arm. For example, the elite volleyball players in China usually have longer Achilles’ tendons and smaller ankle girth, and this contributes to a comparatively smaller value of the index “ankle girth/Achilles’ tendons×100”. The ankle girth/Achilles’ tendons index of volleyball male players were 92.8, male swimmers were 102.3 and male gymnasts were 105.7. The ankle girth/Achilles’ tendons index of volleyball female players was 95.8, female swimmers was 108.3 and female gymnasts was 101.2. Therefore the volleyball players had a longer Achilles’ tendon and smaller ankle girth than that of other athletes. Similarly, the average calf length index of the volleyball players is obviously longer than those of the swimmers. The average calf length index of the male volleyball players was 99.7, the swimmers were 90.3. The average calf length index of the female volleyball players was 100.5, the swimmers were 95.3. These anthropometric characteristics have been considered to be very important in talent identification of volleyball players (Zeng, 1992).

Shondell, (1971) identified the physical and anthropometric traits possessed by successful volleyball players. An initial group of 23 tests and measurements was selected to measure the characteristics of a successful player. A jury of four judges served to provide the criterion which was overall volleyball performance. 93 subjects completed all 23 items.
Statistical techniques utilized provided inter correlation coefficient of the independent variables, correlation coefficients between the independent variables and the dependent variable, step wise regression coefficients and constants, and the square of the multiple correlation coefficients for the regression equation at each step. Reliability coefficients of all items were computed by using extra-class correlation technique. Power appeared to be the most significant factor in successful volleyball performance. Strength did not seem to be a factor in successful volleyball performance.