In this chapter, an attempt has been made by the research scholar to locate literature related to this study. In order to present the relevant studies of specific importance in a systematic and organized manner, an attempt has been made in following pages to review the related literature under the following three heading.

(i) Review of related literature pertaining to Anthropometry and Physique.

(ii) Review of related literature pertaining to development of Motor Abilities in relation to age.

(iii) Review of related literature pertaining to Geographical, Environmental, Nutritional, Racial - Ethnic issues, etc.

(i) Review of related literature pertaining to Anthropometry and Physique.

Degivanna (1943) found that within the limits of his study, factors of body structure, muscular strength and explosive power were associated with athletic success. His investigation further revealed that these factors were of varying importance to performance ability in different sports as was indicated by the tendency for each sport to have its own unique pattern of success.
Espenschade (1963) showed relationship of age, height and weight of school children to performances of boys and girls. The relationship of all performances with height were low. Highest correlations were obtained in the event of jumping and landing. Significant changes occurred in most of the events for both the sexes. Age was recommended as a basis for the test norms.

Gross and Casciani (1962) utilized the data from 1300 students to determine the value of age, height and weight as a classification device for the AAHPER Youth Fitness Test. They reported that in all four groups - senior high school boys and junior high school boys - the factor of age, height and weight had practically no value, singly or in combination as classifiers for the seven test items. In other words each group could be considered as homogeneous group with respect to the effects of these factors on the fitness measures.

Wear and Miller (1962) studied the relationship of physique and developmental level, as determined by Wetzel Grid, to performance in fitness tests of junior high school boys. They found subject who were medium in physique and normal in development were the best performers, and subjects of heavy physiques were poorest in performance.

Somatotype ratings and anthropometric measurements were studied by Hebblinck and Postma (1963) to find their relationship to performances on motor fitness tests. Generally, the correlation between body measurements and motor performance were low. The subjects classified as mesomorphs were superior in all motor fitness tests except the 60 yard dash, the ecto-mesomorphs excelled than endo-mesomorphs in the shotput.

A cross-section study of physical and motor fitness measurements was undertaken by Chatterjee et al. (1992) years. The study brought to light gradual increase in physical and motor fitness measurements with the advancement of age except physical fitness scores. Major increments were recorded between 13 and 15 years of age. All the fitness scores showed positive correlation with age, height and weight but Dash, Shuttle Run, and PFI showed significantly negative relationship.

Chatterjee and Mandal (1994) conducted a cross-section anthropometric survey on 629 healthy boys (9-19 yrs.) of the lower and middle class families of Hooghly district of rural West Bengal to study the growth pattern of boys. They have reported
maximum gain in height and weight of boys was attained at 13-15 yrs. of age. The boys were also superior in physique as compared to South Indian boys (South Region) and boys from rural Udaipur, Lucknow and those reported by ICMR.

Pakrasi et al. (1988) has reported that peak annual increment of growth in height and weight occurs in Bengali boys at 12-13 yrs. and 14-15 yrs. respectively. This is about one year earlier than in the well off Indian, British or American boys.

Carter (1980) conducted a study on young athletes 12-14 years old and showed that the successful ones have the somatotype quite similar to those of the outstanding older athletes. The relationship between somatotype and fitness component such as strength, speed, flexibility, endurance and balance are less well investigated, especially on general population of growing children.

Docherty and Gaul (1991) examined the aerobic, anaerobic and strength performance characteristics of 52 young boys and girls (mean-age 10.8 and 11.1 years respectively) on selected laboratory measures. Anthropometrically, the boys and girls were similar, with the exception of measures of body fatness. The boys demonstrated greater values in maximal aerobic power, anaerobic performance, (especially related to body weight) and strength relative to lean body mass. Since, body size measures including height, were similar, the functional differences could not be attributed to such factor. In fact, large amount of variance, not accounted for, could be interpreted as supporting the unique contribution of genetic endowment or the effect of habitual activity pattern on the performance measures. Cononical correlation indicated a strong relationship between selected anthropometric and performance variables ($r = 0.94$). For boys, height and weight were strongly related to anaerobic performance, where as, weight and thigh volume were strongly related to all performance measures for the girls.

Body structure has generally been found to have a significant relationship to physical performance (Boileau and Lohman, 1977) In children, body size, as reflected by height and weight, is significantly related to aerobic performance or physical work capacity (Adam, 1973; Godfrey, 1974; and Krahenbuhl et al. 1985). Body size, as reflected by height, weight and LBM, for 7-12 years boys, was found to have only a moderate or low relationship with running test of 600 and 50 yards (Slaughter, et al. 1977).
The relationship between measures of body size and muscular strength is less clear. In discussing factors that affect performance, Malina and Rarick (1973) concluded that relationship between strength was “quite low” accounting for 30-35 and 10 percent of variance, respectively, Malina (1975) has also reported high correlation between body weight and maximal voluntary isometric strength of elbow flexor and knee extensors for males 9-18 years of age.

Gelliam et al. (1979) found that age, height and weight for active boys and girls 7-13 years of age contributed between 66 and 77 percent of the common variance in isokinetic knee strength. Excess body fat has a negative impact on physical efficiency (Parizkova, 1973) and especially on physical activities that require “translocation of the body weight, either vertically or horizontally (Boileau and Lohman, 1977). Physique, as reflected by somatotype component, does not appear to influence performance except at extremes (Malina and Rarick, 1973; and Slaughter, et al. 1977).

The studies conducted so far seem to indicate that mesomorphy is positively associated with performance and endomorphy is negatively associated with performance with the exception of static or isometric strength. Ectomorphy shows either none or slightly positive association (Carter, 1980; and Stepnicka, 1976). Bastos and Hegg (1986) conducted a study on 363 upper middle class school boys, age 10-17 years and found that sexual maturation as determined by pubic hair development was the most significant factor in predicting hand grip strength in school boys and chronological age was the least influential factor. Also, during the period from 10-17 years of age, height has decreasing influence from age 10-14 years, and sexual maturation has an increasing influence from 12-15 years. Among the body size variables, height was found to be the best estimator of hand grip strength, followed by body surface area.

In the study developed by Lamphiear and Montoye (1976), the regression analysis of the 10-15 years old age group selected height, weight, bi-acromial diameter, triceps skinfold and arm girth as the variables of greater influence on the prediction of upper length. Together, they accounted for approximately 81% of observed variation.

Hebbelink & Borms (1978) reported that Body size, proportions and composition vary considerably with the maturity status of the developing individual in the adolescent period but maturity related variation in physique is also noted during childhood.
Asmussen and Heebol-Neilson (1955) reported that gain in muscular strength of boys age 7 to 17 years were greater than the theoretical values based upon calculated indices of body structure. They suggested that this was due to some unidentified maturational influences.

Studies concerning the relationship between skeletal maturity and physical fitness variables in young school age children have been carried out by Seiis (1951) on 6 to 9 years boys and girls and Rarick and Oyster (1964) on 8 years boys. Correlation between skeletal maturity and strength and gross motor performance test scores were positive, ranging from low to moderate. Partialing out the effect of chronological age, height and weight, Rarick and Oyster (1964) noted considerably reduced correlation between skeletal age and physical fitness variables, diminishing the significance of skeletal age in explaining individual variation in tests of physical fitness.

Hebbelink et al. (1986) in their study indicated that skeletal age is of relative importance in accounting individual differences in strength of 6 years old boys and girls. Moreover height and weight are the factors logically associated with the strength measures. Gross motor performance variables, such as running, jumping, local muscular endurance and throwing are not significantly related to skeletal maturity status at this stage.

Stepnicka (1976) mentioned in his study that in motor tests the boys and girls (8-14 years) included in the 1st Zone (endomorphs) appear to have the worst results, being regarded as physically non talented. The boys and girls 4th Zone (Mesomorphs) have best result in motor tests and were considered physically talented. In the 4th (Mesomorphs) somatotype zone proved to be physically best developed subjects with good pre-supposition for sports. Beside other facts, it is also evident that the great majority of investigated pupils of the sport classes and sport centres are included in the 4th Somatotype Zone.

Toteva (1986) in his study to establish the changes in the somatotype characteristics setting in during the period of intensive growth of 7 years boys and girls found that endomorphy and ectomorphy decreases insignificantly and mesomorphy grows up moderately. A certain sex differenciation at this age is observed and it can be concluded that somatotype does not indicate substantial changes, a tendency for a more considerable development of mesomorphy being observed.
The association between the somatotype and age at peak velocity, in height, weight and static strength is studied in Belgian boys between 13-18 years of age by Beunen et al. (1986). It was observed that early maturers in height or weight have higher mesomorphy scores. For age at spurt in static strength, the differences between the somatotype tended to be significant.

Telford and Ellis (1986) conducted a study in which 170 boys and girls (trained) were compared within their sex grouping with 143 untrained children of same skeletal age. The trained children were superior in measures of fitness that involved moving or holding their body weight. However in some absolute measures of strength, cardiovascular endurance, power and flexibility there were no differences. Anthropometrical comparison showed that trained group were leaner and possessed longer legs whilst the trained girls have narrower hips. It was also observed that relative fitness of the untrained children does not account for all of their inferiority in many performance tests.

Paliczka et al. (1986) conducted a cross sectional study on sample of 2350 Belfast school children of both sex between the age of 12 and 16 years. The parameters measured were height, weight, % body fat, cardio-respiratory endurance, flexibility static strength, explosive leg strength, muscle endurance and abdominal strength. Comparison of boys and girls revealed that the typical pattern of earlier maturation in female was displayed with girls being heavier and taller than boys at 12 years, but this pattern was reversed by 14 years. In the tests of physical fitness, the boys performed significantly better than girls in all tests other than the sit and reach test for flexibility, where pattern was reversed. In all tests boys showed significant improvement with age, apart from PWC 170/kg. and % body fat. Girls revealed greater developmental variation in performances with age, some showing significant improvement (grip strength) whilst other significantly declined (sit ups and body fat), standing broad jump and speed performance tended to improve. Comparison with other similar studies revealed generally similar developmental trend, although some noticeable differences were apparent.

The effect of age and sex on grip strength was investigated by Sohi (1986) with groups of boys (N=499) and girls (N=473) aged 6-14 years. The analysis of data indicated linear improvements in grip strength with age for both dominant and nondominant hands. In terms of percentage increase the largest improvement (40%) were found between 6 and 8 years of age for both boys and girls. The smallest improvement were found between 9
and 10 years of age for boys (8.7%) and between 10 and 11 years of age for girls (10.3%) and with the onset of puberty the boys scored significantly higher than the girls and for both groups scores became less variable.

Bennemoy et al. (1986) in their study to estimate the influence of anthropometric variables on motor abilities found strong relationship between anthropometric variables and static force. Skeletal age also correlates strongly with strength and endurance.

By factoring body composition and several motor aptitude items, Ismael and associates (1963) concluded that muscular fitness is more closely related to the proportion of LBM than to the total LBM. Similarly, Leasy and Colleagues (1965) found that physical performances in which the whole body must move are dependent primarily on the proportion of LBM. Christian (1964) found a relationship between body composition and motor aptitude in pre-adolescent boys.

Parizkova (1963) studied 96 boys followed longitudinally from 11 to 15 years. They showed no significant difference in growth in height and weight. However, there was a slight tendency for height of boys with most intensive exercise to be greater. From 11 to 15 years the different groups did not show any difference in chest circumference, length and circumferential measurements of the extremities as well as sitting height, biacromial and bitrochanteric diameters.

Sodhi (1991) has reported that there is a strong relationship between proportion of LBM and general physical fitness as measured by various functional indicators. Such relationship are true in case of children also. Bayley and Pinneau (1952) has reported that early maturers finish shorter in height than late maturers.

(ii) Review of related literature pertaining to development of motor abilities in relation to age.

The literature available on motor development is very extensive. The period of growth and development can be divided into several phases. In order to present the literature in a systematic and organized manner, the period from birth till achievement of adult-
hood has been divided into three phases. A short explanation of these three phases are given below:

**Childhood**

This period has been considered to be from 4th year of life till the start of sexual maturation process. This is a long period and it has been divided into various phases - early childhood (4-7 years), Middle childhood (7-10 years), and late childhood (10-12 years) (H. Singh, 1991). For the purpose of presenting the literature this period has been considered as a single period.

**Pubescence**

Pubescence, the first phase of sexual maturation, ends with the achievement of menarche (first menstruation in case of girls) or spermarche (first appearance of ripe sperm in the semen of boys). There are considerable individual and sexual differences regarding the beginning and end of this important period of human life. In girls it starts about 1-2 years earlier and also ends 1-2 years earlier. But in the same sex also there can be individual differences of about 2 years or even more. The phase of pubescence, in case of girls begins at about 11-12 years of age and in case of boys it begins at 12-13 years. Pubescence is the first half of maturation process. It ends with the achievement of first menstruation/appearance of ripe sperm in girls and boys respectively i.e. at about 14 and 16 years respectively.

**Adolescence**

This is the second phase of sexual maturation and extends from menarche/spermarche till complete physical adulthood (maturity) is achieved i.e; at about 17-18 years in case of girls and at about 18-19 years in case of boys. Growth and development during adolescence is a continuation of growth and development pattern of pubescence. Adolescence is characterized by gradual slowing down of rapid changes which started in pubescence.

Since, the present study is confined to 8-14 yrs. of age for both boys and girls, therefore, related literature on motor development in relation to age are confined to only childhood and pubescence.
STRENGTH

Depending on the manner in which strength finds expression in sports movement, the strength has been classified into three types: Maximum strength, explosive strength and strength endurance (Harre, 1979; and Mateveyew, 1981). There is general consensus of opinion that strength improves continuously from birth till about 20-30 years of age (Asmussen, 1973; Malina and Rarick, 1973; and Israel, et al., 1982).

Childhood

Strength in the early childhood improves at a slow but continuous pace (Espenschade, 1940; Farfel, 1959; and Keogh, 1965). Strength in childhood increases in proportion to increase in muscle size (Rodahl, et al. 1961). Harrison and Jordan (1966) conducted a longitudinal study on strength in children. They found that with increase in age, the strength of various body parts improves at different rates. Hollman and Hettinger (1976) reported moderate increase in strength from 8-10 years and concluded that strength is less trainable in this age.

The development of strength in childhood improves continuously and steadily, but it is training dependent. The strength of those muscles of body parts improves better which are used daily (Lewin, 1967; Winter, 1976; and Martin 1980). Children use their legs more frequently for running, jumping etc. Hence the strength of lower extremities is greater than upper extremities i.e trunk and arms (Pavsk, 1971). Similarly in strength endurance, which is highly training dependent, considerable differences among children have been found (Knappe, et al. 1968; and Demeter, 1981).

Pubescence

Rapid increase in muscle size due to increased secretion of sex hormones leads to rapid development of strength abilities in pubescence. Several investigators and scholars have reported rapid improvement in strength abilities during pubescence (Malina & Rarick, 1973; Bringman, 1973; Komadel, 1975; Stemmler, 1976; Ungerer, 1977; Lamb, 1978; Shephard, 1978; and Demeter, 1981).

The rate of increase of strength in girls is however lower than that of boys (Melliccer, 1964; and Winter, 1976). This rapid increase in strength is largely limited to
maximum strength and explosive strength (power). The rate of increase of strength endur­ance is much lower as it is more training dependent (Winter, 1976; and Martin, 1980).

The rapid increase in strength ability during pubescence makes it a highly trainable ability in this age period (Koch and Mielke, 1971; and Winter, 1976; Letzelter, 1978; Harre, 1979; Martin, 1980; and Demeter, 1981).

**SPEED**

**Childhood**

The speed abilities in contrast to strength abilities, improves at a high rate in childhood. Fomin and Filin (1972), Winter (1976), Israel (1976) and Blaser (1978) reported that speed abilities reach their maximal values early in life.

The reaction ability is poor in the pre-school age but it improves rapidly during childhood (Korpvitich, 1971; Grosser, 1972; and Gratty, 1979). The greatest improvement in reaction time takes place between the ages of 6-12 years, (Hodgkins, 1962; Joch and Krause, 1978).

Farfel (1959) reported very rapid improvement in movement frequency in Russian children from 7-13 years. According to Racev (1964) boys and girls achieve maximum stride frequency during sprinting at about 10 years of age. Stemmler (1976), Kohler (1977) and Koinzer (1978) also reported maximal rates of development in the frequency and speed of movement at earlier school age. Running speed improves rapidly during childhood (Nicu and Mazilu, 1970; and Kusnecova, 1974). Stemmler (1968) found rapid improvement in short sprint performance from 7-17 years.

**Pubescence**

The rate of development of speed abilities decreases in pubescence. The reaction time reaches adult values by the end of pubescence after which there is very little improvement (Joch & Krause, 1978). Demeter (1981) and Vilkner (1981) reported that rate of development of reaction ability is slow from 12-16 years as compared to child-
hood. Jursinova (1966) reported that adult values are achieved in reaction ability during pubescence.

The movement frequency also reaches adult values by 13-15 years after that there is only insignificant improvement (Farfel, 1959; and Racev, 1964). Demeter (1981) found low rates of development of movement speed and movement frequency during pubescence. The performance in short sprints improves rapidly during pubescence (Stemmler, 1968; Koinzer 1978; Joch and Krause, 1978). The high rate of development in sprint performances during pubescence is in contrast to the low rate of development of speed abilities. The reasons for this are rapidly improving leg strength and leg length during pubescence (Winter, 1976; and Koinzer, 1978).

**ENDURANCE**

**Childhood**

Several investigators have reported that endurance ability improves at a good pace in childhood (Van Aaken, 1959; Iwanov, 1965; Wasmund and Mocellini, 1972; Winter, 1976; and Wasmund 1978). Astrand (1952), Van Aaken (1959) and Knappe et al. (1966) found that short time endurance considerably lags behind long time endurance in childhood. The anaerobic capacity of children is low and starts improving in the pubescence (Kindermann, et al. 1975; Wasmund & Novacki, 1978; Rose, et al. 1980; and Kindermann, et al. 1978) reported that children are able to work under anaerobic conditions only to a limited extent.

**Pubescence**

Endurance ability continues to improve during pubescence (Tanner 1961; and Stemmler 1962). In pubescence due to endocrine and vegetative changes the cardio-respiratory functions are affected negatively to some extent (Iwanov, 1965; and Schnabel, 1962). But still in boys the endurance ability improves at steady pace during pubescence (Knappe, et al. 1968; and Pilicz, 1971). Kogler and Fehling (1982) reported that aerobic capacity in boys keeps on increasing till 18 years.
The physiological pre-requisites for endurance performance increased oxygen uptake, economy of pulse through increased in stroke volume, improvement in depth breathing, increasing recovery ability and high regulation sensitivity, reach optimum condition during pubescence. (Mellerowicz, 1965; and Ungerer, 1977). All these results in good trainability for endurance. Oelschlagel and Wittkopf (1976) and Wirth et al. (1980) found rapid increase in heart volume, oxygen pulse and stroke volume during pubescence. All these physiological factors leads to good and fast improvement in endurance during pubescence (Bringman, 1973; and Dietrich, et al. 1974).

Kindermann. (1975) and Wasmund and Nowacki (1978) reported that anaerobic capacity starts improving faster during pubescence. Kirsch (1970), Nocker (1974), Fomin and Filin (1975), and Bouchardt and Thibauldt (1979) found that the ability to work under anaerobic conditions improves significantly during pubescence.

AGILITY

Agility is a very complex motor ability. In the recent past there is a consensus of opinion that agility is not a single ability but a complex of several abilities (Mattausch, 1973; Meinel & Schnabel, 1976; and Blume, 1978). As these abilities are primarily dependent upon the coordinative processes of the central nervous system, have been named as coordinative abilities which are important in sports. In the following pages, review of the development of agility or coordinative abilities in relation to age are presented.

Childhood

Childhood is a very favourable age period as far as development of agility or coordinative abilities are concerned. The central nervous system matures early in the life and therefore biologically the ground work for the development of coordinative abilities is achieved earlier as compared to strength, speed, endurance abilities (Israel, 1976).

The agility or coordinative abilities improve rapidly before puberty after which the improvement slows down considerably (Nicu & Mazilu, 1970; Winter, 1980; Israel, 1976; Harre, 1979; Ludwig & Hirtz, 1981; and Demeter, 1981).
In the first three years of life the level of coordinative abilities is very low but from the fourth year onward the development becomes very fast (Lewin, 1967; Winter, 1976; and Martin, 1980). At the age of 4-5 years, the child is able to combine simple movements (Lewin, 1967; and Winter, 1976), The balance and rhythm abilities improve at a very fast pace from 3-7 years (Lewin, 1965; Cratty and Martin, 1969; Cratty, 1979; and Martin, 1980). Teichert (1964) found that rhythm ability improves from 7-10 years at a faster rate than before.

The rapid development of coordinative abilities continues till 11-12 years, as a consequence the child’s ability to learn motor skills also improve rapidly and reaches it’s peak at about 10-11 years (Hirtz, 1967; Winter, 1976; and Ungerer, 1977). The age of 10-12 years has been called by Winter (1976) as the age of best motor learning ability. The high rate of development of coordinative abilities is reflected in very high rates of improvement in agility test. Winter (1969) found that the rates of improvement in agility tests are the highest in life at the age of about 10 years. Cratty (1979) also reported high rates of improvement in agility run till 8-9 years.

Pubescence

Pubescence is not a favourable period for the development of agility or coordinative abilities. The rapid physical and physiological changes taking place during pubescence negatively affect the development of coordinative abilities (Schnabel, 1961; Winter, 1969; Jenson & Fischer 1979; and Brandt, 1979). This effect is more clear and pronounced in complex movements (Winter, 1976). Schnabel (1962) reported that these disturbances are more pronounced in boys than in girls. The motor learning ability also deteriorates during pubescence. (Schanbel, 1962; Winter, 1976; and Martin, 1980).

(iii) Review of related literature pertaining to Geographical, Environmental, Nutritional, Racial - Ethnic issues, etc.:

Ikeda (1962) compared the Physical Fitness of children (9-12 years) of Iowa, USA and Tokyo, Japan through some motor fitness tests. He also observed some anthropometric measurements. The result indicated that Iowa children were heavier, taller and had longer legs than Tokyo children but Tokyo children record better in motor perfor-
mance tests except sit ups. The author opined that Tokyo children had more chances for activity through physical education classes than the Iowa group.

Rosentein and Frost (1964) observed the physical fitness of senior high school boys and girls participating in selected physical education program. The amount of physical activity out of class was recorded by each pupil. They conducted that pupils participating in good programmes improved significantly more in physical fitness than participants in poor programmes. The greatest improvement, they observed in strength with some gain in agility, balance and endurance.

Pontheiux and Barker (1965) found that black males were superior to white males in 50 yard dash, standing broad jump, pull-ups, soft ball throw and 600 yard run and walk. The black females were superior to white in soft ball throw, SBJ, agility run and the 50 yard dash. The authors also reported that black children were significantly faster in 35 yard dash. Males were superior to females in power and strength item, running speed and agility where as female were superior in flexibility, balance, hopping and rope skipping.

Sloan and Wiggett (1967) found no clear pattern of advantages emerged in black, coloured or white group tested in physical fitness battery. White subjects performed better on some of the AAHPER test items but it was assumed that their greater strength, speed and endurance was related to the greater height and weight. It was suggested that this advantages might have been genetically determined and/or was related to socio-economic factors such as higher income and better nutrition.

Brengden (1973) made a comparison of physical fitness and anthropometric measures of pre-adolescent, Mexican American (n=300) and Anglo American males (n=300) between the age of eight to eleven yeas of age. The finding revealed significant differences between the Mexican American and Anglo American males in certain Physical fitness items and anthropometric measures. The relationship between selected anthropometric measures and various physical fitness items were significantly higher for the Mexican American males. The result indicated that Anglo American males are superior in performing selected physical fitness items.

Garray, Levine and Carter (1974) after an intensive study of anthropometric measurements of Olympic athletes concluded that top level performance in particular event
demands particular type of body size and shape, other aspect being similar. They estab-
lished strong relationship between the structure of an athlete and the specific task (event) in
which he excelled. Clear physical prototype exist for optimal performance at the level of
Olympic games. They attributed the genetic influence for this, as body size and compo-
sition are some what genetically determined.

Conard and Philip (1976) studied the relationship between grade, sex, race and
motor performance over 553 Kindergarten black and white children. The total test bat-
tery were agility, speed, power, flexibility and endurance. Significant improvement was
found at each grade for speed, power and endurance items, males made significantly bet-
ter performances than females in all items, with the exception of flexibility. Black chil-
dren had significantly lower values than white children in the speed item of each level.

Tanner (1977) has reported that the growth and development are influenced by
the climatical variation. He has reported that linearity of physique tends to be more preva-
lent in people living in hotter region which fits in with the finding that the growth period
is prolonged and maturation somewhat delayed in warm regions. The linear build ie; a
relatively greater height per unit body weight, is attained by delayed skeletal maturation.
The evidence drawn from tropical regions is scanty and findings are complicated by other
factors such as nutrition, disease, social class etc. The African children are noticeably
more linear than European children of the same age.

Richardson (1977) reported that the majority of black youths are more active in
their daily life activities than white youths, the intensity of activity and specific nature of
the activity may preclude the actual act of any positive benefits.

In an unpublished dissertation work, Saha (1980) studied on randomly selected
tribal and non tribal school students of Tripura state, aged 14 to 18 years and found that,
the mean composite scores of anthropometric measurements and physical fitness compo-
nents of the tribal school students were higher than those of the non-tribal school stu-
dents, but none of the differences in the means were found statistically significant.

Lee (1980) classified black and white children from low socio-economic areas
according to authoritarian control attitudes expressed by the children’s mother. Subjects
were tested using a running task and a jumping task. The results of this study indicated
that jumping and running skill of children reared by non-authoritarian mothers Black children, regardless of the parental style, showed greater skill than the white children in both jumping and running.

Shephard (1980) has reported that habitual physical activity has an influence upon the working capacity of the individual. Shephard (1986) conducted a survey study on Canadian children and found that Canadian children are fairly short, but with this exception, Canadian fitness is comparable with that found in other "western" nation having a similar socio-economic status. This finding was due to both automation and the restoration of personal fitness in most western nations. Nevertheless, the Canada Fitness Survey provides a valuable bench mark against which may be measured the impact of both automation and new fitness initiatives.

Miyashita and Sadamato (1987) studied the changes of body composition and aerobic working capacity (VO₂ = max) of Japanese children (6-12 yrs.) in the last 15 to 20 years in comparison with European and North American children. The deleterious changes were found in the increase of body fat and the decrease in VO₂ = max among the children in these industrialized countries. For the proper development in cardiopulmonary functions, the practice of relatively intensive physical activity in childhood was strongly recommended.

Goslin and Burden (1986) conducted a physical fitness study on white (n=98), coloured (n=92) and black (n=32) senior high school pupils and found that white subjects scored higher on tests of aerobic and anaerobic power and speed sit ups. Black subjects were stronger than the other two groups. There were no differences between the subject groups on tests of balance, upper body endurance, agility or flexibility. Male results were higher than female results on all tests except flexibility where the trend was reversed. It was felt that social and economic factors and the intensity of habitual physical activity played a significant role in the result of study.

Ghildyal (1996) has reported that zonal variation in height, weight, fat % and LBM in boys and girls of North Region of India may be attributed to geo-physical variation, genetic factor, environmental influences and different dietary habits. Differences in selected physical variables might be due to the fact that growth and development pattern varies for boys and girls.
Sodhi (1991) has reported that mean body weight of the population in hot regions is demonstrably lower (in all continents) than that in temperate and cooler climates. As the mean temperature increases geographically, the lower limb tend to be longer in hotter climates. The tendency towards attenuation of limbs in hotter climate is also seen in upper limbs, since the ratio of span to height is greater. He has also reported that the correlation between shape and mean temperature account for about 50 or 60 percent of the total inter population variance. Other factos, particularly population movements also influence the variation in physique and body composition.

Birrer and Levine (1987) has indicated that although mesomorphy, and to a lesser extent ectomorphy are positively associated with enhanced performance. Efficiency of movement progress improves through out childhood to early adolescent but are highly dependent on environmental influences. Further performance is influenced by the effect of genetic factors on specific traits in 30 to 85% of cases. He has suggested that sports performance may be optimised by early identification of individual with positive genetic and somatotype markers and negative risk factors.

Pathmanathan and Prakash (1994) conducted a study on well off north western Indians. They have reported that body shape and size, with relatively longer legs, is a useful adaptation to the hot climate of north-west India.

Malina (1988) in her study has reported that motor development in Black and White American children are inconsistent. Environmental factors are most often cited as underlying racial-ethnic variation but have not been systematically investigated. A biocultural approach is essential if an understanding of racial and ethnic variation in motor performance is to be attained.