Chapter III

RELATED LITERATURE
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Sincere efforts have been made by the research scholar to locate literature related to the present study. The related literature to the present study found from various sources, on role of psychological characteristics, physical abilities, age, height and weight, have been abstracted in this chapter to provide a back-ground material and to evaluate the significance of the present study as well as to interpret its findings.

The related literature to the present study has been presented in the following design:

1. Literature pertaining to personality and sports performance.

2. Literature concerning Anxiety in Sports.

3. Literature regarding concentration and sports performance.

4. Literature regarding physical abilities (strength and flexibility) and sports performance.

5. Literature pertaining to age, height and weight and sports performance.
Literature pertaining to Personality and Sports Performance

Literature pertaining to Personality and Sports Performance has been further presented under three following heading as the studies regarding the personality and sportsmen have been conducted in mainly three dimensions.

Personality Traits of Athletes and Non-athletes

Sports scientists are trying to differentiate between athletes and non-athletes with regard to their personality traits. In fact, the major portion of the research literature on personality structure in the field of sports psychology is related with the comparison of personality factors between athletes and non-athletes (Sperling, 1942, Slusher, 1964, Cooper, 1969). Majority of the investigations have indicated that athletes differ from non-athletes on a number of personality traits. Booth (1958) using MMPI investigated the differences in the personality of football players, athletes and non-athletes. His results revealed that the athletes from the various sport groups and non-athletes differed significantly on several of the MMPI scales. Cattell (1965) has indicated that certain traits distinguish athletes from other groups. Parson (1964) revealed that champion swimmers differed from the average population in 15 of the 16 factors of Cattell 16 PF and the champion swimmers apparently possessed marked extreme scores on personality factors.
Slusher (1964) conducted studies on personality and intelligence characteristics of selected High School Athletes and Non-athletes. Selected High School athletes (junior and senior in baseball, basketball, football, swimming and wrestling) were compared with non-athletes from the same population for differences in selected profile scales, as indicated by the Minnesota Multiphasic Personality Inventory (MMPI), and intelligent quotients (I). Personality characteristics in terms of MMPI categories of hypochondriasis (Hs) depression (D), hysteria (Hy), psychopathic deviation (pd), femininity (MF), paranoia (Pa), and psychosthenia (pt), distinguished between athletic and non-athletic groups. Hypochondriasis was significantly higher for all athletic groups, except swimmers, when compared with the non-athletic group. Only hypomania (Ma) and the validity scale (K) failed to differentiate between athletic and non-athletic groups.

Werner and Gottheil (1966) compared athletes and non-athletes collegiate groups using Cattell's 16 PF and found athletics group having significantly higher scores on A+, F+, H+ and O₂ indicating extraversion pattern.

Werner (1966) conducted study on personality development and participation in college athletics on the basis of their past histories of athletic participation. A group of 340 cadets entering the United States Military Academy were designated as athletes, and another group of 116 were designated as athletic non-participants. The Cattell's Sixteen Personality Factor Test was
administered shortly after entrance and again shortly prior to graduation. Entering cadet athletes were significantly different from non-participants on seven of the 16 PF Scales. The proportion of athletes who graduated from the academy was significantly greater than the proportion of non-participants who graduated.

Behrman (1967) conducted study on personality differences between non-swimmers and swimmers. The investigation was made to determine whether there are personality differences between male college freshman swimmers and non-swimmers and to determine the relationship between personality traits and swimmers experiencing a common course of instruction in swimming. Subjects were compared on the basis of swimming performances, personality tests, biographical data forms, and interviews with subjects who failed to learn how to swim. Comparison revealed significant differences between swimmers and non-swimmers and between learners and non-learners. The data indicated a need to investigate methods of teaching fearful non-swimmers based on indication of pertinent personality traits, fears, and experiences in the water.

In the study done by Malumphy (1968), the sport participants were found to be more conscientious and tough-minded, but less imaginative and less venturesome than the non-sports participants. Newmann (1968) suggested that participation in high level athletic competition provides and adds a dimension to one's personality. He found that athletes were more sociable, more aggressive in
their approach to problems, more self-confident, more critical of themselves and more extroverted than non-athletes. Ogilvie (1968) also found that traits like emotional stability, tough-mindedness, consciousness, self-control, low energetic tension level, self assuredness and out-goingness consistently were associated with athletic achievement.

Berger and Littlefield (1969) compared the personality of football players and non-athletes. They found insignificant differences in CPI score between outstanding football players, non-outstanding athletes and non-athletes. Gupta (1969) studied the personality characteristics of hockey champions and non-athletes by administering MMPI Test. The results of his study revealed that hockey champions were highest on Ma scale while low of PF scale. Hockey champions were found to have greater ability to concentrate, self-confidence, extraversion, tendency to worry less and less intelligence as compared with the group of non-athletes.

Hunt (1969) reported that Negro and White varsity athletes had similar personality profiles as did the Negro and White non-athletes. Hence, athletes, regardless of ethnic background tended to differ from the non-athletes.

Little (1969) found that the athletic group was highly extroverted and sociable while the non-athletic group was characterized by introversion and lack of sociability. His findings are essentially in agreement with those of Kane and Warburton (1966)
and Pierce (1969) i.e. athletes display fewer neurotic symptoms than non-athletes. So he concluded that athletes have consistently been found to differ from non-athletes on a number of personality traits. The athlete tends to be stable and extroverted, with the exception of cross country runners and marathoners who are characterized by introversion.

William et al. (1970) found that the female athlete, like the male athlete, tends to differ from the non-athlete on a number of personality factors. Also female athletes from different subgroups tended to differ on various dimensions of personality. Yanada and Hirata (1970) reported that those students who continued in their sport clubs were less neurotic, less depressive, and more hypomanic than those who dropped out. Goles (1971), however, found athletes to be significantly more extroverted than the non-athletes, and the sport groups did not differ on this dimension. Also, none of the groups differed on the neuroticism, stability dimensions.

Morgan and Hammer (1971) reported that college wrestlers and experienced marathoners scored significantly lower than the population average on anxiety. Morgan and Costill (1972) also found the American world-class wrestlers to be more extroverted than the normal population and marathoners, who in turns were more introverted than the population and most other athletic sub-groups. Bosco (1972) administered Cattle's Sixteen Personality
Factor Questionnaire to champion gymnasts and 9 college students of comparable age. In his study, the gymnasts scored higher in emotional stability and maturity, confidence and seriousness. Chadwick (1972) found that female athletes were significantly more tough-minded, practical, group dependent, subdued, and less intelligent than non-athletic group. Rusch (1972) found that adult female athletes to be more reserved and tough-minded that the non-athletes. however, Gooch (1973) found variations in personality between successful and non-successful women athletes and between inter-collegiate and non-inter-collegiate women athletes. Evidence also indicated that there was relationship between personality and physical performance. Singer (1972) showed that a group of inter-collegiate basketball players were more tough-minded and group dependant than non-athletes.

Mohan et al. (1979) found that the players were more extroverted than non-players and low on neuroticism implying more stability of emotionality. Thakur and Thakur (1980) studied personality characteristics of the athlete and non-athlete Indian College males using projective method of personality assessment and found that the characteristics associated with the athletes were happiness, cordial and affectionate, anxiety, achievement, dominance and superior organisation capacity, whereas the characteristics associated with the non-athletes were guilt, acquisition, passivity, rejection, superior imagination.

Eysenck et al. (1982) reported that athletes tend to be high on psychoticism than the non-athletes. According to them, a high psychoticism scores may be described as being aggressive, troublesome, cruel and inhuman, lacking in feeling and empty. He is hostile to others, even his own kith and kin.

Daino (1983) conducted study on personality traits of adolescent tennis players. The purpose of this investigation was to determine if there were significant differences in personality traits between a group of adolescent tennis players and a group of not practising sports adolescent. This study was carried out on a sample of 132 subjects, boys and girls and were classified as: tennis players, 36 males, 30 females, non-sports 36 males, 30 females, from otherwise similar characteristics. Eysenck personal- ality questionnaire, Middle Sex Hospital Questionnaire and Will to Win Questionnaire were administered. The obtained results indicate that the comparison group differed from each other on a number of personality traits. In general tennis players scored significantly higher in extroversion and will to win, and exhibited a less neuroticism (emotionally unstable), anxiety apprehension obsession and depression.
Fu (1984) studied the personality profiles of athletes and non-athletes in six developing countries by administering 16 PF (Form A). From each country eighty subjects were selected out of which 40 were sportsmen who had participated up to inter-collegiate level and 40 were non-sportsmen of the same educational qualifications. Half in each category were male and other half female. Differences in personality profiles were observed from male and female students from Venezuela, Nigeria, Hong Kong and Taiwan. Similar differences were also found among athletes and non-athletes from Venezuela and Nigeria. Further comparisons were also made within each ethnic group.

Kumar and Thakur (1986) found that athletes were not anxious, tender-minded and worrying persons, but had out-going personality in comparison to non-athletes. These results support the findings of Eysenck et al. (1982) who reported that athletes tended to be low in neuroticism or anxiety and tended to be extraverted than the non-athletes. Singh and Singh (1986) found that neuroticism tendency was significantly higher in the non-sports groups of students, whereas, no significant difference was observed in extraversion scores between the two groups. Shankar (1986) found that the position winner gymnasts and non-position winner gymnasts of various universities of India were almost equally stable and extraverts in their psychological make up of the personality scales. However, the gymnasts differed from non-athletes on both the dimensions of personality. Hence, gymnasts were
better equipped mentally for successful performance and achievement in sports than non-athletes.

Sharma and Shukla (1986) also concluded that athletes in various sports specialities tend to be out-going, socially confident, emotionally stable, happy go lucky, conscientious (rules bound), venturesome, self-reliant, rigorous, confident, self-sufficient, controlled and relaxed. On the other hand, the non-athletes are reserved, less intelligent, affected by feeling, weak super ego, shy, tender-mindedness, suspicious, doubting, indisciplined and tense.

Dureha (1987) concluded that the sportsmen and non-sportsmen differed in their personality characteristics in some factors like "emotional stability and realism about life, cheerfulness and frankness, tender-mindedness and practicability and great control over emotions and greater regards for self-respect and social reputation.

The present investigator et al. (1987) studied the personality traits of Indian National Women Gymnasts. The national women gymnasts were found significantly more out-going, more intelligent, more conscientious, more sober, more trust-worthy, more practical having high self concept control and relaxed when compared with the non-sportswomen.

Bawa and Debnath (1989) studied the personality traits of Indian national women football and gymnastics teams. They found a significant difference in six of the 16 Personality traits
between the two teams. Female gymnasts were found to be significantly more intelligent, more conscientious, having strong super ego strength and more controlled, having higher self concept control, whereas national football team was found more suspicious, more apprehensive and moody and more self sufficient than gymnastic team.

Personality Traits of Sportsmen/Sportswomen of Individual and Team Sports

The results regarding differences in the personality traits of players of individual and team games are unequivocal. Some studies have failed to be able to find difference between team and individual athletes (Duffy 1962, Ikegami, 1968, Pyeche, 1970). But some studies have shown that athletes in team sports tend to be extroverted and self-confident, while those participating in an individual sports are more inclined to be introverted, stable and confident. Of course there is a popular belief that individual sport competitors are more introverted and self-centered than team competitions who are more extroverted and team oriented.

Hein (1954) found team sports participants to be more extraverted than those participating in individual sports. He also found that participants in individual and dual sports possessed less amount of self-assurance. Husman (1955) showed in his study on boxers, wrestlers and cross-country distinguishing characteristics as far as aggressive tendencies were concerned. His findings
were that the cross-country runners tended to be more extra punitive than the boxers and the boxers possessed less over all intensity of aggression and had more super ego.

Niblock (1960) found that female athletes to be more energetic, enthusiastic, efficient, as possessing more leadership potential, and were optimistic and more extroverted. Slusher (1964) using MMPI found that personality differences existed even among athletes who participated in different sports.

Peterson et al. (1967) reported that women athletes who participated in individual sports when compared to women competing in team sports were more dominant, adventurous, sensitive, radical, imaginative, self-sufficient, and more forthright. They also found team sport female athletes to be intellectually, brighter and more conscientious and aggressive than the normative group of equivalent age and education. Thus, the athletes from the individual sports were more introverted than the team sport athletes but both groups were characterised by emotional stability.

Rushall (1967) while comparing personality characteristics of male swimmers with female swimmers found that females were socially bold, noisy and unrestrained in their behaviour, whereas males appeared to be self-centred and individualistic. It was also found that novice female swimmers were, in general, more introverted than a control group of female athletes, not primarily engaged in swimming. Rushall (1970) concluded that
personality is not related with success in swimming.

Mulumphy (1968) and Ogilvio (1968) also conducted a related investigation, where four groups of female athletes i.e. athletes in teams sports, in individual sports, team individual sports, subjectively judged sports and the non-athletes, differed on various factors. The athletes from individual sports were more extroverted than those athletes from team and team-individual groups. This seemed to be in dis-agreement with the findings of Peterson, Weber and Trousdale (1967). Malumphy also found that the team sport group was less extroverted than the non-athletes. However, he found individual female athletes to be more anxious, venturesome, tough-minded, extraverted, while team athletes were lower in leadership, less venturesome and extraverted.

Kane (1970) found a rather complex relationship between the second order personality variable "extraversion" and performance of "track athletes" (sprinters), and they were found to be frequently more extraverted than middle distance runners. He claimed that as the distance increased, there was a trend towards introversion. William and her associates (1970) found that male and female competitive race car drivers tended to be reserved, self-sufficient, autonomous, assertive and aggressive, and they scored below average on affiliation and nurturance. Kennedy (1971) critically analysed the effects of sports participation on the modification of various personality traits possessed by an individual before starting his/her sports career. Here he emphasised
on the most commonly found personality traits in the champion athletes as stated by ogilvie. These traits are: i) Emotional stability, ii) Tough mindedness, iii) self-assurance, iv) Basic trust in people, v) psychological endurance, vi) conscientiousness, and vii) out-going.

Ogilvie (1971) found male competitors to be basically emotionally healthy persons who tend towards extroversion. They were tough minded, self-assertive and self-confident with a high capacity to ensure the stress involved in high level competition. Peterson, Weber and Trousdale (1971) in their study on U.S. Olympic female participants have compared female participants of individual sports with participants of team sports and reported that women from individual sports were significantly more dominant and aggressive, adventurous, sensitive, imaginative, self-sufficient, sourceful than team sport athletes.

According to Cratty (1972) 'there appear to be singularly identified' athletic type of personality. Rather the data available indicate that within specific events or types of events there are common types of personality traits found in group of superior athletes. For example there seems to be a common group of personality traits associated with events involving hard physical contact with others (like wrestling). Personality traits seems common to individual engaging in aesthetic events of gymnastics and figure skating.
Johnson (1972) demonstrated differences between female athletes participating in such sports as basketball, bowling, field hockey and golf, as did Kroll and Crenshaw (1968) between footballers, wrestlers and gymnasts. In another study conducted on West Germany, Sack (1975) revealed that middle and long distance runners when compared to handball and football players were different along with dimensions of dominance, introversion-extraversion and body build.

Gruber and Parkins (1978) found women who completed in inter-collegiate competition to be significantly higher on the factors F (Sober), and I (tough-minded) which compared to the non-participant group. William (1978) reported that selected personality traits are frequently associated with the elite female athletes, and specifically, that the successful female competitor generally tends to be more assertive, dominant, self-sufficient, independent, aggressive, reserved, Kirkcaldy (1982) found no significant differences regarding the personality dimension of team and individual athletes.

By considering team sports separately by categorising athletes into one of three classes i.e. offensive, centre and defensive players, Kirkcaldy (1982) found that males in attacking positions (offensive players) were substantially higher in psychoticism (tough-minded, dominant, aggressive) and extraversion as compared to mid-field (centre) players. There being no difference
between offensive and defensive participants. The attacking player was significantly more neurotic (emotionally unstable) than either centre or defensive player. The forward, offensive players were less easily differentiated from defensive players, the later group exhibiting a more emotionally stable pattern than the offensive athlete. In females, the trend was some what reversed i.e. attacking players were less extraverted and more neurotic than players from other positions. No significant differences were found to exist in the personality profiles of female athletes between different positions. Sharma and Shukla (1982) studied the personality characteristics of sportsmen of individual and team sports. The reported that individual sports athletes were higher on these traits: Conscientiousness, outgoing, super ego-strength, vigorous and toughmindedness, outgoing, super ego-strength, vigorous and toughmindedness. They also found significance differences between athletes and non-athletes on 12 traits.

Kirkcaldy (1982) found that the female basketball players (successful and unsuccessful) scored significantly lower on factor I than the non-athletic female group towards the tough-minded side of the scale. On factor L, the unsuccessful basketball players scored significantly lower than the successful players, indicating that successful players are more trusting group. Daino 1983) found that in general, tennis players scored significantly higher in extraversion and will to win and exhibited a less "neuroticism" (emotionally unstable), anxiety apprehension, obsession and depression.
Kamlesh et al. (1986) studied the personality traits of "General" and "Reserved" category physical education majors. Eysenck personality inventory was administered on 38 males (28 "general" category and 10 "reserved" category) and 38 female (28 general category and 10 reserved category) Physical education majors. They reported that male and female physical education majors, within their category groups differed significantly on extraversion and neuroticism. Sharma and Shukla (1986) found that the individual sports athletes were higher on conscientiousness, outgoing, super-ego, strength, vigorous, relaxed and tough-mindedness. Singh (1986) found that the players of individual events and team games differed significantly on the extroversion and neuroticism traits of personality. In the case of both males and females, the athletic group was more extrovert and more neurotic than the hockey group.

Singh and Brar (1987) found that both male and female handball players were just ambiverts. They, however, suggested that these studies need to be extended further to know the personality traits of the athletes in different sports events in Indian conditions. Singh and Debnath (1988) studied the personality characteristics of Indian national women gymnastics and football teams by administering 16 PF. Significant differences (p .05) were observed in factor B, G, L, O, Q2 and Q3 between national gymnastic team and football team. Non-significant differences were
observed in other factors of 16 P.F. Gymnasts were found more intelligent, rule bound and had high self control, women football players were found to be more suspicious, guilt proneness and self sufficient than gymnasts.

The present investigator and Debnath (1989) studied the personality traits of female national badminton players, gymnasts and cyclists by administering the Hindi version of Neyman-Kohlstadt Diagnostic test for Introversion - Extroversion prepared in Hindi by Dr. Jai Prakash. All the three groups were found to be an average category on Introversion - Extroversion scale. But when the mean scores were compared the badminton players were found significantly more introverts than other two female groups.

Personality and Sports Performance

Personality has been widely acknowledged as an important aspect of physical ability. Some experts believe that certain personality traits are the only real differentiators between success and failure in sport (Fisher 1976). Others state that there is insufficient evidence that a positive contribution to personality occurs through high level competition (Ogilvie 1968). There is a growing evidence that personality traits are sports specific and predictable (O’ Conner and Webb, 1976; Kroll and Crenshaw, 1968). Several investigators have directed their attention to understand the relationships between personality and level of performance.
Bidulph (1954) has reported significant differences in some of the personality traits between superior athletic groups and less skilled group. In his study, superior athletes showed higher levels of personal and social adjustments.

Several investigators have directed their attention to determine the relationship between personality and level of performance. Johnson, Hutton and Johnson (1954) found that the outstanding athletes were found to possess several distinguishing characteristics like "extreme aggressiveness, a freedom from great emotional inhibition, high and generalized anxiety, high level of intellectual aspiration and feelings of exceptional self-assurance."

Laplace (1954) conducted study on personality and its relationship to success in professional baseball. The purpose of this study was to determine whether specific personality traits are associated with success in professional baseball. To determine this a "success" group of 49 major league players was compared to a "non-success" group of 64 minor league players. The Minnesota Multiphæsic personality Inventory and a biological data sheet were employed. Results indicate that major league players are better able than minor league players to: 1. Apply their strong "drive" towards a definite objective by exercising self-discipline. 2. Adjust to occupations, as professional baseball, requiring social contact or the 3. Exercise initiative.
Booth (1958), Slusher (1964) have reported certain personality traits as distinguishing athletes of one kind from those of other kinds. Marrimán (1960) conducted study on relationship of personality traits to motor ability. In this study the California Psychological Inventory (CPI) and the Philips JCR Test were administered to 808 High School boys. For purposes of comparison the subjects were classified as follows: Upper and Lower motor-ability groups; athletes and non-athletes matched according to motor-ability scores; and participants in team sports, participants in individual sports, and participants in team-individual sports. The upper motor-ability group scored significantly higher than the lower motor-ability group on the measure of poise, ascendancy, and self-assurance and on the measures of intellectual and interest modes.

Few significant differences were found between mean CPI scores when the athletes and non-athletes were matched according to motor ability. Few significant differences were found between mean CPI scores for participants in team sports, participants in individual sports, and participants in team-individual sports. The results of this study indicate that motor ability is related to personality traits.

Rasch et al. (1960) conducted study on some personality attributes of champion amateur wrestlers. In this study fourteen candidates for the 1960 Olympic wrestling team were given the Berfit test of masculinity-femininity to determine if their scores
would resemble those of known male homosexuals or those of
college freshmen in general. It was concluded that the wrestlers
did not differ appreciably from the male freshmen. It further
became evident that they considered themselves straight forward,
mature, modest and masculine.

Kane (1964) who reviewed the literature pertaining to perso-
nality and physical ability came to the conclusion that a positive
relationship existed between "athletic ability and stability as opposed
to anxiety, athletic ability and extraversion as opposed to intro-
version." The results of the investigations conducted since Kane's
(1964) review have been equivocal as provided by considerable
evidence showing that success in sports in dependent upon certain
physical capacities. Kane (1964) also examined the relationship
between various physical abilities, personality factors, physique,
and socio-metric status. He found (i) that a high level of physical
ability favours extravert development, (ii) that among those of
high physical ability, only those achieve high standards in competi-
tive conditions who rate highly in extravert, and (iii) that size
supports stability.

Parsons (1964) administered the 16 PF to champion swimmers
and found that they differed from the average population on
15 of the 16 factors. However, these swimmers in the champion
group who were selected to participate on 1962 Canadian team
did not differ from those swimmers who were not selected.
Studies conducted by Kane (1965), Berhram and Kroll (1967) and Dardin (1972) have indicated that determination, drive, nerve, the killer instinct are the qualities that are expected to be found extraordinarily in champion athletes. They have also shown that athletes of one sport differ from those of other sport and non-athletes in their personality characteristics. Kroll and Carlson (1967) have reported no differences in personality make up, between superior and inferior participants in wrestling and karate.

Kroll (1965) conducted study on personality factor profiles of collegiate football teams. Five collegiate football teams were selected so as to provide data on winning and losing teams as well as on several categories of colleges. Personality profiles of five teams (N=139) on the Cattle I6 PF test were scrutinized through a multiple-diseriminant analysis and a maximum-likelihood classification method.

Significant descrimination between teams were demonstrated with the highest contributors to the derived-discriminant function being factor B (intelligence), factor H (shy versus bold), factor O (confident versus worrying), and factor Q3 (casual versus contro-

lled). Based upon actual versus predicted group membership, the percentage of correct classifications was .55. when based upon prediction into winning or losing categories, the percentage of correct classifications was .82.
Singer (1969) compared the basketball players and tennis players on EPPS norms and also the highest and lowest ranked athletes in both sports. The baseball team scored significantly lower than the other two groups, on the intraception variable, lower than the tennis group on the achievement variable, lower than the norm group on autonomy and lower than the tennis group on dominance. Both the baseball and tennis groups scored significantly higher than the norm group on the aggression factor. No differences were noted between high and low rated baseball players. Some researchers like Rushal (1970) and Ellison and Freischlag (1975) have concluded that personality is not a significant factor in sports performance.

Williams et al. (1970) conducted study on personality traits of champion level female fencers. Thirty national level female fencers were studied with the Cattel 16 Personality Factor Questionnaire and the Eduwards Personal Performance Study to determine if there were distinct personality traits characteristic of champion level female fencers and if there was any correlation between personality traits and level of achievement in the 1968 National Championship. A definite fencer may be described as a very reserved, self-sufficient autonomous individual with a below-average desire for affiliation and nurturance. She has a strong need to be the very best and is an intelligent, creative, experimenting, and imaginative person. She also tends to be assertive and aggressive. An analysis of variance revealed that only one personality factor would differentiate levels of achievement. Top level compe-
titors was significantly more dominating than the low level competitor.

Morgen and Costil (1972) administered the EPI, the IPAT Anxiety Scale, and the Depression Adjective Check List to a group of experienced marathoners. Correlations was computed between performance in the marathon, the maximal oxygen intake of the subjects, and the psychological variables. Marathon performance was not significantly correlated with any of the variables.

Singer and Haase (1975) conducted study on sports and personality. By means of theoretical reflections and empirical findings the author makes clear that the discussion about the relationship between sport activity and personality is still widely influenced by global assumptions and hypotheses. Questions such as whether or how far sport influences the development of the personality of the sportsman cannot be answered thus scientifically.

O'Conner and Webb (1976) compared the personality traits of four groups of inter-collegiate female athletic competitors and one group of non-competitors students by administering both forms of A and B of the Cattle's 16 Personality Factor Questionnaire and found significant difference on the four personality factors
i.e. personality factor of intelligence, radicalism, self sufficiency and control.

Breedlove (1978) investigated the relationship of selected personality traits and professed self concept to performance in gymnastics in women collegiate gymnasts. Jackson's personality research form and the TN self concept scale were administered to 48 collegiate gymnasts. Scores from these instruments were compared to performance in 4 individual gymnastics events (vaults, uneven bars, balancing beam, and floor exercises) and the all round event as determined by meet scores. Significant relationships were found between of physical self, moral ethical self, total variability in the area of personality.

Ejem (1978) conducted study on personality traits or superior volleyball players. In an analysis of pre-requisites of superior volleyball players the author followed also their personality traits. In all of the teams of the Czechoslovak championship, the 1st league (100 players, with a mean age under 26 years). He applied both forms of the Eysenck's Personality Inventory (EPI), disclosing two bipolar secondary personality factors: extraversion - introversion and emotional liability - stability. On the basis of an analysis of the matrix of rank correlation coefficients he found relationship
between personality dimensions and volleyball performance.

The findings of Singh (1979) supported that high-skilled players, irrespective of the game they played were more extrovert and less neurotic than the low-skilled players. Sorenson (1979) used Mortinek Zaichkowsky self-concept scale and the jump and reach test the pass test and zig-zag run test for motor performance and found significant correlation between self-concept and performance on all three motor tasks for the sixth grade girls (P < .05) but absence of significant relationship between self concept and motor performance in first grade children and sixth grade boys.

Williams and Parkin (1980) conducted study on Personality Factor Profiles of three Hockey groups. The Cattel sixteen personality profiles of eighty-five male field hockey players. The subjects considered of three groups based on achievement level in hockey. Multiple discriminant analysis revealed that the International group (N = 18) which included the 1976 Olympic Gold Medalists, had significantly different profiles from the club group (which consisted of players of average ability) while the third group which comprised of players who had represented their province (N = 34) and who were regarded as being advanced were not
significantly distinguishable from either of the other two groups, they appeared to be more similar to the players at the highest level. The profile components that contributed most to the significantly discriminant function were factor O (confident - apprehensive), B (intelligence) L (trusting - suspicious), C (emotionally less stable - emotionally stable), H (shy - bold), F (Sober - enthusiastic) and (tough - tenderminded).

Dvorcek (1981) conducted study on remarks on the personality of a junior top tennis player. The study points out some possibilities and consequences in the psychological diagnostics of the junior top tennis players. On the basis of a quantitative analysis of data obtained from the junior representatives, the author out-lines a partial profile of a successful junior tennis player. At a hypothetical level he differentiated some adaptation mechanisms of athletes with respect to failure. The presupposed findings may be applied in the practice both for selection purposes and the training of talented boys and girls.

Recently, interest in the relationship between "sports and personality" has once more received a boost (Kirkcaldy et al. 1983, Bachleitner, 1984) while there are some researchers who have established an obvious relationship between athletic performance and personality traits (Eysenck et al. 1982, Kirkcaldy 1982), there are others who deny such a correlation mainly because the results provide contradictory findings (Sack, 1982).
Costa (1984) has investigated the football player's personality and reported that the high competitiveness of the game requires in a real champion a well-balanced strong, disciplined, conscientious, self-controlled and self-assured personality.

Chisholm (1986) investigated difference between successful and less successful gymnasts. The study was conducted on 76 female gymnasts. The researcher reported that the successful gymnasts were significantly higher in drive, conscientiousness and exhibition when compared to less unsuccessful competitors. Less successful gymnasts tested, scored significantly higher in leadership, emotional control and guilt proneness when compared to their counterparts. All of these gymnasts scored high in affiliation, determination, conscientiousness and trust in addition to scoring low in aggression, autonomy and dominance. Singh (1986) reported that the champion boxers of All India Inter-varsity level were emotionally more stable, possessed strong super-ego strength, self-reliant, practical, confident, experimenting, self-sufficient, highly self-concept and unfrustrated. On the other hand, non-champions boxers of All India Inter-varsity level were dependent, imaginative, depressive, emotionally less stable, humble, weaker super-ego strength, conservative and frustrated.

Uppal and Gill (1986) found that highly skilled male badminton players were more suspicious, neither less intelligent nor more intelligent and neither tough-minded nor tender-minded as compared
to poorly skilled male badminton players who were less intelligent, tough-minded and neither trusting nor suspicious. On the other hand, highly skilled female badminton players were tough-minded, suspicious and hard to fool as compared with poorly skilled female badminton players who were neither tough-minded nor tender-minded and neither trusting nor suspicious.

Clarke (1987) studied the personality and attitudinal profiles of 250 applicants to sports related courses. He reported that unsuccessful group scored significantly higher than the successful group in the subdomain of vertigo and females were significantly higher in the sub-domain of aesthetic. Kumari et al. (1988) studied the personality make up 89 female players. They reported a significant difference in Extroversion aspect of personality between university player and low achievers and a non-significant difference in Neuroticism between university players and low level achievers. While doing inter-game comparison volleyball players were found significantly more stable than hockey players. Hockey players were found to be significantly higher on extraversion scores from football, kno-kno and kabaddi players. Extraversion was not found to be highly related trait with university level athletes.

Morgan et al. (1988) conducted study on personality structure, Mood states, and performance in elite male distance runners. The purpose of this investigation was to evaluation the psychological characteristics of a sample of elite U.S. male distance runners,
as well as examine the relationship between these variables and
distance running performance. Fourteen elite male distance runners
volunteered to participate and they completed a battery of psycho-
logical questionnaire consisting of the state-trait Anxiety Inventory,
Profile of Mood States, and Eysenck Personality questionnaire.
In additions, structured interviews were conducted with each runner
in order to assess motivation, cognitive strategies, pre-competition
arousal levels, and prevalence rates for stateness. The results
of the interview and questionnaire data were found to be consistent
with previously published reports concerning elite male and female
distance runners. Ability ratings for the 10,000 meter run were
 calculated by a panel of experts based on past performance.

Predictive validity estimates for the performance criterion
were observed to vary from \( r = 0.92 \) to \( r = 1.00 \) \( (p > 0.01) \) in pilot
research. Multiple regression analysis indicated that a measures
of global mood and trait anxiety accounted for 45 per cent of
the variance in performance \( (r = 0.67, p > 0.04) \), and these results
support the concept that performance is associated with mental
health.

**Literature Pertaining to Anxiety in Sports**

A considerable amount of research has been done to ac-ber-
tain the effect of anxiety on performance of motor skills and
sports. The researches in anxiety and sports performance have
been conducted mainly in two dimensions i.e. (1) difference
in anxiety between athletes and non-athletes and between athletes of various sports disciplines (2) relation of anxiety to performance in sports.

Studies Related to Anxiety Between Athletes and Non-athletes and Between Athletes of Various Sports Disciplines

Johnson and Hutton (1955) investigated changes in what they termed "neurotic signs" right before the match and then returned to normal the day after the contest. Shepard et al. (1958) conducted study on "Manifest Anxiety and Performance on a complex perceptual motor task. This study investigated the relationship between manifest anxiety and performance on a complex perceptual-motor tests. A group of 483 under-graduates was tested for emotional stability. Two groups, differing in manifest anxiety, were determined and for each group - 28 students (10 male and 18 female) were selected. Manifest anxiety in relation to level of performance was investigated by using the Tronto Complex coordinator. The subjects practiced 24, 1-minute trials which were divided into 3 blocks of 8 minutes separated by 5-seconds intervals. It was found that 28 non-anxious subjects were superior in terms of both, a higher number of matches and a lower error-match ratio.
Hammer (1967) conducted study on a comparison of differences in manifest anxiety in university athletes and non-athletes. The 103 subjects who provided the data consisted of forty freshmen football players, twenty one freshmen and varsity wrestlers, and fortytwo non-athletes. The study revealed that there were significant differences between the M.A.S. scores of high achieving wrestlers and low achieving wrestlers, and between high achieving wrestlers, and non-athletes. There was no significant difference between M.A.S. scores of high achieving football players and low achieving football players, or between high achieving football players and non-athletes. There was no significant differences between the M.A.S. scores of football players and wrestlers or between athletes (football and wrestling) and non-athletes. There was no significant difference between the M.A.S. scores of low achieving football players and wrestlers and the M.A.S. scores of non-athletes.

Malumphy (1968) found female team athletes to be significantly more anxious than individual players and non-participants. Morgan (1970) reported that the anxiety levels of varsity wrestlers were lower prior to a match than at a pre-season measure. A subsequent study (Morgan and Hammer, 1974), however, indicated that the anxiety of wrestlers increased one hour before a match.

According to Spielberger, Gorsuch and Luschane (1970), there is no apparent trend showing individual or team sport
athletes differ in A-trait. Oxendine (1970) suggested that football blocking and tackling and weight-lifting require extremely high A-states, that basketball, boxing and soccer require moderate A-states, and that archery, bowling and golf require low A-state for optimal performance. Participants in dangerous physical activity usually experience high levels of anxiousness and arousal. Egstrom and Backrech (1971) have noted that over-whelming levels of anxiety among diverse may lead to panic thus causing an increase in under-water accidents.

Tutko (1971) stated that anxiety is greater in individual sportsmen than in team sportsmen. In an individual sport, success or failure lies solely with the individual participant. The individual stands alone when he fails and must singly accept the repercussions of losing. In the team games, errors usually go unnoticed because of the general activity of the contest, and moreover, success and failure are commonly shared.

Griffin (1972) found differences in A-trait among athletes, while administering Spielberger's Trait Anxiety Inventory (Spielberger, Gorsuch and Luschene 1970) to 682 females engaged in eight competitive sports, representing three different age-groups. He found that the differences in A-trait for the three age-groups were significant with the 19+ group being lower in A-trait. For the various sports, A-trait scores also differed significantly and female gymnasts were highest in A-trait and female
basketball players were lowest in A-trait. Kane (1972) has reported that in general, anxiety is higher for women than for men, although there are many exceptions. He further reported that British women athletes are significantly less anxious than their female counterparts in the U.S.A., in part because the British are more generally accepting of females in athletes than are Americans.

Morgan and Costill (1972) conducted study on psychological characteristics of the marathon runner. The purpose of the investigation was to assess the psychological characteristics of selected marathon runners. Nine (N = 9) U.S. marathon runners completed psychological tests which provided measures of (i) introversion-extroversion, (ii) neuroticism-stability, (iii) anxiety, and (iv) depression. It was concluded that the marathon runners who were evaluated in scored within the normal limits on all of the psychological variables with the exception of anxiety. The runners scored appreciably lower than the norm group for the anxiety variable. Also, none of the psychological variables were significantly correlated with performance in the marathon.

Hardman (1973) compared A-trait among 42 different samples of athletes. He found that most male athletes were within the normal range of A-trait on the Cattell I6 PF using the derived anxiety factor. Hence, most athletes tended to have A-trait levels similar to the general population. He also suggested that superior athletes are less anxious than average-ability players.
Morgan et al. (1973) conducted study on psychobiological correlates of success in Canadian for the 1972 Olympic freestyle team. The purpose of investigation was to evaluate the psychobiological correlates of success in twenty five finalists for the 1972 Olympic Freestyle team. Successful (N = 7) and unsuccessful (N = 18) wrestlers were compared. The dependent variables were state anxiety, trait anxiety, depression, hostility, vigor, fatigue, confusion, somatic perception, extroversion, neuroticism, aggression, perceived exertion, a psychometric lie scale, age, height, weight % body fat, muscular strength, static endurance, dynamic endurance, and maximal heart rate, \( VO_2 \) and VE. A one way ANOVA for each dependent variable revealed that two groups to differ on state anxiety, tension, vigor, confusion, the psychometric lie scale, dynamic endurance, and maximal heart rate and \( VO_2 \). Stepwise discriminant function analysis were performed utilizing selected bio-logic data alone, psychologic data alone, and a combination of both sets of variables. These analyses yielded multiple R's of 0.67 (biologic), 0.73 (psychologic) and 0.92 (psychobiologic). The variables remaining following the stepwise solution were state anxiety, extroversion, vigor, the psychometric lie scale, \( VO_2 \) and dynamic biologic model was the most efficacious in predicting success in wrestling.

According to Martens (1977), that if difference exist in general A-trait between athletes and non-athletes, they are
minimal. General A-trait is a measure of the tendency to become aroused in a wide class of situations. It is difficult to explain why athletes should be higher or lower in A-trait than non-athletes for all types of situations. This, however, may not be true when considering a person's tendency to become anxious in competitive sports.

Baumann (1979) conducted study on types of anxiety and its avoidance in gymnastics. To eliminate anxiety during the learning of gymnastics skills as well as during competition is a basic demand. The author first of all informed about psychonalytical attempts and those out of the area theory of learning concerning the origin of anxiety and important categories of anxiety that could be observed by the coach such as timidity, anxiety because of lack of orientation, because of unfamiliarity, "concrete fear".

Hogg (1980) conducted study on Anxiety of the competition swimmer. After remarks concerning the concept of anxiety (discriminated was between 'trait anxiety." State anxiety and competitive anxiety) the author informed about attempts to objective anxiety by means of psychological tests. Research results concerning the topic "anxiety in swimming" were mentioned. Symptoms of anxiety that could be observed by the coach were named. Techniques to reduce anxiety (e.g. autogenic training, mental training, biofeedback-training) and practical implications for the coach were explained.
Finn and Sprague (1981) made a comparison of competitive trait anxiety levels of 9-12 years old participants in little league and neighbourhood baseball. Results showed significant differences in the mean anxiety scores: (a) among test trials conditions for the little league group as well as neighbourhood sample, (b) among test-trial conditions for the 9, 10 and 12 years old age-group, and (c) between the little league and neighbourhood participants during pre-season, mid-season and post-season conditions. The results were: a) exposure to a competitive experiences influenced the A-trait of the children, b) age was a pertinent factor regarding A-trait scoring, and c) the organizational type of competitive situation affected the A-trait results of the little league and neighbourhood groups.

Giese (1981) tested 19 male alround gymnasts from the Big-eight Conference and a control group of 21 male Kansas University students on physiological parameters, the state-trait anxiety inventory and Laskies Test of competition attitudes. The gymnasts were divided into two groups on the basis of their performance level. He has reported a significant difference at 0.05 level in flexibility, strength, percentage fat and state-trait anxiety among the gymnastic groups and controls.

Ruisel (1981) conducted study on the influence of anxiety on the sport performance. In the contemporary psychology a dual
understanding of anxiety is enforced; as a temporary psychic state as well as permanent personality trait (anxiety). In his paper the author discusses some concrete explorations on the influence of anxiety as well as socially determined fears from failure. In conclusion the author presents practical possibilities how to eliminate anxiety during the training process.

Sanderson and Ashton (1981) conducted study on analysis of anxiety levels before and after badminton competition during a badminton tournament. Pre-match and post-match anxiety states of males/females and match winners/losers were monitored. Matched pairs 't' tests on the before after data revealed a significant decrease (P > .05) in the female players anxiety after winning matches. It was argued that the Spielberger state anxiety test has potentially the greatest use of the individual level and women it is used in conjunction with analysis of the reasons for the existence of particular states.

Athletes self reported perceptions of responses to anxiety eliciting situations were probed by Fisher and Zwart (1982) for the purpose of describing athletes anxiety profile, in which it was found that the anxiety responses varied partially with the perceptions of the situations. It was pointed out that the outcomes and efficiency expectations bear direct-relevance to the comprehension of competitive sports anxiety.
By administering Martens' SCAT, Power (1982) made an analysis of anxiety levels in track and field athletes of varying ages and abilities. He found: (i) a significant tendency for anxiety to increase with age, (ii) the significant differences existed between the competition sub-groups, and (iii) CTA seemed to be a significant problem as far as track and field athletes and as such levels of CTA were found to be detrimental to performance.

Reviv and Rotsteiv (1982) studied trait anxiety, state anxiety and self control in marathon runners. The findings of this study revealed significant differences between the marathon runners group, the team sports athletes and individual sports groups. The marathon runners were characterized by a lower level of state anxiety before competition and a higher level of self-control. It was reported that a high level of self-control which is typical of marathon runners, makes it possible for the marathoners to endure the pain and other difficulties which arise throughout the long run.

Calderar (1984) conducted study on stress anxiety in sport. Also sport seems to be source of acute and chronic stress with possible effects in physical and psychic health of a person. A simple test like the one used by Holmes in psychosomatics, has allowed the author to discover the presence of "stress anxiety" in the world of sport. In fact, "stress anxiety" can also effect
officials, trainer and other sports engaged persons with possible inter-personal side effects (family, school, work). The author also emphasised efficiency interventions in order to prevent behavioural and psychomatic negative consequences.

Gurley et al. (1984) conducted study on Dance and sports compared effects on psychological well-being. This research tested whether dance uniquely changes subjects' evaluations of their psychological well-being. College students (N= 133) in three types of classes - dance, sports, and academic - filled out a 20 scale semantic differential inventory before and after a 90 minute class period. Both dance and sports classes, as compared with the academic controls, decreased anxiety and depression, thus confirming results of previous exercise research. In addition, when compared with sports, the dance classes produced more positive evaluations of psychological well-being on eight other scales: The dancers characterized themselves as significantly more creative, confident, relaxed, excited, motivated, healthy, intelligent, and energetic. Dance combines art with physical exertion, and this combination may contribute to the observed differences in the psychological effects of dance versus sports.

Eby et al. (1986) studied the psychological profiles of an elite men's and an elite women's basketball teams. Scores were obtained for trait anxiety (Martens 1977), achievement orientation, affiliation, self esteem and sport cohesion. Results showed few
differences between the scores of the male and female players in all the measures, which supports the contention that elite players of both genders are more similar than dissimilar. The one exception was for self-esteem in which men's team scored significantly higher ($p > 0.02$) among the variables.

Mace et al. (1986) studied the stress inoculation training to central anxiety and enhance performance in sport. Some skills were taught to cope up with psychological stress by developing thoughts, mental images and self-statements aimed at enhancing performance. The investigators indicated that groups varied significantly in terms of both self-reported stress and observer estimated stress. The stress inoculation group had significantly lower self-reported stress intensity scores than both the control group and the practical training group. In addition they had lower scores than the control group and the practical training group on observer estimated stress. They concluded that stress inoculation training has considerable potential for modifying stress reactions in sports.

Sanderson and Hughes (1986) investigated the psychological correlates of cross country running by administering competitive state anxiety inventory immediately before and after the race. Analysis of the pre-race data in relation to performance suggested a somewhat closer relationship between absolute success and psychological variables. The poorer performers would not appear
to find comfort in the achievements of sub goals. They also found that lower finishers are more inclined to make excuses as a mean of protecting self-esteem. Analysis of pre- and post race CSAI data revealed a significant reduction in anxiety post race, a significant correlation with performance post-race and a non-significant correlation between pre and post race scores. They concluded that if the complex reasons for particular anxiety stress are to be investigated realistically and performance is to be more sensitively predicted, then more psychological comprehensive approaches need to be adopted. Singh (1986) found significant differences in the competitive anxiety between the athletes and hockey players, whether males or females or combined, the athletes having more competitive anxiety than the hockey players. He also found that as compared to the players of the individual events, the players of the team games had less competitive anxiety. Singh and Singh (1986) found the level of anxiety to be significantly higher in the non-sports group of students.

Burton (1988) conducted study on "DO anxious swimmers swim slower"? Re-examining the elusive anxiety performance relationship. The purpose of investigation was to utilise a multi-dimensional measure of anxiety and a more sensitive intra individual performance measure to evaluate the relationship between anxiety and performance. Three hypotheses were tested. First, cognitive anxiety is more consistently and strongly related to performance
than is somatic anxiety. Second, somatic anxiety demonstrates an inverted U relationship with performance, whereas self-confidence and performance exhibit a positive linear relationship and cognitive anxiety and performance exhibit a negative one. Finally, short duration and high and low complexity events demonstrate stronger relationships between somatic anxiety and performance than do long duration or moderate complexity events. Two samples of swimmers completed the CSAI-2 prior to competition, and performance data were obtained from meet results. Correlational and multiple regression analysis generally supported hypotheses.

The present investigator and Debnath (1989) studied the anxiety level of sports women and non-sportswomen (N= 62) by administering Sinha's comprehensive Anxiety Test and found a significant difference in anxiety level between sportsmen and non-sportsmen. A non-significant difference in anxiety level among sportswomen of various sports disciplines was also reported.

Relationship of Anxiety to Performance in Sports

Some researchers have also studied the effect of anxiety on sports performance and relationship between sports performance and anxiety level. Gold (1955) reported that college tennis players were lower in A-trait than professional players.
Matarazzo et al. (1955) conducted study on Human maze performance as a function of increasing levels of anxiety. This study was designed to check the hypothesis that anxiety, as an acquired drive, would facilitate learning up to a point, but beyond this level increased anxiety would hinder learning. One hundred and one male subjects were given the Taylor Manifest Anxiety scale and classified into seven groups (later reduced to four) on a scale of increasing anxiety level. Two measures of learning a maze were used: a) time, and (b) traits to reach a criterion. When time was the measure of learning, a curvilinear relationship was found which supported the hypothesis. The data on trials showed a rectilinear relationship.

Reed (1960) found that both high and low levels of anxiety tended to disrupt the learning process, whereas, moderate levels of anxiety created an ideal atmosphere for learning and performance. But his suggestion that top class athletes are lower in A-trait was not supported. A series of studies conducted by Fens and his colleagues (Epstein and Fens, 1965; Fens and Epstein, 1967; Fenz and Johnes, 1974; Fenz, 1975) with parachutists give considerable insight into the role of skill and experience as mediators in the anxiety performance relationship. The results obtained by Fenz (1975) consistently showed that good parachutists exhibited an inverted U-shaped curve with arousal levels rising early but subsequently dropping so that arousal is only slightly elevated just before the jump. Poor parachutists, in contrast, showed continual rises in arousal and arousal was at its highest level just before
the jump. The findings of several studies confirm that perceived threat and corresponding state anxiety levels decrease with success experiences and increase with failure experiences (McAdoo, 1970; Gaudry and Poole, 1972; Hodges and Durham, 1972).

Holingsworth (1965) investigated the relationship between levels of trait anxiety, state anxiety and the performance of gross motor skill. A strong relationship was found to exist between state and trait anxiety. It was also found that as the performance level increased with practice, the anxiety level tended to decrease. Hutson (1966) studied the relationship between level of anxiety and the learning of skills in beginning horseback riding. To assess levels of anxiety in six women enrolled in a beginning riding class, the Parallel Anxiety Battery was used. The findings showed that as the students increased in skill, their anxiety tended to decrease.

Research evidence provided by Spence and Spence (1966) showed that high anxiety trait individuals tended to perform more poorly than their counterparts who were low in anxiety traits under conditions that involved negative evaluation of performance. Krop (1966) also found that anxiety was detrimental to the performance of novice collegiate gymnastics competitors but had no effect on experienced gymnastic performance.
Trait anxiety and achievement motivation have been studied as mediators of effects of competition on motor performance. Out of the three studies conducted to find the effects of competition on motor performance, Out of the three studies conducted to find the effects of competitive situation on high and low trait anxiety subjects, one study found low anxious subject as performing better than high anxious subjects in a competitive situation (Vaught and Newman 1966), another study found the opposite (McGown 1969), and a third found no differences (Martens and Landers 1969). Results of these studies conducted by Vaught and Newman (1966), McGown (1969), Martens and Landers (1969) on anxiety and motor performance are somewhat conflicting.

Further, some studies showed greater threat and higher state anxiety as evidenced by high trait-anxious people (Hodges, 1968, McAdoo, 1970). A few investigations indicated that competitive trait anxiety is an important inter-personal determinant of perceived threat when people are anticipating participation in a competitive experience. The results of these studies showed that higher competitive trait-anxious adults and children exhibit higher elevation in state anxiety than do low competitive trait anxious persons when facing competitions (Scanlan, 1975; Martens and Gill, 1976; Martens and Simon, 1976; Martens, 1977).

Perhaps the most persuasive evidence for the existence of a relationship between sports competence and A-trait was
provided by Ogilvie (1968) who reviewed the sports personality literature. On the basis of this review, he concluded that athletes, particularly superior athletes, have unique and identifiable personality profiles. Superior athletes are emotionally more stable, have lower levels of A-trait, and greater resistance to emotional stress. He did not qualify this for any specific sport or the sex of the participant. Cooper (1969), Husman (1969), Johnson and Cofer (1974), Kroll (1970), Martens (1975a, 1975b), Morgan (1972) and Rushall (1972) failed to concur with Ogilvie (1968). Each of these researchers concluded that there are no consistent differences in A-trait among participants when compared with non-participants or between participants of different skill levels.

Blancy (1970) investigated the relationship between environmental stress, psychoendocrine responses and competitive gymnastic performance. Sixteen male gymnasts were tested during one non-stressful practice meet and 3 stressful competitive meets. All measures were taken during the anticipating period proceeding to subjects actual performance were the performance rating. Results indicated significant differences between the non-stressful psychological measures means and stressful levels.

Bush (1970) noted no relationship between anxiety and level of competition for the Springfield College Women's Gymnastics Team. Those conflicting findings could be the result of the numerous ways in which anxiety is measured and the variety of motor
skills included in such experiments.

Some researches supporting the findings that state anxiety increased with failure and decreases with success are available (McAdoo, 1970; Gaudrey and Poole, 1972; Gill, 1976; Martens and Gill, 1976; Scanlan, 1977). Most of this work has dealt with the immediate impact of winning and losing upon post-competitive state anxiety levels.

Spielberger's trait-state theory of anxiety (1972) predicts that high A-trait subjects manifest greater increases in A-state than low A-trait subjects when the situation is perceived as threatening. Based on Spielberger's (1966) state-trait anxiety theory, McAdoo (1970) reported that subjects high on A-trait respond to threatening situations with greater levels of A-state than persons low on A-trait. It was also shown that success reduces, while failure increases A-state more in high A-trait than in low A-trait subjects.

Several researches have examined changes in A-state as a function of time to compete. Research by Martens and his co-workers (Martens, Gill, Simon and Scanlan, 1975; Martens and Gill, 1976, Martens, 1977) indicates that state anxiety levels are higher at pre-competition and mid-competition than at baseline measures.
Klavora (1975) used State-trait Anxiety Inventory developed by Spielberger et al. (1970) with 300 high school basketball and football players. They found out that high A-trait players in both samples were higher in A-state for all three A-state measures i.e. one week prior to a game in a practice session, 1/2 hour before a regular season game and again 1/2 hour before a tournament play off game. Both the high and low A-trait groups showed substantial increases in A-state just prior to both contests when compared to the practice A-state level. No difference was found between the regular season game and play off game. Baseler, Fisher and Mumford (1976) also did not find a relationship between A-state and gymnastic performance in college women.

Burton (1976) also studied the relationship between trait and state anxiety with movement satisfaction and participation in physical activities. He found that the high A-trait subjects had higher A-state scores along with lower movement satisfaction scores than did the low A-trait subjects on both pre-tests and post-tests. No change was found in the A-state level of the low A-trait group, but the A-state level of the high A-trait group decreased significantly over the treatment period.

Born (1977) investigated the relationship between arousal and anxiety of gymnastic performance. Pulse rate and palmer sweating were utilized as indicents of arousal. Anxiety was assessed by means of the state-trait anxiety inventory. The inter-correlation
matrix of all variables: gymnastic ability, pulse rate, palmer sweating, state anxiety, trait anxiety and gymnastic performance revealed limited relationship between gymnastic performance and arousal.

Momford (1977) studied the relationship between psychological arousal and women gymnastics performance. Resting and competitive levels of arousal were assessed by the palmer sweat index (PSI), a technique designed to identify and enumerate active sweat glands, PSI data were collected immediately prior to competition at each of 5 meets. She reported that gymnasts performed best under low arousal conditions.

In the area of competitive sports, the relationship of performance to state-trait anxiety has also been studied by many other investigators including Carron and Bennett (1978), Hanin (1980), Cratty and Hanin (1980), because in the stressful setting provided by competitive sports, it is not unusual to observe an athlete whose fears at least interfere with the effective performance.

Martens and Gill (1976) reported that subjects' A-state levels on the Spielberger STAI increased as the number of games won on a motor maze task decreased. Both high and low A-trait subjects increased in A-state after failure, but remained relatively low in A-state after success. Mahoney and Avener's (1977) study with male gymnasts revealed differences in arousal patterns as
a function of skill level. Olympic qualifiers reported slightly more anxiety than non-qualifiers prior to competition, but non-qualifiers reported higher anxiety during performance.

Naczyk (1977) investigated the differences in trait and state anxiety levels among individual participating in three divisions of junior high school competitive ice hockey. There were significant differences among competitive situations and between pre-test and post-test after winning but increased after losing in women's inter-collegiate basketball. Morgan and Hammer (1977) found significant change in A-state of college westlers. It was also found that pre-meet A-state rose significantly from a base line level and post-match A-state levels were significantly lower than pre-match.

Research findings by Martens and Gill (1976); Martens (1977); Scanlan and Passer (1978), have indicated that high A-trait individual manifest greater A-state just prior to engaging in competition than low A-trait individuals. However, little is known about the manner in which competitive trait anxiety influences perceived treat during actual competition with an opponent of equal ability. One related study (Martens and Gill 1976) examined A-state level at mid-competition and found that high A-trait children evidence greater A-state than low A-trait children Martens (1977) found that the mean scores increased from the base level through tournament first and second found competition. This result indicated that state anxiety increases though-out the competitive possess.
Scanlan (1977) contended that successful outcomes reduced threat of potential negative evaluation, whereas failure outcomes maximize threat. His investigation of attribution of high Vs low A-trait subjects relative to success-failure on a competitive motor maze task clearly indicated that success-failure was an important factor affecting the perception of threat, as measured by A-state levels.

Gerson and Desbaies (1978) conducted a study on competitive trait anxiety and performance as predictors of pre-competitive state anxiety. The results yielded a significant positive relationship between SCAT and pre-competitive state anxiety. It was found that the anxiety measures were significant predictors of performance in this setting. This finding is in agreement with the results obtained by Martens and Gill (1976) and Scanlan and Fasser (1978). Anxiety and performance levels have been reported to be interrelated (Griffiths et al. 1978, 1979). The negative correlations evident in the study (Griffiths, Steel & Vacaro and Karpman, 1981) between state anxiety and performance and trait anxiety and performance were supportive of this research.

Scanlan and Passer (1978) investigated the relationship between competitive A-trait and A-state by testing the boys 11-12 years old participating in youth soccer in Los Angeles. SCAT and Spielberger's (1973) State Anxiety Inventory for children (SAIC) were given prior to the season. A-states were reassessed thirty
minutes before the eight game of the season and immediately after the game. SCAT was a significant predictor of the basal A-state taken prior to the season and of pre-game A-state. These relationships showed that boys higher in competitive A-trait had higher A-state than boys low in competitive A-trait before the season, before the eight game but not after the game. They reported that winning players were lower in A-state than losing players.

Scanlan and Passer (1978) found CTA to correlate significantly with basal and pre-competitive state anxiety scores among youth male soccer players. Weinberg and Genuchi's (1980) investigation of male college golfers concluded that CTA was a significantly predictor of first round competition scores only.

Gruber and Beauchamp (1979) in their study on relevany of the Competitive State Anxiety Inventory in a sport environment," found changes in anxiety states before and after competition, where state anxiety was significantly reduced after all games that were won but remained high after all three games that were lost. The girls were found to be significantly more anxious before the crucial games when compared to the easy games.

Koyama, Imomata and Takeda (1980) found significant differences in three different sessions on state anxiety inventory (SAI), but found non-significant correlation between anxiety and
competition outcomes and players' self-evaluation.

Thirer and Denknell (1980) conducted study on female inter-collegiate athlete's trait-anxiety level and performance in a game. The study examine pre-competition trait anxiety level and its influence or athletic performance. Four different female inter-collegiate varsity sport teams (n=30) were used and coaches were asked to assess performance. Pre-competition trait-anxiety levels and performance ratings were recorded of varying times of the season. Findings indicated no relationship between players anxiety level and the coaches assessment of performance in a game. This suggests that the coaches rating may not be reliable as pre-competition anxiety levels were consistent with the perceived importance of each contest.

Weinberg and Genuchi (1980) conducted study on relationship between competitive trait anxiety, and Golf performance. A field study, examines the relationship between competitive trait anxiety, state anxiety and golf performance in a field setting. Ten low, moderate and high OTA collegiate golfers (n= 30) were BH examined. Results indicated a significant CTA main effect with low CTA subjects displaying lower state anxiety than moderate or high CTA subjects. The competition main effect and performance results also were significant and it was found that SCAT was a good predictor of pre-competitive state anxiety.
Huddlestone and Gill (1981) examined state anxiety as a function of skill level and proximity to competition. The results indicate that state anxiety increased immediately prior to competition. The pre-practice and pre-meet measures, which did not differ from each other, were both significantly higher than the post-practice measure, suggesting that practice creates anxiety levels similar to those generated by a competitive meet. A state score of qualifiers and non-qualifiers differed only slightly following practice and prior to the meet. The A-state levels of non-qualified were, however, somewhat more elevated than those of qualifiers prior to practice and immediately before the competitive event. Wandsilak, Potter and Lorentsen (1982) also confirmed the previous findings concerning the relationship between CTA and pre-game state anxiety. They concluded that state anxiety increase as the event becomes closer in time.

Sanderson and Ashton (1981) conducted study on analysis of anxiety levels before and after badminton competition. During a badminton tournament pre-match and post-match anxiety states of males/females and match winners/losers were monitored. Matched pairs 't' tests on the before-after data revealed a significant decrease ( p > .05) in the female players' anxiety after winning matches. It was argued that the Spielberger state-anxiety test has potentially the greatest use at the individual level and when it is used in conjunction with analysis of the reasons for the existence of particular states.
Power (1982) conducted study on an analysis of anxiety levels in Track and Field athletes of varying ages and abilities. Martens' Sport Competition Anxiety Test was administered to sixty-five adult male track and field athletes who were also divided into sub-groups representing all ages, events, experiences, and abilities. There was a significant relationship between age and anxiety ($p < .01$). No logical pattern regarding CTA emerged from any of the sub-group comparisons made. Forty per cent of the whole sample were classified as being high in CTA of the twenty-seven sub-groupings, all but three and twenty-five per cent or more of their subjects classified as being high in CTA.

Scustroem and Bernardo (1982) studied inter-individual pre-game state anxiety with basketball performance and found significant A-state effects for both composite game performance (PERF) and total points (TP). Although A-trait predicted absolute A-state levels extremely well, it failed to achieve a significant relationship with performance. Moreover, high A-state scores were found to be associated with poorest performance in all the three trait groups.

Cook et al. (1983) conducted study on relationship among competitive state anxiety, ability, and golf performance. They have reported a relationship between pre-competitive state anxiety and performance.
Using SCAT, Smith (1983) found that all star athletes had significantly lower anxiety scores than playing substitutes and this agrees with the concept that team sport athletes of higher status were less threatened by competitive situations than athletes of lower playing status.

Furst et al. (1984) investigated the relationship between sports performance and the state anxiety sub-component of cognitive worry and emotionality. Different sportsmen and [hand ball (N=13) and swimmers (N=37)] were given Liebert and Morris's worry-emotionality scale and Spielberger's State Anxiety Inventory (SAI) immediately before competition before national championships. Their results showed that for the team sport athletes positive correlations (\( r = .40, .27 \)) were found for emotionality and SAI respectively with performance. A zero correlation (\( r = -.04 \)) were found for worry and performance. For swimmers the correlations were \( r = -.24, -.29 \) and 0.2 for the three variables respectively. For both groups SAI and emotionality were highly correlated while worry had low correlations.

The primary purpose of the investigation of Dowthwaite and Arm Strong (1984) was to determine the effect of a competitive game on the anxiety levels of individual players. The game selected was soccer and squad of eleven male college players acted as experimental subjects. The adult version of Sport Competition Anxiety Test (SCAT) was administered to determine their trait
anxiety, ten minutes before the first and immediately after the last match. The competition short form of Spielberger's State Anxiety Inventory (CSAI) was administered to determine state anxiety levels ten minutes before and immediately after each game. The CSAI was applied to three matches, two judged to be easy and other match being classified as crucial. This was used to detect changes in A-state due to importance of the game. The group won all three matches. Scores of the instrument were indicative of changes in anxiety states before and after competition. The men were found significantly anxious before the crucial game when compared to the easy games.

Singh (1985) studied the anxiety level and concluded that (i) the competitive anxiety decreases with the increase in age in the case of the male athletes, but it increases with in the case of female athletes, (ii) in the case of male and female athletes, the competitive anxiety in the Indian athletes has no relationship with their experience of participation in competition, (iii) the Indian athletes have moderate level of competitive anxiety as compared to the sample norms proving the inverted U-shape relationship between performance and anxiety.

Rainey et al. (1987) conducted study on competitive trait anxiety among male and female junior High School athletes. The Sport Competition Anxiety Test (SCAT) was used to identify athlete-test with high and low (upper and lower 25 per cent) competitive
trait anxiety (CTA) from among 60 male and 60 female junior high scholars. High CTA athletes reported more frequent evaluation and performance worries and more anticipated negative feelings when playing poorly than low CTAs. These groups did not differ on perceived importance of success in sport, and on perceptions of their success/failure in sport. Males and females differed significantly an only team performance expectancies. Results provide support for the hypothesized relationship of fear of failure and fear of evaluation to CTA.

Raglin and Morgan (1987) conducted study on stimulated and actual pre-competition anxiety in college swimmers. State anxiety was evaluated in 25 male college swimmers in order to contrast prospective simulated anxiety values with actual ratings. Repeated measures ANOVA revealed that state anxiety increased ($p > .01$) prior to the difficult and easy competitions, but the increase was significantly ($p > .01$) to the difficult ($r = .72$) and easy ($r = .60$) meets, and the mean anxiety values were nearly identical for both conditions. Pre-competitive anxiety was not related to performance rating. It is concluded that college and swimmers can accurately predict their pre-competitive anxiety levels well in advance of actual competition and the better performance were more accurate in their predictions.

Ellickson (1987) conducted study on pre-competition anxiety states in female and male college athletes. The purpose of this
investigation was to evaluate pre-competition anxiety prior to usual, best, and worst performances by means of Hanin's retrospective recall method. The state anxiety scale was administered under baseline, usual, best and worst conditions. The sample consisted of 165 female and male athletes who were competing the university level in basketball, soccer, swimming and tennis. On the basis of Hanin's model it was hypothesized that pre-competition anxiety 1) would be significantly elevated, 2) there would be no gender effects, 3) there would be no effect due to sport, and 4) recall simulations would be similar for the usual, best, and worst conditions. Each of these hypotheses were confirmed and it is concluded that any effort to enhance performance by altering anxiety should be approached on a personalized basis.

Verma (1987) found that as compared to athletics and non-sportswomen, sportswomen from team games such as basketball, hockey and volleyball had higher level of anxiety. Sportswomen from individual sports such as athletics, cycling etc., which are of an independent nature tended to reduce anxiety level and inculcate the tendency of introversion.

Kim (1988) investigated the effectiveness of anxiety reduction technique on levels of competitive anxiety and shooting performance. 48 shooters were divided into 4 groups. A group (relaxation Imagery Group) B group (Meditation, Imagery Group), C group (combined group) and D group (control group) training was given
for 20 minutes a day for 6 weeks. SCAT (Martens 1976) was administered to measure competitive anxiety. Physiological anxiety was measured by heart rate and blood pressure. Also shooting scores were recorded. It was found by him that low competitive anxiety caused improved shooting performance, significant correlations were not found to exist between cognitive competitive anxiety and performance.

Mann and Bala (1989) studied the anxiety level of football players of 11 universities by administering SCAT (Martens 1977). They found that football players possessed above average level of anxiety before competition and level of anxiety increased at different stages of competition.

**Literature Concerning Concentration and its Relation to Performance in Sports**

Concentration plays important role in achieving optimum performance in every field of life. The greatest athletes are legendary for their power of concentration. Emphasising the importance of concentration in learning, Krueger (1984) states that "there is nothing in life that one can do without concentration and perfect concentration is that what enables one to perform perfectly." The great athlete, the great champion is the person who can shut out the rest of the world and concentrate on contest and the performance at hand, Frost (1971). The spectators, crowd and
competition surroundings distract the attention of an athlete during competition. A gymnast, who wants to perform at his best, must have such powers of concentration, that when the action starts he can concentrate wholly on the task at hand and can perform as if nothing else existed except himself, his spatial and temporal environments. The more experienced and highly skilled gymnast becomes, the more he can control his attention. An experienced gymnast can select the important cues and shut out the others. He can give focal or primary concentration on one cue and peripheral or secondary concentration to another. In gymnastics one has to concentrate on one's own performance without giving any attention to the performance of others. According to Ravizza (1987) the trained and competent performer always concentrate specially and primarily on the central and important aspects.

Many researchers have studied the relationship of concentration to performance in sports. Beroga (1975) discovered that short duration of various exercises and the need to carry them out with maximum efforts demand a special concentration, the habit of arriving at maximum degree of anticipation, that is the mobilisation of all the physical and psychic resources during a determined time. Nideffer (1976) stated that it was conceivable that highly successful gymnasts may differ in their attentional and interpersonal characteristics from those who are less successful.
Brucke (1978) administered, on 22 male varsity all-around gymnasts from 9 universities, Level of Concentration Grid Test (L.C.G.T.) two days prior to the team competitive gymnastic meet. The LCGT consisted of 10 rows by 10 columns comprising 10 cells. Each cells contained 1 randomly assigned interger, between 1 and 100. Each subject was allotted 4 minutes to place a check on each cell in numerical order. The LCGT scores was correlated with all around score received in competition. A non-significant relationship between concentration and competitive results were reported.

Gleneross (1979) found out that the degree to which the available capacities and abilities to concentrate acitivity be utilized depends largely upon the learned strategies. Bos and Machling (1979) showed that somatic variables have the greatest influence on performance. Concentration demonstrates a greater weightage than IQ for the cognitive performance variables.

Silva (1981) found out a significant relationship between self-report levels of concentration and subjects performance in both sports and non-sports settings. Subjects performance was superior in situations where concentration levels were elevated. Results suggested that concentration was an influential factor in skilled performance.
Ravizza (1982) studied the relationship of concentration to gymnastics and hatha yoga, and reported a relationship between gymnastics performance and concentration. He has suggested that before competition, after warming, concentration can be focused as one goes for stretching exercises. According to him concentration is developed by focussing on the ingredients of the stretch. When distracted the distraction needs to be acknowledged and then pull the attention back to stretch. This teaches the gymnasts to concentrate on breadth with the stretches rather than just physically stretching the body. This ability to concentrate on the ingredients of a stretch is similar to the ability to concentrate on the ingredients in the execution of the performance.

Sandhu (1982) was of the opinion that as the speed of observation increased more errors were committed by the volleyball players in the task demanding high concentration. Further more 82 per cent of the subjects failed to muster optimum observation capacity in the first set, and 80 per cent of them failed to touch their best performance in this set. According to Schmid (1982) there are many different techniques athletes use to achieve higher level of concentration. One useful approach is to teach them the key attentional points. Developing key points to concentrate on in the routine will fill the gymnast's mind and she will not have time for negative thoughts such as "I hope I don't fall." In addition the key points are the cues to centre one's attention on the task at hand and to avoid distractive thoughts and feelings.
Concentration is possibly the most critical psychological skill necessary for a gymnast, Hunschen and Gordin (1983). The goal of a gymnast is not to be consistent 100 per cent times in performance but to be consistently close to his optimal performance. According to Maheney et al. (1983) one of the more noteworthy aspects of elite athletes regardless to sport is their noteworthy apparent ability to not only survive and recover from performance efforts but also to apparently "harvest" the experience in a way that seems to facilitate further improvement. Exceptional athletes are seldom stranger to experience of errors, sub-optimal performance and defeat." Another related characteristics of elite athlete is their apparent ability to focus their concentration on task at hand.

Vallerand (1983) conducted study on predictive validity of the Test of Attention and Interpersonal Style (TAIS) in a sport setting. The purpose of this study was to assess the relationship between athletes' attentional style as measured by Nideffer's Test of Attentional and Interpersonal style and a performance component, decision making. The subjects were divided into good average, and poor decision makers groups. Results from the analysis of variance revealed no significant differences among the three groups. Further more, a discriminant analysis on the good and poor decision makers revealed no clear picture. Van Schoyck and Grasha (1981) also concluded that the Test of Attentional and Inter-personal Styles does not seem to be sensitive enough to pick up differences in attentional style between performances.
of different levels.

Unestahl (1983) states that a comparison between different world class competitive gymnasts show considerable differences in physical dimensions. Some are short and some are tall. Psychometer functions like coordination, flexibility and timings shows many more similarities and the same is true with mental equipment. A good gymnast will have more mental toughness and emotional stability than a mediocre gymnast. For the ideal performance state concentration is very important, so it ought to be natural for a good gymnast to train confidence, concentration and emotional stability. He investigated 5000 Swedish athletes and showed a clear relationship between Inner Mental Training and Level of Competence.

Wilson et al. (1985) conducted study on Assessment of attentional abilities in male volleyball athletes. The need to concentrate or focus one’s attention is a skill required in all sports. This study investigated the discriminatory power of self-report questionnaires and physiological instrumentation to distinguish between athletes whom the coach identified as good or poor concentrators in sport. Elevel male university volleyball players completed the TAIS. The EEG frequency and amplitude of the left hemisphere were recorded every 30 seconds during a stress assessment. The protocol was a 5 minute baseline, 2 minute stroop stresser, 5 minute recovery, 4 video spage Egg games and a 5 minute recovery.
ANOVA indicated that the BET and BIT scales of the TAIS and EEG frequency differentiated between good poor concentrators. The good concentrators appeared to have a more narrow focus of attention and an ability to maintain a more relaxed brain state of rest.

Sohi (1985) while presenting the attention in competitive sports writes that attention is pre-requisite for performance excellence during learning, training and competitive situations. In order to match with the excepted task performance, the sportsman has to cope-up with different types of attentional demands which are specific in nature. In sports, there exist many excitants which usually distract the attention. To avoid distractivity concentrational training is a remedy which can enhance concentration ability. It is obvious that strong muscles and attentive mind are essential for better performance. Khan et al. (1986) studied the basic cognitive characteristics of top level Indian National Basketball, Volleyball and Handball players. One of the cognitive variables studied by them was concentration. They reported a non-significant difference in concentration among the three ballgame players. While comparing the mean scores they reported that mean concentration scores of basketball players was the highest followed by handball and the volleyball players possessed the least concentration among the three ball game players.
Albrecht and Feltz (1987) conducted study on Generality and Specificity of Attention related to competitive anxiety and sport performance. The test of attentional and inter-personal style (TAIS) was developed as an objective measure by which an individual's attentional predisposition could be identified and used to predict performance on a variety of tasks. Significant positive correlation were found between B-TAIS ineffective subscales scores and competitive trait anxiety. However, these relationship were not found with the general TAIS.

Maxeiner (1988) conducted study on concentration and Distribution of Attention in Sport. Representative of various sport disciplines were investigated and diagnosed by means of a concentration test (Test d2) and distribution of attention test (d2 and also reaction time test). 1) The distribution values varied with the corresponding demands for information processing in the various disciplines. 2) The concentration values did not differentiate well among the disciplines but their correlation with the distribution values was quite good. 3) The results of the investigation tended indirectly to disconfirm the hypothesis that concentration and distribution in training and in competition could be learned.

Schaefer's (1988), purpose of the study was to determine whether significant differences among various sports exist in anxiety, concentration and persistency. The psychological variables
were estimated by using $d^2$ concentration test (Brickenkamp 1962), anxiety scale (Reynalds and Richmond, 1978) and persistency scale (Lufi 1986). Analysis of variance between sport-types revealed significant ($p > .05$) differences in concentration capacity and effort rate but not in anxiety component or in persistency. Junior table tennis players produced more concentrational involvement. Correlation analysis revealed moderate positive correlation between age and concentration capacity and worry and concentration.

According to Cratty (1989) attentional processes are critical both when athletes perform and when they learn their skills. Lack of appropriate concentration often limits the athlete in learning new skills and later exhibiting them in competition.

**Related Literature regarding Physical Abilities**

Performance in sports is also determined by the level of physical abilities such as strength, endurance, speed, flexibility and agility. Different levels of these physical abilities are required for successful performance in different sports.

Though gymnastics is a technical sport discipline in which performance is evaluated on the basis of the technique of the executed skills yet the execution of complicated movements on various apparatus depends on the level of strength and flexibility of gymnast. A few researchers have studied the important role played by physical abilities in performance in sports.
Cureton (1941) observed a very high relationship of muscular strength of general health, physical fitness or capacity. He further stated that without strength there could be no physical activity, moreover when muscular strength was low all other life functions were handicapped. Stuart (1964) gave correct emphasis on ratio of body weight and strength in men gymnastics. He stated that correct ratio of strength and body weight (i.e. relative strength) helped in performing appropriate movements in gymnastics.

Johnson (1968) studied the relationship of balance, speed, strength, height, arm and leg strength to success in collegiate wrestling. The subjects (N = 208) for this investigation were collegiate wrestlers with at least two years varsity experience. Subjects were classified as successful, average and unsuccessful according to their win, loss percentages. A second classification was by weight (light weight, middle weight and heavy weight). ANOVA showed no difference among the wrestlers in the three weight divisions on dynamic balance, explosive leg strength and reaction time. In elbow flexion the middle weight category was stronger than the light weight. The light weight and middle weight were faster in movement time and reaction time. The unsuccessful wrestlers had longer legs than the average and successful wrestlers. Bakker (1969) studied factors associated with success in volleyball. He measured the height, weight, leg strength, grip strength, a few skinfolds and jumping ability. He found a significant relationship of jumping ability and reaction time to success in volleyball.
He also computed a regression equation to predict success in volleyball playing.

Smith (1969) studied the three groups of subjects, 68 beginning players, 11 varsity players and 3 highly skilled players in relation of volleyball playing ability to scores achieved in the sargent vertical jump. Vertical jump correlated 0.35 with the Brady test and 0.55 with the judges' evaluation. It was concluded that vertical jump is not an accurate predictor of volleyball playing ability. Austin (1970) investigated the relationship of modern dance performance to strength coordination and kinesthetic perception. Fifty five subjects were given grip strength, Bass dynamic balance test. Three judges rated ability to perform a set technique. No significant relationship was observed by Austin between grip strength, dynamic balance and performance technique.

Spackman (1970) states that a gymnast must have his shoulders loose and flexible. He must be able to do split, front as well as side split with ease. The back must also be very strong and flexible, especially in order to work for free exercise and vaulting. Gymnast must have extreme range in ankle for pointing out the toes. The wrist and hands must be very flexible and strong to work on every piece of equipment. The importance of flexibility i.e. ability to execute movement with larger amplitude, obviously is of great importance in gymnastics because of nature of sport. Prestidge (1972) stated that a gymnast required a great deal of
strength in almost all parts of the body but more specially, in legs, abdomen and shoulders; sufficient strength so that gymnast might perform all the movement easily without strain, strength so that in the event of there being a slight fault in a movement she could resort to strength to correct it.

de Garay et al. (1974) have investigated the performance determinants in gymnastic. According to them gymnastics shares many performance qualities with other Olympic disciplines when observation is only limited to the overt movement patterns that performed. Strength and speed are important physical determinants. Explosive acceleration on the vault can be compared to the effort required in the sprint events in track while strength requirements for the rings may match those found in wrestling or weight lifting. de Vries (1974) pioneered much of the work in the area of flexibility and athletics. He defines two types of flexibility. Static and dynamic. Static flexibility refers to range of motion of a particular joint. Dynamic flexibility refers to the flexibility of motion, i.e. the ease with which a joint moves through the range of motion during dynamic activity. If a muscle contracts quickly or in a jerky motion it will stretch the antagonist muscles causing them to contract, thus limiting the range of dynamic motion. A firm static stretch involves the inverse myotatic reflex which results in an inhibition of an antagonist group of muscle allowing them to relax which enhances or increase the range of motion.
Gates (1974) studied certain selected structural and functional measures predicted success in various gymnastic skills areas and to develop prediction equations from these measures. The subjects were tested on parallel bars, trampoline, tumbling and rings. Stepwise multiple regression was utilized to form predictive equations for the areas tested. The correlation of .811, -.151, .324, and .799 between skills in gymnastic and dips on parallel bars, weight, handgrip and pull ups respectively were reported.

To determine the differences in physical fitness of sportsmen of various sports disciplines, Michalek (1974) conducted six objective test items consisted of (1) three strength tests: dips, pull-ups, and leg lifts, (2) two tests of explosive power: the vertical jump and the vertical arm pull, (3) the bar snap a test of total body coordination. An analysis of variance obtained on the objective data indicated statistically significant difference amongst groups on all six test items, gymnasts were found to be better than non athletes on all the tests. Gymnasts were also found significantly better on test items: dips, bar snaps, legs lifts and pull-ups than baseball, volleyball, football and track groups (p > 0.05). The test items that proved to be valuable predictors of success in gymnastics were: dips, bar snap, pull-ups, leg lifts, arm pull and vertical jump (p 0.05).

According to Bates (1976) flexibility as a subject area has been overlooked both in its research and applied aspect.
Success in gymnastics depends on high degree of flexibility. He suggested a slow stretching method for holding the stretched position for 60 seconds is quite useful for developing flexibility in gymnastics. Grup (1976) is of the opinion that first need of a gymnast is to be supple and strong. These qualities are not only essential for performing the various exercises successfully and without strain but also bring grace and beauty to the sport.

Patric (1976) states "flexibility is one component of strength fitness, that is often overlooked. Good flexibility of muscles and tendons allow them to respond properly to the stresses and strains of violent contractions.

Warren (1976) states that gymnastics is a sport required strength and mobility along with grace and poise. All these qualities are rarely found in would be gymnast. If the whole range of the movement is to be covered, these qualities must be trained and implemented. Baley (1977) observed that good flexibility was essential for the development of skill in gymnastics since resistance from muscles, tendons and ligaments would be minimal. Such movements in gymnastics as scales, hand springs, eagle gaints, top vaults etc. needed considerable flexibility.

Individualized materials and self-assessment training techniques were developed by Black (1977) for beginning male competitive gymnastics and were tested at the junior high school level.
Correlation determined relationship among 13 parameters. The parameters were trunk flexion, pull-ups, dips, hand stand, triceps skinfold, weight, height and scores from each event. Hand stand was greater predictor of skill scores on 5 apparatus.

Allsen (1978) states that there are people who still believe that greater increase in strength will destroy their flexibility, reduce their speed and interfere with their performance because they believe in many of the myths and truths about strength and strength training. Jenson and Fisher (1979) stated that high degree of total body flexibility was desirable and unusual amount of flexibility in certain body regions was necessary for maintenance of correct form in gymnastics. Fox (1979) is of the opinion that strength training does not lead to muscle boundness but contrarily it results in the improvement of flexibility. But too much flexibility may lead to muscular trauma as well as joint injury particularly in contact sports. Harre (1979) stresses the importance of relative strength in gymnastics. According to him gymnastics is strength endurance dominating sport discipline in which strength is required to perform a set of elements.

Fukushima (1981) observed that a gymnast required to possess sufficient physical conditioning in order to master difficult movements and for faster progress. Without this one might not be able to acquire various skills and might learn incorrect elements. He is of the opinion that more than 60 per cent of men's move-
ments and 30 per cent of women's gymnastic movements involve momentary supporting tasks which puts much demands upon gymnast for strength. Also the tumbling phase of the floor exercises and entire takeoff stage of horse vault require a muscular strength for an appropriate explosive take-off from the floor.

Walia (1981) studied the relationship between strength, flexibility and performance in gymnastics. He reported a significant correlation of maximum leg strength, bench press, sit-ups (abdominal strength), hand grip strength, explosive leg strength and arm strength to performance in gymnastics. However, he did not observe a significant relationship between shoulder flexibility, trunk flexibility, and arm span to performance in gymnastics. He further reported that 83 per cent performance can be predicted by the flexibility and strength tests in gymnastics.

Harre (1982) pointed out that flexibility was a primary pre-requisite for qualitatively and quantitatively for good execution of the movements. He further stated that lack of flexibility can results in (a) difficulty in learning new elements, (b) injuries, (c) incomplete expression of conditional abilities i.e. strength, speed, endurance and complex forms. The importance of flexibility, i.e. ability to execute movements with wider amplitude is obviously of great importance in gymnastics because of the nature of the sports. Venketeswariu (1982) studied the psycho-biological profiles of track and field athletes. He found a significant differences
in grip strength, body weight, percentage of body fat, aerobic fitness between sprinters, middle distance runners and shot-putters. He also found significant differences in state anxiety, tension, depression, vigour anger and confusion.

According to Wilmore (1982) an athlete's performance can be separated into a number of individual components. The components of strength, power and muscular endurance appear to be extremely important for most athletic performances. Strength can be expressed either statistically or dynamically and muscular contraction can be either concentric (shortening) or eccentric.

Chakravarthy (1983) investigated the relationship between arms strength, leg strength, grip strength, agility, flexibility and balance to performance in college level gymnasts. He has found insignificant correlation of arm strength, leg strength, left grip strength spine and shoulders flexibility to performance in gymnastics. A significant correlation between right grip strength and performance in gymnastics has been reported by him. Gill (1983) investigated the relationship between the grip strength, arm strength, hand, foot and stepping reaction fitness to playing ability in badminton. The study was conducted on district level players. She reported a significant contribution of arm strength, hand, foot and stepping ability to better performance in game of badminton.
Gill (1986) investigated the relationship of selected physical and physiological variables to performance on gymnastics. The subjects were eighty male gymnasts. He reported a significant relationship of left grip strength, trunk flexibility, arm strength, leg strength, dynamic balance and shoulder flexibility to competitive performance in gymnastics.

Shaw et al. (1988) studied the relationship of selected physical variables and judo performance. They reported that judo performance was significantly related to speed ($r = .858$), agility ($r = -.855$) explosive leg strength ($r = .687$) and arm strength ($r = .694$).

Singh (1988) studied the physiological variables of basketball players. The results showed that 9 physiological variables, right grip strength, left grip strength, leg press, vertical jump, resting heart rate, anaerobic fitness and flexibility were good predictors of performance in basketball. Blood pressure (systolic and diastolic) were found non-significant predictors.

Tenenbaum et al. (1988) studied the physical and psychological pre-requisites for gymnastic talent development. A battery of tests which included (a) pull-ups on bar, (b) standing broad jump, (c) shoulder flexibility, (d) co-ordination, (e) sit-ups. Following one month, the subjects were given a battery of psychological measures which included concentration, frustration and anxiety.
Two competitions after one year were used as criterion measure. Multilinear regression revealed that 58 per cent of the variance in gymnastic performance was explained by psychological variables, particularly concentration, need persistence and ego defence. High potential gymnasts performed better on all tests.

**Related Literature Pertaining to Age, Height and Body Weight**

Age, height and body weight also play significant role in achieving optimum performance in any sport as the peak performance age, peak performance height and peak performance weight are specific in nature and differ from sport to sport. Olympic athletes in different sports and events have shown some specific body configurations to be some what representative of successful athletes. For example sprinters have been found to be sport and muscular, throwers being tall and heavy and hurdlers having longer legs (Correnti and Zauli, 1964; Jokl; 1964; Tanner, 1964; Hirata, 1966; Hirata, 1979; Carter, 1984).

Jokl (1954), Tanner (1964), Hirata (1966), Carter (1970), de Garay et al. (1974), Sidhu et al. (1975), Sodhi (1976), Hirata (1979) and Carter (1984), have suggested a relationship between mechanical and physiological requirements of a particular event and the physique of successful participants. There is a great deal of speculation that physical characteristics can affect the successful
performances with sports. In gymnastics, the shorter and light
body appears to be most prevalent in the successful gymnasts.
Support for this contention is supplied by a great deal of research.
Le Veau, Ward and Nelson (1974) found support for well known
fact that gymnasts are considerably smaller than most athletes.

The body measurement of gymnasts begun as early as
1943 by Digiovanna with male gymnasts. He concluded that the
individual who tended to succeed in college gymnastics was one
who, compared to the normal individual, had smaller height, leg
length and hip width and substantially larger in arm girth. Gymnasts
were described as moderately shorter, substantially more muscular
and stronger and powerful than average college student. Cureton
(1951) stated that men with larger and longer trunk but with rela-
tively shorter limbs succeeded most usually in weight lifting, diving
and gymnastics. The gymnasts he measured were shorter and
extremely well muscled and were generally classified as medial-
mesomorphs. He found gymnasts to be stronger group of athletes.
They had strong broad shoulders in combination with outstanding
flexibility.

Bosco (1962) compared the group of normal sample with
that of male gymnasts and reported that the gymnasts had signifi-
antly less fat component throughout, more musculature in upper
trunk and more thinness in lower extremities. The gymnasts were
found significantly smaller in stature than normal sample. Read
(1967) found better gymnasts significantly lesser in height, lesser in sitting height, lesser in lower extremity length and upper arm length than other two lower ability groups of gymnasts he measured. Looking first at the height of males Bird (1961) found the gymnasts, when compared with normal young men on measurement of physique, to be below average in height. Similarly Basco (1962) found the gymnasts averaged significantly less than normals in standing height. The averaged less burst height and total height indicating that they possessed proportionally longer legs than upper bodies and to a greater degree than normals. According to Bosco this would class the gymnasts structurally as agility and jumping athletic typers. With regard to weight for male gymnasts weight on the average has been less than normals (Bosco 1962). The data indicated that on the average, shorter and lighter men succeeded the most in gymnastics.

Medved (1966) in a sample size of 6217 adult sportsmen found that the male gymnasts tended to be smaller than the average subject (p > .01). Read (1967) found that among the twenty six high school male gymnasts the better male gymnasts were less in standing height. Gunney (1973) reported that if two gymnasts were equally trained with identical body builds the taller gymnast was at dis-advantage because he or she had a smaller strength body weight ratio than shorter gymnast. Schmidt and Kohlrausch (1969) in their study of body type of German male athletes found
support for Digiovanna's results. They found gymnasts to be short with broad shoulders, narrow hips, markedly developed shoulders and arms muscles and light legs (Christenson 1979).

LeVeau et al. (1974) studied the Japanese and American National Gymnasts and found that the mean height of male Japanese Gymnasts (164.3 cm.) was five centimeter shorter than American Gymnasts (169.6 cm.). They observed that combination of lighter body and relatively greater strength specially in upper body provided an ideal structure for gymnastics movements. Christensen (1979) reported that the gymnasts with light and small body size appeared to have some distinct advantages over the taller and heavier body structure with all other factors being considered equal.

Salmela (1980) compared the age, height and weight of the gymnasts of 1972 and 1976 Olympic Games and concluded that gymnasts who participated in 1976 Montreal Olympics were younger, smaller and lighter as compared to gymnasts of early years. The present investigator (1981) studied the physique and performance of Indian gymnasts. It was found that the gymnasts of higher abilities significantly differed than the gymnasts of low level in age. But a non-significant difference was observed between the high and low level gymnasts in body weight and stature.
Carter et al. (1982) studied the Montreal Olympic Gymnasts and concluded that the typical male gymnast was 25.4 years old, 169.3 cm. tall and 63.5 kg. in weight. Gymnasts were found to be smaller than other sportsmen on most variables, except for greater arm girth. Gymnasts were proportionately larger on upper body breadths and girths and forearm length.

Singh et al. (1982) studied the gymnasts, swimmers and footballers. Gymnasts were found to be the lightest and leanest of the three groups by him. The upper girth was found more in gymnasts as compared to other groups. The sitting height was also found significantly lower in gymnasts as compared in other groups. Singh (1983) reported that the peak performance age of Indian gymnasts ranged from 20 to 26 years. He has reported non-significant difference between high and low performance gymnasts in age, height and weight. The Indian gymnasts were found lighter than the Olympic gymnasts reported by LeVeau et al. (1974).

Carter (1984) found the gymnasts of 1968 Olympic Games and 1976 Montreal Olympic Games, to be the smaller of all athletes in most dimensions. Age, height and weight were examined for athletes at 6 smaller and two winter Olympics from 1928 to 1976. Means were tabulated for all sports for both the sexes. There were large increase in size between 1920 to 1976 Olympic Games with the exception of gymnastics. Carter reported that age, height
and weight of gymnasts of 1976 Olympic were lesser than the previous Olympics. He reported the age, height and weight of 1964 Olympic Gymnasts (N= 122) as 26.0 (years), 167.2 (cm.) and 63.3 (kg.) for 1972 Olympic Gymnasts (N = 129) as 24.7 (years, 168.0 (cm.), 64.1 (kg.) and for 1976 Olympic Gymnasts as 23.4 (years), 168.5 (cm.) and 62.0 (kg.) respectively.

Singh and Debnath (1988) studied the physique of Indian national women gymnastic team. They reported that Indian female gymnasts were significantly heavier, more endomorph and lesser ectomorph when compared with the inter-national female gymnasts. Indian female national gymnastic team was found heavier, and older when compared with the Chinese, Japanese and South Korean teams of 1986 Asian Games Seoul.

Many researchers in Indian (Sidhu and Anand, 1971, Malhotra, 1971; Malhotra et al., 1972; Muthiah and Venketeshwarlu, 1973; Sidhu and Wadhan, 1974; Sidhu et al., 1975; Venketeshwarlu, 1975; Uppal and Pal, 1978; Mall et al. 1979; Kansal et al. 1980; Sodhi, 1980; Kansal et al. 1982; Malhotra and Sodhi, 1982; Sidhu and Grewal, 1982; Grewal, 1983; Debnath and Bawa, 1989), have studied the relationship of age, height and weight to performance in various other games and sports.

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