CHAPTER-1

INTRODUCTION
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1.1 BACKGROUND INFORMATION

Human body is a complex machine. The sophisticated mechanism of this complex machine has attracted scientists to probe into its complex nature. With the advancement of technology, numerous sophisticated instruments have been developed to enable scientists to gain further insight into the functioning of human body. In spite of extensive inventions and discoveries, there still exists tremendous demand on scientists to obtain appropriate answers to certain queries about the mechanism of the human body. It therefore becomes apparent to understand the relevant changes that occur during rest or when the body is exposed to different intensities of physical activity and also during different stages of life. Exercise Physiology is an aspect of sports medicine that studies the functional changes that occur in the human body when exposed to physical activity. Thus, Exercise Physiology could be defined in a nut shell as—"a science that elucidates how the human functions, reacts, adjusts and adapts when exposed to varied degrees of physical activity or training. The extensive knowledge of Exercise Physiology builds a strong foundation for professional groups like physical education teachers, coaches, and fitness experts etc., concerned with physical activity. It helps these professionals to acquire and disseminate knowledge pertaining to physical activity of human beings. Furthermore, it assists in scientifically constructing and implementing exercise or training programmes for various categories of people be it for those who are involved in competitive sports or those interested in acquiring optimal fitness. It also helps in designing and
managing rehabilitative programmes for those suffering from various health disorders. Moreover, the sedentary class of people can be motivated to lead a positive and healthier lifestyle. Thus, whether it is the selection of potential sports persons, sports team or creating an awareness of fitness among masses, the knowledge of exercise physiology serves everyone thereby, contributing to the concept of "Fit People, Fit Nation". Nothing is as essential to success in life as sound health. It enables us to work with energy and comfort, and better to endure unusual physical and mental strains. While the others suffer the penalty of Feebleness, decay, the fortunate possessors of a sound mind in a sound body is better prepared, with proper application to endure the hardships and win the triumphs of life. A number of Biochemical, morphological and physiological changes occur in human body with advancing age. These changing processes are events of one’s life cycle that no one can avoid and skip. Physical Anthropology in the olden days was mainly concerned with the study of skeletal parts and metric analysis of different superficial bodily organs. But now-a-days physical anthropologists take into consideration, the internal organs of the human body to study their biochemical constitutions. How the physiology of man interacts with the external factors like climate, food habit, occupation etc. is also an important concern of Physical Anthropology. Thus, in order to study the biochemical variation in man and other primates, the branch known as Physiological Anthropology has been designed under the auspices of Physical Anthropology.

Human beings are characterized by different constitutions. An individual’s constitution embraces characteristics of morphology, physiology and psychology. However, morphology offers the clearest and simplest
hunting ground in constitutional research. There are great differences in bodily form amongst humans, and these differences occur in all degrees of detail, from the general size and shape of the individual to the curve of the eyelid or the form of a particular finger. These variations are certainly not recent in origin; they represent a form of quantitative balanced polymorphism. Different builds have presumably different advantages in different circumstances and at different times. The somatotype describes the shape of the physique and is independent of its size. Height and weight along with the somatotype are necessary to give a complete picture of the physique. Different schemes of classification of human physique have been proposed by different workers. But, introduction of somatotyping by Sheldon et al. (1940) was a historical landmark and great step forward in the description of physique. Anthropometric measurements nowadays have become important tool in evaluating the changes in body size and shape due to illness, level of physical activity and nutritional intake during the long period of adulthood. Different body shapes are to some extent attributed to the marked individual variation in subcutaneous fat pattern. With the increase in body weight, which is not associated with growth, there is little change in the contour of the carcass and the thickening subcutaneous tissue becomes the predominant cause of the body outline, gaps between muscles become filled in, body points appear less prominent and the shape of the body become increasingly determined by the pattern of increase in the thickness of the subcutaneous tissue.

Since World War II, the dangers of obesity have been increasingly recognized. Life insurance mortality Tables have shown that in the age group 45-50 years, the death rate increase roughly 1% for each pound of excess fat
(Sloan et al. 1962). Early recognition and assessment of obesity, as of other dangerous conditions are important. Of the available methods for estimating the proportion of fat in the living body, the determination of body density, by underwater weighing is probably the most reliable but require heavy and expensive apparatus. Another methods used include the measurement of skin fold thicknesses, estimation of total body water or of total body water and extra cellular fluid and estimation of lean body mass from basal oxygen consumption and urinary creatinine. Of these the simplest and the one showing the best correlation with body density is the measurement of skin folds. Many estimation of body fat by one or more of these have been performed on men. Much less information is available about women although some valuable work has already been done in this field.

Out of the mechanisms of the human body functions, cardiac functions and lung functions present a platform of study in the field of exercise physiology. And the important traits studied are heart rate, pulse rate, blood pressure; both systolic and diastolic, vital capacities and lung volumes.

1.2 PHYSIQUE, PHYSIOLOGY AND BODY COMPOSITION RESEARCH IN INDIA

Putatunda and Dhara (1994) studied the association of Waist to Hip (WHR) ratio and Body Mass Index (BMI) with blood pressure in tribal (Santhal) and non-tribal women of Midnapore town, West Bengal and observed that in non-tribal women SBP is highly correlated with WHR in higher age group where the value of WHR is highest and the DBP is also
associated with WHR in the middle age group. Whereas they observed that tribal women do not show significant correlation between blood pressure and WHR except for middle age group which shows a negative correlation. Regarding BMI, they found that BMI is associated with systolic and diastolic pressure among non tribal women while the tribal women exhibit poor association between BMI and blood pressure (Systolic and Diastolic). Among tribal women, relatively lower co-relation co-efficient had been observed. They suggested that it might be due to the difference in physical activity level between two groups of women. Tribal women exert greater physical activities in their day today life than sedentary non tribal women. They also suggested the probable effect of socio economic and nutritional factors. Rao et al. (1997) studied the growth in physiological variables among Koya Dora tribal boys of Andhra Pradesh and found that systolic and diastolic blood pressure and pulse rate increased with increasing in age with minor fluctuation. They observed deviations from expected trend and suggested that it might be due to the difference in body composition, habitual physical activity, diet, income, smoking, aging etc. Banerjee (2004) studied body build, body surface area and blood pressure in a rural marine fishing population of Orissa and following results were observed i) no inter-age group difference showing statistically insignificant in body surface area ii) no consistent age related trend in SBP and DBP iii) a clear cut age related trend in body built which corresponds the general theory of the science of aging. He also examined the variation of BP levels in relation to the body build types and found that BP levels have certainly been altered along with the body build types. Both SBP and DBP are found to be high among the very sturdy and obese people (Hypersthenic), whereas these readings are quite low among the people with very weak (Ashtenic) morphological disposition. BP reading has been found
to be moderate in the normosthenic group of people with normal built. Venkataramana et al. (2001) conducted a study on the association of BMI, body fat distribution and fat patterning among the Reddi and Mala population of Andhra Pradesh. They observed that age was significantly and positively correlated with BMI, WHR, Height, Weight, SBP and DBP among Reddi males while for females, only WHR, SBP and DBP show positive correlation with age. Among the Reddi males, they observed positive correlation of BMI with both the blood pressure but WHR shows positive correlation only with SBP. However in females, there was positive correlation of BMI and WHR with both the BPs. In Mala population, they observed that age was significantly and positively associated with WHR and SBP among the males whereas significant correlation of age with SBP and DBP among the females. They found negative correlation of WHR with DBP among Reddi males and SBP among Mala males. It was found that the abdominal and subcutaneous tissue were lower in Malas compared to the Reddis. They suggested that the reason might be attributed to ethnic as well as socio economic disparities between the two populations. Kaur et al. (2002) studied physiological variation between Jat Sikhs and Bania girls of Punjab and observed that Jat Sikh have significantly higher value of Vital Capacity and hand grip strength. However, no significant difference was observed regarding SBP and DBP between the populations. The reason as suggested by them was greater physical work among Jat Sikhs resulting to more consumption of O₂ thus making them physically fit. Bhasin and Singh (1992) studied the body morphology and lung function of Bodhs of Ladakh and observed that they have higher values of FVC and FEV₁₀ as compared to the other population group of the Jammu and Kashmir and they have given the reason that it is due to comparatively higher altitude and higher terrain activities in Bodhs. Their
BSA and BMI are also found to be lower in comparison to other population of the state. They have also observed that Bodhs of Changthang shows lung functions, more closely related to stature as compare to body weight. Bhasin and Singh (1992) studied the anthropometric parameters and lung functions in Kashmiri Muslims adults of Jammu ad Kashmir and compare with the other population of the state. It was found that Kashmiri Muslims were the tallest and heaviest among the other population group of the state. But, Kashmiri Muslims have higher forced vital capacity than Dogras, Tibetans, and Baltis only. All high altitude groups of Ladakh except Tibetans show higher value than the Kashmiri Muslims come under the category of balanced somatotype with dominance of none of the three components. They have higher rating of endomorphy and mesomorphy than the other population groups of the Jammu and Kashmir state but the ectomorphic rating of other population groups are higher than the Kashmiri group under study. Bhasin and Singh (1991) studied the relationship of the lung function and body parameters among the Gujjars and Tibetans of the Jammu and Kashmir, India and observed that FVC and FEV_{1.0} show positive correlation with height vertex and body weight. It has also been observed that lung functions show higher values of correlation with body weight than height vertex. Similar findings have been reported for Ladakhi Bodhs, Gaddis of Himachal Pradesh, and Dogra population of Jammu (Malik and Singh, I.P 1979; Singh, I.P and Bhasin, 1983; Bhasin and Singh 1990). Bhasin and Singh (1992) conducted a study on body morphology and lung functions in Dards of Ladakh and observed that Dard Bodhs show short stature and lesser body weight when compared to population of low altitudes but they show better lung functions than that of the population group of the low altitude, as well as, various Ladaki groups of higher altitude regions. Bhattacharya and Banerjee (1996)
studied the vital capacity in children and young adults of India. They observed that the vital capacity increases with increase in age in both the sexes. However, the increase in vital capacity with age in females is comparatively much smaller than the increase in vital capacity with age in case of boys. Their observation agrees with the opinion given by Krishnan and Vareed (1932) that there is a gradual increase of vital capacity from 18 to 21 years when it reaches the maximum and then there is a decline. They also observed that the vital capacity is lower in girls than the boys in all the age groups (7-20 years) studied. They also found that the vital capacity increases with increase in height in both the sexes. However, there is a little relation of vital capacity and body weight in both the sexes. Regarding BSA, they observed that BSA is related with vital capacity showing increase in vital capacity with increase in BSA among boys but in case of girls the relationship is not significant. Bhattacharya (1963) conducted a study on the vital capacity of the Jat males of Punjab ranging in age from 16-22 years. He observed that vital capacity increases with the increase in age, stature and weight. Bhasin and Singh (1990) conducted a study on correlation of lung functions with height and weight among Dogras of Jammu and Kashmir, India and observed that in Dogra population groups, lung volumes show positive correlation with stature and weight. It was also observed that lung functions show higher value of co-efficient of correlation with body weight than stature. Similar findings have been reported on Ladakhi Bodhs, Gaddis of Himachal Pradesh (Malik and Singh, 1979 and Bhasin, 1983). Basu (1954) conducted an observation on pulse rate and blood pressure among the male Noluas of Bengal, age varying from 22-30 years. He observed that the average pulse rate of Noluas is 75.09 per minute higher than those of Europeans, South African Negroes (male), Nicobarese and Andamanese. The average systolic pressure was found to be
96.6mm Hg and diastolic pressure to be 58.3 mmHg. Banerjee (1984) studied the effect of occupation on blood pressure among the Bihari truck drivers and helpers living in Howrah town. He compared the BP of drivers and that of helpers and found that SBP is higher among helpers and DBP is higher among the drivers. However, it showed no significant difference in respect of these two blood pressures. But, age corrected DBP was significantly different between the two groups. They suggested the need of further study on the rural counterparts in order to understand the effect of migration on BP and to neutralize the effect of the same in order to find out how BP vary with various type of occupation. Kaur and Mogra (2006) studied the association of BMI, BF and hypertension among postmenopausal women. They classified the women into two groups that Hypertensive group and Normotensive group. They observed that there is a significant positive relationship of age with SBP and DBP among Hypertensive group at post menopausal stage while Normotensive women had positive relationship only with DBP. BMI had a positive and significant relationship with SBP and DBP except DBP of Normotensive women. WHR was not found to be strongly associated with blood pressure in the studied group. Kapoor (2000) studied the body composition and adaptation among high altitude and plain adult females. She observed that the high altitude females are shorter and lighter than the plain females. The waist to hip ratio was slightly higher in high altitude females in comparison with that of plain females. However, the BMI value was higher among plain females as compared to high altitude females. It was observed that the high altitude females are leaner than plain females as adjudged both by thickness of skin folds at various sites and also by BMI. Tanushree et al. (2006) conducted a methodological study on estimation of body fat by different methods in collegiate students of Guru Nanak Dev University,
Amritsar. They observed that Male students have higher mean value for WHR, water content in percentage and body density than female students with highly significant differences among them. The mean value of BMI for male students is also found to be higher than that of the female students. However, female students have higher mean value of total fat mass estimated by various methods than male students showing highly significant differences among them. They have concluded that the skinfold (triceps, subscapular) method was found to be most accurate for the assessment of body composition components. Bhardwaj (1972) studied the effect of prolonged stay at high altitude on body fat content among two battalions namely S. Indians stationed at 13,000 ft. above sea level and Gorkhas, at 13,500 ft. above sea level. He observed that a prolonged stay at high altitude lowers body fat content. Bhasin and Singh (1992) studied the body composition of Bodhs and Baltis of Ladakh and found that BMI and BSA continuously increase from 8-18 years. Bodhs show higher BMI than their Balti counterparts in all the age groups. But for BSA in 19<sup>th</sup> age groups, both the groups show same BSA. In 1991 Bhasin and Singh studied the body composition of Gujjars, Dogra Brahmans, Dogra Rajputs, Dogra Scheduled castes and Tibetans. They have found that BMI increases continuously in all the age groups from 8 to 18 years in all the population groups. Similar observation was found for BSA. Gosh (2006) examined the effects of socio economic and behavioral characteristics in explaining the central obesity among adult Asian Indians in Calcutta, India. It was observed that both the ex smokers and never smoking habits had significant negative impact on WHR whereas positive association was established between WHR and smokers. Comparison between smokers and non smokers revealed significantly higher WHR for group pertaining to smoker with no significant difference in the
level of BMI between the groups. He had observed that men and women who are divorced and who had unstable union had higher WHR than persons in stable union. In fact divorced status had explained almost 6% of total variation of WHR in the study population. Sedentary behavior or physical inactivity had positive impact on waistline. In fact, sedentary behavior alone explained 12.5% of total variation of WHR. Similarly, low fat and salt diet along with sufficient intake of fruits and vegetables had cumulatively explained almost 14% of total variation of central obesity. Bhardwaj et al. (1973) did a comparison of body composition of the high natives of Ladakh with sea level residents. They observed that there were significant losses in boy weight and fat after exposure to high altitude. Body water, however, showed significant increase over its previous value. Dibamani et al. (1999) studied the body composition of Meitei boys belonging to both affluent and non affluent families. They observed that the weight gain from 12 to 18 years is slightly higher among the affluent boys than non affluent boys and it was also found that the heavier body weights of the affluent boys are more reasonably due to fat mass and residual mass. They concluded that comparatively higher rate of consumption of protein and fat rich food coupled with less physical activity is the possible reason for heavier fat mass and residual mass of the affluent boys than non affluent boys. Talwar and Kaur (2002) studied the somatotype changes in adolescence among Mentally Retarded Athletes who participated Special Olympics National Games held between 25\textsuperscript{th} Sept. to 29\textsuperscript{th}, 1998 at Punjab University ground, Chandigarh. They found that there were clear differences between male and female somatotype components. The dominance of endomorhphy over mesomorphy is the characteristics of females, whereas dominance of ectomorphy over endomorphy is the characteristics of sample males. The somatotypes of males
lie in the balanced ectomorph sector (2.90-2.45-3.74) and that of females in the endomorph-ectomorph sector (3.37-2.77-3.33) of the somatocart. Interestingly boys do not show a major change in component dominance with age. However, sample girls show a definite change in component dominance. They suggested that these differences in the somatotypes of boys and girls athletes are presumably due to genetic factors, dietary patterns, differential physical activity and other socio cultural or environmental factors, since Olympic sample consisted of mixture of caste groups. Parkash and Malik (1988) studied the effect of smoking on anthropometric somatotype and grip strength among the Santhal tribes of West Bengal. They found that non smokers were taller, significantly heavier, with significantly greater body circumferences and skin fold thicknesses than the smokers. Somatotype Dispersion index among the smokers is lower as compared to non smokers. Analysis of grip strengths and mesomorphic component revealed a comparatively lower muscular strength and mesomorphy among the smokers. They have given the reason for lower grip strength among smokers as under development of muscles and decrease in the availability of energy in the muscles. Berry and Deshmukh (1963) studied the physique of male college students in Nagpur. They observed that the students are lower in endomorphy and mesomorphy and higher in ectomorphy than his Oxford and American counterparts and differences are statistically significant. They opined the reason to be of genetic as well as chronic sub-nutrition. Bhasin and Singh (1992) studied anthropometric somatotype of Bodhs and Baltis of Ladakh and observed that Bodhs have higher rating than Baltis for endomorphy and mesomorphy and lower rating in ectomorphy. Bhasin and Singh (1991) conducted a study on somatotype changes during adolescence in Gujjars and Tibetans of Jammu and Kashmir and observed that Gujjars along with Dogra
Brahmins, Rajputs and scheduled castes of Jammu district lie in the same sector of somatochart i.e. meso ectomorph. They concluded that this similarity is due to influence of environmental factors on somatotype. However, Tibetans, a high altitude group showed balanced ectomorphy. In comparison with other population groups from other regions, Gujjar and Tibetans show higher rating in somatotype component. Sinha and Kapoor (2005) who work among Punjabi adolescent boys and girls found that the increase in BMI with age was more pronounced in girls than in boys. They pointed out that it is due to the relative increase in fatness more pronounced in females than in males. Verma and Kapoor (1998) who work on the effect of cold stimulus on blood pressure among Punjabis of Delhi found that both SBP and DBP increases and found to be significant in almost all the age groups in both males and females. Kapoor et al. (1998) found that the subcutaneous fat distribution pattern changes with age. They also found that the WHR showed an increasing trend after twelve years of age among Jat Sikh boys indicating more thickening of the waist region as compared to the hip region. Satwanti et al. (1977) conducted a study to find out relationship of Body Density to body measurements in young Punjabi women. They found that all the body measurements are negatively correlated with body density. They also pointed out that the regression equations predicting body density in young women are not universal and should only be applied to groups of individuals of similar ethnic composition. Pandey and Malik (1990) compared the anthropometric somatotype of Bod girls residing at Ladakh and Kullu valley. They found greater mesomorphy and ectomorphy in the high altitude Bod girls than in ethnically similar low altitude Bod girls of comparable age. They pointed out that the high altitude environment influences the somatotype component. They also found that endomorphy increases with advancing age in both the
groups. Mesomorphy was found to be higher in the high altitude girls than in their coevals living in low altitude indicating greater work load in the former group, causing increase in muscular mass. Satwanti et al. (1980) worked among 230 young Punjabi women between the ages of 16 and 32. They found that women gain fat as the age advances and that body fat were positively correlated with body fat content. Kapoor et al. (1985) examined the parent-offspring correlation for body measurements and subcutaneous fat distribution among Punjabis. They found that even at birth the females tend to be fatter than males and that pattern of subcutaneous fat distribution and not the amount of fat is under greater influence of genetic factors. They also found high parent-offspring correlation in the case of linear measurements, breadths and bony girths indicating considerable involvement of genetic component. They pointed out that the amount of fat deposition is influenced by environmental factors as suggested by the weak association between skinfolds of mothers and children. Ghosh and Malik (2004) conducted a comparative study of age changes in somatotypes of Brahmin and Rajput boys of Sundernagar, Himachal Pradesh and found that in both the cases, the subjects tend towards Mesomorphy with age changes. However, significant ethnic variation had been found in all age groups. Satwanti et al. (1978) estimated body fat and lean body mass in young Indian women (16-24 years) and concluded that simple girth measurements could be substituted for skinfold thickness for predicting fatness and leanness for their subjects. They also found that majority of body measurements were negatively correlated with body density while significantly positively correlated with lean body mass.
1.3 STATEMENT OF OBJECTIVES:

Although a large number of studies on the physique, physiology and body composition were conducted on various population of India, no such studies has ever been conducted on the Meitei women of Manipur, except that of Dibamani et al. (1999) who studied body composition among the affluent and non affluent Meitei boys of Manipur. So, considering the dart of information on the body composition and physique of Meitei women of Manipur, the present work is carried out. The present work, which is steered by the hypothesis that- there will be variation between the Rural and Urban women on the basis of variation in their exposure to different environmental conditions, aims at:

1. Studying the relation between body composition and physiological traits
2. To find out the important factors determining body composition and also influencing physiological traits and
3. To observe variation in ageing related changes in both body composition and physiological traits between the two groups.

A brief account of Manipur and ethnographic profile of Meitei are presented in the next chapter.