Chapter - II

REVIEW OF RELATED LITERATURE

A serious attempt was made by the research scholar to go through the literature related to the present study. A brief review of these studies are enumerated in this chapter.

Rawles\(^1\) conducted an objective evaluation of standards and types of posture and concluded after experimenting with 300 young adult women, that "it appears there is much current exaggeration of the connection in the adult between posture and performance efficiency, physical or intellectual."

Digiovanna\(^2\) concluded that there seems to be a fairly definite tendency for posture to be positively related to athletic achievement.

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Carnett\textsuperscript{3} using X-ray techniques and administering barium or bismuth to adult subjects, found that the stomach commonly elevated 3-4 inches when the individual change from slumped to and erect posture.

Clarke\textsuperscript{4} has mentioned the fact that high arches indicate the better feet which are stronger, more elastic, more efficient in all uses of the feet. Low arches indicates conditions which are coincident with pain, quick fatigue of inefficiency in hard uses of the feet.

Deaver\textsuperscript{5} has pointed out the relation of posture to mental and physical health. He has said that posture is an index of personality. For good health correct posture should be taught early as one of the essentials of health. Erect posture is an expression of intelligence and character and index of physical efficiency. Correct posture of body is of first importance as ill health results in incorrect posture.


\textsuperscript{5} G.G. Deaver, "Posture and its Relation to Mental and Physical Health," \textit{Research Quarterly} (March 1933) : 221.
Kety\textsuperscript{6} explained that poor posture causes a cramped position of the heart, lungs and abdominal organs. Circulation of blood is impeded and the organs furthest from the heart fail to receive adequate oxygen. Undue stretching of some muscles in bad posture causes muscular and nerve fatigue.

Bad posture is responsible for undue stain on joints and ligaments which often causes pain. Just as lack of a lignment in automobiles causes friction, So poor posture always causes fatigue, wear and tear in human being.

Cyriax\textsuperscript{7} stated that poor dorsocervical posture which induces cardiac impairment may cause sudden heart failure, angina and functional heart troubles.

Kelly\textsuperscript{8} has pointed out that persons having pain and strain in the feet could develop, pronated feet and its correction is gigantic task among the


school children. He also noticed that low positive significant correlations were found between flexibility of the arch and criteria of pronation and low negative correlation between flexibility of the arch and degree of out toeing. He reported that functional foot complaint is relatively un-common among children and very common among adults. Fifty to sixty percent of the child population has shown promotion to greater or lesser degree.

Kelly\(^9\) has pointed out posture as an index of health. For good health general health habits should be checked and all possible steps should be taken to correct faulty exercises to achieve the best result.

Fox\(^10\) studied the relationship of abdominal strength to selected postural fault reported that dysmenorrhea occurs with greater severity among college women with as way back postural condition.

Van Hagen et.\(^11\) have pointed out the interrelationship between emotions and posture. Emotions tend to reveal the feeling of the individuals


and the conscious assumption of good posture can bring about the feelings of self-confidence and adequacy. Psychologists have given stability to this concept when they have indicated from their studies that correct posture keeps up the spirits and tends to vanish fear and depression.

Goldthwaite\textsuperscript{12} suggested a strong relationship between posture and circulation and indicated that the good circulation in the vital organs is impossible with a slumped chest because of resultant poor breathing and mechanical blockage. He mentioned further that ulcered stomach, postural diabetes, gasteroptosis and enteroptosis are traceable to poor posture, many researchers of this problem described the harmful effect on health of visceroptosis, the abnormal falling downward of the abdominal viscera. Extreme cases of this problem show lack of endurance and are usually affected with constipation, headache and offensive breath.

Rathbone\textsuperscript{13} has pointed out numerous factors for causing weak feet. Faulty carrying positions for infants, or faulty skeletal alignments of legs.


and feet during the first weight bearing on knees or feet during the creeping
and toddling stages or faulty shoeing when little feet are so malleable. These
mechanical features will cause poor foot statics.

Bortz\textsuperscript{14} had defined that bad posture with its poor mechanics is
accompanied by lack of muscles tone, lowered threshold to fatigue and
lessened available mechanical energy.

Brown\textsuperscript{15} has found through his investigation which was designed to
determine the relationship between body type and body alignment and center
of balance. Each subject was classified into body type components of
endomorphy, mesomorphy and ectomorphy. Methods used for measurement
were sheidons technique for somatotyping a modified technique of
Hawland's ailgonometer for body alignment and the Lovett – Reynolds
techniques for determining the center of balance. Statistically, somatotype
was not significantly related with body alignment or with the center of
balance. However, significant correlations were found to exist between

\textsuperscript{14} E.L. Bortz, "Stress and Exhaustion." \textit{Journal of American Medical
Association} 164 (1957) : 2059-2060.

\textsuperscript{15} Gaydena M. Brown, " Relationship Between Body Types and Static Posture of
Young Adult Women," \textit{Research Quarterly} 31 (October 1960) : 403.
height and trunk length measures and between a ratio of trunk measures and body alignment.

Rodell\textsuperscript{16} has found out that pelvic tilt had significant but slight relation with hip flexibility and essentially zero relation with the other measures. Abdominal muscle strength was substantially correlated with abdominal muscle endurance, but ankle pronation and hip flexibility were essentially uncorrelated. The leg span, leg length measurement of hip flexibility was a reliable and easily administered test. The evidence indicated that the pelvic tilt of a person with normal musculature and flexibility was due largely to postural training and habit.

Barry and Cureton\textsuperscript{17} have observed three type factors of physique, 1\textsuperscript{st} related to growth in transverse directions and adipose tissue, and 2\textsuperscript{nd} related to growth in vertical dimensions, and 3\textsuperscript{rd} related to motor performance, were isolated: power, endurance, dynamic shoulder strength. The morphological and performance measurement were found to be essentially unrelated. As


\textsuperscript{17} Alan J. Barry and Thomas K. Cureton, "Factorial Analysis of Physique and Performance in Prepubescent Boys," \textit{Research Quarterly} 32 (October 1961) : 283.
one related to growth in-transverse directions and adipose tissue characterized by bulkiness, prominent girths (upper arms) broad hips, narrower shoulders and thick fat covering.

2. One related to growth in vertical dimensions and characterized by a lean frame and attenuated limb.

3. One related to dysplastic growth in vertical dimensions and characterised by disproportionate development of trunk and legs.

Three factors related to motor ability were isolated:

(i) Power dominated by jumping events and distinguishing those with high, from those with low ability to handle the body weight.

(ii) Endurance, distinguishing individuals with high from those with low organic efficiency.

(iii) Dynamic shoulder strength, which separate those with high muscular endurance in activities requiring strength of the shoulders from those with low muscular endurance. This factor was more closely related to the morphological variables than was the case with the other two motor fitness factors and may be related to muscular growth.
(iv) The second order factors were extracted: general size, differentiating between those who are above and those below average in total body mass.

Flint and Diehl\(^\text{18}\) have investigated the relationship between anteroposterior alignment of the trunk and strength of the muscles which flex and extend the trunk. The result showed significant relationship between trunk strength and alignment. A low but definite relationship exists between backextensor strength and alignment.

Siemsen and Dolan\(^\text{19}\) report that the incidence of the postural defects among senior High School boys: faulty anteroposterior (56.6 percent); scoliosis (49 percent); unequal shoulders (41.5 percent); flat feet (37.7 percent); bowlegs (13.2 percent); and knock knees (7.5 percent)


Flint\textsuperscript{20} found significant relationship between trunk strength and anteroposterior alignment of elementary school girls.

Barham\textsuperscript{21} has pointed out in his study that "The posture group" has made significant improvement because of devoted 20 percent of each class period to posture training activities throughout the school year. Whereas non posture group did not show any kind of improvement because of the fact that they were not imparted any posture training activities.

Rathbone and Hunt\textsuperscript{22} have found that an individual's habitual posture reflects the general health and state of mind. A happy person tends to be erect and extended while an ill or depressed person tends to slump and lanky. Posture is considered by many to be an indication of the spiritual as well as the emotional tone of the individual.


\textsuperscript{21} John W. Barham, "Posture Programs for Elementary School Children," Completed Research in Health, Physical Education and Recreation 6 (1964) : 60-61.

Anderson\textsuperscript{23} has surveyed hand and eyes dominance, hip and eye elevation, dropped or forward shoulder, anterior and lateral cervical tilt, and whether or not glasses were worn were determined on 31 male subjects with the aid of a posture screen and has found that individuals with glasses have very low level of postural deformities. And there was no direct relationship between posture and laterality. It was a general notion that wearing of glasses affect posture whereas it is not so.

Rathbone\textsuperscript{24} and Hunt have observed that an individuals habitual posture reflects the general health and state of mind. A buoyant and happy person tends to be erect and extended while an ill or depressed person tends to slump. Posture is considered by many to be an indication of the spiritual as well as the emotional tone of the individual.

Alderman\textsuperscript{25} conducted an investigation of the need for posture education among High School girls and a suggested plan of instruction to


meet these needs and reported that 93 percent of sophomore girls at Belair High School, Houston, Texas, has postural faults. The most frequent faults were: forward head 62 percent; round shoulders 36 percent; lateral asymmetry of shoulders 31 percent; hollow back 29 percent; pelvic tilt 21 percent. Thus, physical education have problems to solve if the value of good posture is accepted.

Munson\textsuperscript{26} has found critical changes occurred in the chest, abdominal and hip regions between grades 1 and 3 which were important to well balanced anterior – posterior posture. The frequency of anterior – postrior postural deviations indicated a crucial need for re-emphasis on posture education.

Devis\textsuperscript{27} has made the study on the status of postural patterns. The study is an analysis of 750 physical examination record cards from 5 selected years. Postural pattern changed over the years. Significant differences between the percent of the occurrence were found for many factors. The most wide spread postural deviations still include forward head,

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forward shoulders, protruding abdomen, pelvic tilt, and pronated feet. Nearly all types of scoliosis decreased significantly over the years studied. This study proven that with advancing age if other posture defects manifest significantly scoliosis appears to be reduced.

Alderman\(^{28}\) has made study on posture by taking photographs of 83 girls revealed that 93 per cent had posture deviations. Subject had little or no previous posture instruction and after 8 lessons in regular health education classes, 62 per cent of the subject showed improvement. It is not necessary that posture correction can be done with exercises only. If we can correct their bad habits and teach them correct movement of the posture, can achieve improvement in general.

Minotti\(^{29}\) has made study of S.S. for 3\(^{rd}\) and 4\(^{th}\) grade students with postural deviations. S.S. were randomly assigned to either an experiment (E) or control (c) group. The S.S. in the E group were assigned individual


exercises for correction and the E group did the exercises in addition to regularly attending physical education classes for 3 months. During this period the C group attended only physical education classes, when both the group tested for postural deviations. Ancora showed that the total posture and anterior-posterior component of the E group were significantly better than that of the C group. But there was no difference between the 2 groups in the lateral.

Cooper and Glassow\textsuperscript{30} associated posture with attitude of readiness, self confidence and assurance which certainly gives better appearance, better advantage and expression of attentiveness.

Munchow and Alber\textsuperscript{31} have found that in adolescent children in the age group 14-19 years ossification of spine had not completely ended. Thus scoliosis and formation of transitional vertebrae was excited by the training which was more in the case of athletes than the weight lifters. He has therefore observed that it would be important to exclude such adolescents at

\textsuperscript{30} John M. Cooper and Ruth B. Glassow, \textit{Kinesiology} 3\textsuperscript{rd} ed. (St. Louis : The C.V. Mosby Company, 1972), P. 185.

the beginning of the training whose ossification of spine had not completely set-in.

Kumar, sarowala, Thapar and Mathur\textsuperscript{32} have proved that the higher the arch the better is the leverage, action of foot and efficiency of functional activity especially in running. High arch indicated better feet which are stronger, more elastic and more efficient in all natural uses of foot, therefore, high arched foot should be preferred for the best runners, whereas low arched feet indicate conditions which are associated with pain, early fatigue or inefficiency in all natural uses of foot.

According to Beulah France\textsuperscript{33} feet grow for twenty years. Almost every arrives in the world with the making of perfect feet. Before the first year is indeed, eight percent of all babies have the beginning of foot trouble, by two years twenty two percent are on the wrong path. At the age of five, forty one percent are headed in the wrong direction more than half the children who reach the age of ten are future pedal cripples to some degree.


\textsuperscript{33} Beulah France,”Happy Feet” \textit{Heralds of Health} 45 (1975): 6
Wells and Luttgens\textsuperscript{34} have found posture as a position, and multisegmented organism of human body. They said that emotional reactions of an overly sensitive individual turn to abnormal posture. For good posture, good coordination requires to avoid tension in muscle group.

Morehouse and Miller\textsuperscript{35} have pointed out that standing increases fatigue by cerebral anemia and reduction I cardiac out-put.

Local fatigue of the feet, which frequently interferes with production in job that require prolonged standing, change in posture from the upright to varying degrees of the recumbent position and periodic elevation of the feet serve as practical measures to reduce cardio-vascular strain and fatigue, especially in hot environment.

According to L. Garrison and A.K. Read\textsuperscript{36} Body mechanics is the proper alignment of body segments and a balance of forces so as to provide

\textsuperscript{34} Katharine F. Wells and Kathryn Luttgens, \textit{Kinesiology Scientific Basis of Human Motion} 6\textsuperscript{th} ed. Philadelphia : W.B. Saunders company (1976), P. 393.


maximum support with the least amount of strain and the greatest mechanical efficiency.

Sortland, Tysvear and Stroli\textsuperscript{37} have noticed that mostly football players develop slight or moderate scoliosis due to degenerative changes in the cervical spine. Few players "headers" reported to have suffered from cervical complaints pain and stiffness for years, and some of the players develop spondylosis.

Watson\textsuperscript{38} pointed out that lumbar lordosis was significantly higher in individuals who specialized in soccer. Scoliosis and abducted scapula were more common in the hurdlers. The flat feet was high in the foot balers and hurdlers. Abducted scapulae were uncommon in rugby players. In a group of footballers and soccer players who were studied longitudinally, the degree of lumbar lordosis increased during the course of two playing seasons. Groin strain and back injury were found to be more common in sports men with lordosis. It is suggested that athletic activity may sometimes lead to postural


defects which are probably a predisposing factor in certain types of sports injury.

Mckenzie, Clement and Taunton\textsuperscript{39} have pointed out that the runners with excessively pronated feet have features which predispose him/her to injuries that most frequently occur at the medial aspect of the lower extremity: tibial stress syndrome; patellofemoral pain syndrome; and posterior tibialis tendonitis. These problems occur because of excessive motion at the subtalar joint and control of this movement can be made through selection of appropriate foot wear, plus orthotic foot control. As runner with curve feet often has a rigid foot and concomitant problems of decreased ability to absorb the force of ground contact. The shoes should be board-lasted, straight lasted, have stable heel counter, extra medial support and wider flare than the shoes for the curve foot.

Zanandrea Hemes Luis\textsuperscript{40} Screening was performed to detect Scoliosis, lateral Pelvic Tilt (L.P.T.) and Lodosis among 4681 males, Grades 5 through


\textsuperscript{40} Zanandrea Hemes Luis. The incidence of Scoliosis, lateral pelvic Tilt and Lodosis among the fifth to eleventh grade in Sao Paul City, Brazil. \textit{Dissertation abstracts international} vol. 50 No. 4 (October 1989) P.898.
11, from Public School in Sao Paulo City, Brazil. There were 30 randomly selected school from four different socio economic levels. Scoliosis was seen in 310 students (6.6%) with greater (PL 0.05) incidence among grade 9 through 11, L.P.T. in 49 (1.0%) with greater (P>.05) incidence among the Grade 5 and 6, Both statistically totaled 3,942 observation (84.2%) with equal occurrence among three grade groups (5 and 6, 7 and 8, and 9 through 11). It was concluded that musculoskeletal deviations do exist among males grades 5 through 11 in Sao Public City, regardless of Socioeconomic level. Programmes for screenings students from such age groups were deemed important and necessary.

Herbert and Boke Chako41 more than ten years ago, they began the night time treatment of early scoliosis in growing children with implanted muscle stimulators. The early devices were radio frequency (RF) compiled units with an implanted receiver and external transmitter antenna which the patient used at night to power and activate the implant. Compliance with this treatment was 95 per cent. Recent developments have led to the use of a new, totally implantable stimulator for the treatment of scoliosis curves. The

unit has no external components, is programmed and interrogated by telemetry and is externally, switched by the patient using a magnet. Compliance with it continues at a high level, product reliability to date has been perfect and the clinical results continue to be good.

Ohtsuka, Yamagata and Arai⁴² have stated the screening program for scoliosis started by Chiba University in 1979 consists of using moiré topography, low dose roentgenography and a final ordinary X-rays examination. The number of children screened through this Chiba University Medical School (CUMS) screening program to 1986 amounted to 1,246,798. The incidence of scoliosis of more than 15° increased linearly according to age from the fifth grade primary school children (0.07 per cent) in boys, (0.44 per cent) in girls to the second grade Junior High School Students (0.25 per cent) in boys, (1.77 per cent) in girls. The female predominance of scoliosis cases with curvatures of more than 20° detected during the total period was 10:1 and this female predominance was the same for primary school children and junior high school students. According to a study of the incidence of scoliosis by districts (area were divided according to population

density and urbanization) there were no significant differences in the fifth grade primary school children between the sparsely and densely populated areas. In the cases of children beyond the fifth grade primary school level, however, the incidence in the densely populated areas were significantly higher than those in the sparsely populated districts. The incidence of scoliosis of more than 20° decreased significantly every year among Junior High School students, because, they were screened periodically in school and the scoliotic students who had already been detected were left out of the next screening. This study establishes that screening for scoliosis by the CUMS Screening Program is cost-effective with a load risk of radiation hazards.

Jones\textsuperscript{43} headed the study on flat-foot had found that “Flat Feet may actually be protective whereas high arches may be a risk factor for injury.” Generations of flat-footed candidates have been rejected by the military under the assumption that they were more prove to injury. But new data indicate that flat feet may actually prevent lower-limb injuries. Researchers at the US Army Research Institute of Environmental Medicine, the Walter

\footnotesize{\textsuperscript{43} Bruce Jones, “Flat-foot Nonsense,” \textit{Reader's Digest} 137 (October 1990) : P.142.}
Reed Army Institute of Research and The Nike Sports Research Laboratory Collaborated on a study. In it, the feet of 248 infantry trainees were photographed before 13 weeks of basic training. The subjects, grouped according to arch height, were then followed and monitored for training associated injured. The findings: the higher the arch, the greater the risk of injury. Trainees with high arches were 2.4 times more likely to suffer a foot injury than flat-footed trainees.

Sward et al.\(^\text{44}\) have made studies on the changes in thoraco-lumbar of athletes. Back pain and radiological changes of the thoraco-lumbar spine were investigated in 142 top athletes, representing wrestling, gymnastics, soccer and tennis (age range 14-25 years). All groups of athletes reported back pain at high frequencies (50-85 per cent). Male gymnasts had significantly increased incidence and severity of back pain as compared to the rest of the athletes. Radiological abnormalities occurred in 36-55 per cent of the athletes. Reduced disc height, schmorl’s nodes and change of configuration of vertebral bodies correlated with back pain (P < .05, P < .01, P < .05). Significant co-variation between these types of abnormalities was

found. Athletes with great demands on the back are thus subjected to an increased risk of symptomatic damage of the spine.

The spine of athletes, at least in some vigorous sports is subjected to frequent and considerable loads with subsequent risks to back injuries and back pain. An increased frequency of radiological abnormalities of the spine has been found among young athletes in certain sports, such as wrestling (55 per cent), gymnastics (42 per cent) and water ski-jumping (45 per cent.)

In the general population, most radiological abnormalities are considered non relevant or of questionable significance in individuals with back pain. Reports on the correlation between back pain and radiological thoraco-lumbar abnormalities in athletes are sparse and contradictory.

The aim of the present study was to investigate the occurrence of back pain among athletes in various sports and to analyse its correlation to radiological changes in the thoracolumbar spine.
Belgesundeu and Rottker\textsuperscript{45} have found out that Radiograms were taken of subjects with no symptoms of cervical spine problems; the cervical spine was evaluated in the spontaneous posture and at maximal flexion and extension. The position and movement of the vertebra intervertebral height and gliding were calculated. The results showed that (1) Lordosis in women occurred less pronounced than in men, and that there was an increase with age; (2) C 2-3 was the least flexibility segment and mobility increased in the caudal direction; mobility decreased with age and the segment of the lower cervical spine with the highest mobility decreased the most; (3) all posterior and ventral intervertebral heights showed a decreased with age at C 5-6 and C 6-7; (4) Vertebral gliding decreased with age.

Singer, Jones and Breidahl\textsuperscript{46} have surveyed the sagittal plane curve characteristics of the thoracolumbar spine which were evaluated from 286 lateral chest radiographs comparing the cobb technique with a computer-aided digitizer. Thoracic kyphosis and curve apex were measured from T-3


to T-11 segments, and in 120 cases, the level of thoracolumbar curve inflexion point was determined. An age related increase in curve magnitude was similar for both measurements, although computer generated kyphosis angles were generally larger. The apex of thoracic kyphosis was consistently located near T-7 for males compared with greater variability with age for females. The thoracolumbar inflexion point shifted caudally with increasing years, being most marked for females. The ability to describe quantitatively the thoracolumbar curve characteristics, calculate angles between selected segments, determine points of inflexion and maximum curvature, indicates that radio-graphic evaluation of sagittal spinal curvature is improved with the use of computer-aided measurement.

According to D. K. Miller and T.E. Allen⁴⁷ there are many causes of poor posture and poor body mechanics including environmental influences, psychological condition, pathological conditions, growth handicaps, congenital defects, and nutritional problems. Any of these may have an adverse effect on the posture of the growing child, the adolescent, on the adult. Extended periods are needed to establish good body mechanics.

Lee Dongwoo. The purpose of this study was to investigate the relationship between postural configuration during bipedal stance and performance on manual Constraints imposed on perceptual motor workspace. The manipulation of any constraints would bring the individual to change the body configuration to maintain stable and efficient body configuration for a given task. It was assume that when they need to change their body configuration, organisms strive to adopt a control strategy in which minimum energy is expended to maintain a postural that is consistent with the task goal.

Miyakoshi N, Itoi E, Kobayashi M, Kodama H. The objective of the study was to evaluate the impact of postural deformities and spinal mobility on quality of life (QOL) in patients with spinal osteoporosis. A total of 157 postmenopausal women aged over 60 years with osteoporosis were divided into five groups according to their postural deformities: round back (RB, n=41), hollow round back (HRB, n=33), whole kyphosis (wk, n=40), lower acute kyphosis (LAK, n=18) and normal posture (NP, n=25), QOL was evaluated using the Japanese Osteoporosis QOL Questionnaire.


(JOQOL) proposed by the Japanese Society for bone and Mineral Research. This questionnaire contains six domains, with higher scores indicating higher levels of QOL. The number of vertebral fractures, thoracic kyphosis and lumbar lordosis angles, and spinal range of motion (ROM) during maximum flexion and extension.

Were also measured with radiographs. Total QOL scores in RB, HRB, WK, and LAK groups were significantly lower than those in the Np group, and those in WK group were even lower compared with the other groups (P<0.05). All the groups with postural deformities, but not the NP group, showed significant positive spinal correlations between total QOL score and spinal ROM (0.521 ≤ r≤0.747, P<0.05). Total QOL score showed a significant correlation with age, number of vertebral fractures, lumbar lordosis angle and ROM in a total of 157 patients. However multiple regression analysis revealed that spinal ROM best correlated with the total QOL score. We concluded that QOL in patients with osteoporosis was impaired by postural deformities, especially by whole kyphosis, and that spinal mobility has a strong effect on QOL in these patients.

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