INTRODUCTION

One of the central themes of physical anthropology is the study of human biological variations with a view to understanding the processes of human evolution. In the early part of the 20th century, physical anthropology was primarily concerned with the taxonomic classification of human population with a view to understanding the human evolutionary history. It is under this theme of study that the sub-discipline has undergone different stages of changes and development. The advent of the science of genetics, in particular, has brought about a considerable impact on the anthropological perspective of human evolution. One of the major breakthroughs during the 1950s is the recognition that the changes in the genetic composition of population from generation to generation are but an evolution. The population as such is the "unit of evolution". As a unit of evolution, a population has a heredity, which consists of an array of genes of the different genotypes, or individuals of such a population. "It occupies a definite position in space and time. It derives what it needs for energy, growth, body repair, reproduction, protection against the elements of enemies, from its physical environment, and so affects it and is affected by it. If the population is successful in meeting its needs it survives or expands; if not, it diminishes and become extinct" (Roberts, 1991). Thus, there is always a "delicate balance" between a population and its environment. For its survival, the population must maintain such a balance through time. This realization has now dominated the views of many modern physical anthropologists, or biological anthropologists. Besides, the impact of other disciplines such as demography, zoology,
molecular genetics, physiology, auxology, nutrition, ecology, etc. has considerably expanded the horizons of physical anthropology as a holistic discipline of human biology. The areas of interest are nowadays manifold ranging from functional aspects of anthropometry to mapping of human DNA. The concepts and approaches that have emerged in the fields of modern physical anthropology are more holistic in nature with more emphasis on biological and social problems of the world today – overpopulation, environmental destruction, poverty, nutritional and health problems.

Many physical anthropologists today are interested to understand the relationship between human biology, especially to those aspects relating to health and nutrition, and various socio-cultural factors (Strickland and Tuffrey, 1997). In fact, it is now believed that the human biological processes are largely influenced by various social, economic and cultural aspects of the society. Thus, it is crucial on the part of physical anthropologists to undertake such studies with a view to having a better understanding of not only the processes of human evolution, but also the health and nutritional aspect of human populations. This thesis is a small attempt to deal with the health and nutritional status of the Hmar population in Mizoram with a view to understanding how certain selected socioeconomic variables interact or associated with demographic and biological measures of health and nutrition.

Health is an important input for the development of human resources and the quality of life, necessary for the overall development of a community or country as a whole. According to the World Health Organization, “health is a state of complete mental and social well being and not merely the absence of diseases or infirmity” (WHO, 1971). Although it may not be possible to attain all such types of well-being as referred to in this definition, the WHO’s constitution says, “The enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being without distinction of race, religion, political, economic and social condition.” As such, health is a holistic concept, and one may define health in any manner relating to either one or all physical, mental and well-being of an individual, or a population, according to one’s expediency of study. From the anthropological point of view, one may consider health as a state of well-being due to the interplay between socio-cultural and biological factors - environmental and genetic factors (Kar, 2000).
In order to measure the health status of a population, one needs to take into consideration certain health parameters, which are generally considered as health indicators, although the method of measuring may vary from one study to another (Gwatkin, 2000). Park (1995) has listed a number of health indicators under different categories, viz., mortality rates, morbidity rates, disability or illness and injury rates, nutritional status, health care and delivery indicators, family planning and epidemiological policies, social and mental health indicators (e.g., include suicide, homicide, acts of violence and crimes, road traffic accidents, juvenile delinquency, alcohol and drug abuse, smoking, and the like), environmental indicators (e.g., physical and biological environmental conditions in which diseases occur such as air and water pollution, radiation, solid wastes, noise, exposure to solid substances in food and drinks, etc.), socio-economic indicators (e.g., population growth, per capita income, per capita expenditure, per capita gross national product, level of unemployment, literacy rates, family size, number of persons per room, per capita calorie availability, social security and welfare services), and health policy indicators (e.g., GNP spent on health services, water supply, sanitation, housing, community development, and so on).

It is, therefore, obvious that there are a large number of health variables, and for that reason, it is also suggested that health status is a function of many biological and socio-environmental factors. Accordingly, it is not simple to assess the health status of the population, especially in the case of individual research as it requires a technical knowledge from different fields or disciplines. "This is because health, like happiness, cannot be defined in exact measurable terms. Its presence or absence is so largely a matter of subjective judgment" (Park, 1995). Nevertheless, selection of few sensitive, specific and reliable variables is also meaningful especially for screening or identifying the health problems of a specific population at a given point of time, which are required for immediate intervention. From the biological anthropological point of view, demographic variables (e.g., fertility, mortality and reproductive wastage), self-reported morbidity, nutritional anthropometry of adults, growth and nutritional status of children, and haematological traits including blood pressure and hemoglobin contents are commonly used as health indicators of population (Khongsdier, 1996). These health variables/traits are in turn influenced by numerous biosocial factors. An attempt to
understand the relationship of these health traits with various socio-economic factors like educational level, occupation, income, etc., may be very helpful in understanding the health status of a population.

In the present thesis, we shall deal with the health status of the Hmar population of Aizawl District, Mizoram, with respect to certain selected health parameters such as demographic variables, anthropometric variables, growth and nutritional status, morbidity and hemoglobin level. An attempt will be made to look into the interrelationship between these health parameters and their association with age, sex, economic condition and educational level. In the following sections, we shall make a brief review of literature to have a general idea of the current status of research in this area and to derive the specific objectives of this study.

REVIEW OF RELATED LITERATURE
The review of related literature given below is far from being exhaustive. Instead, an attempt has been made to point out the needs of further researches in Northeast India in general, and to derive the objectives of the present study in particular. The review may be briefly presented as follows:

DEMOGRAPHY
Demographic variables such as fertility and mortality are very important to understand the genetic and social structure of human population (Basu, 1969; Khongsdier, 2005c). Thus, demographic study of population is an integral part of anthropological research. On one hand, demographic variables are largely influenced by various socioeconomic factors. On the other hand, they can affect the genetic composition of human population. Demographic parameters are, therefore, very vital for understanding not only the genetic structure, but also the socio-economic condition of a population. In the present study, we are not concerned with the genetic structure of the population, but we shall look into certain socio-economic factors that may influence fertility and mortality of the population.

It is widely accepted that fertility and mortality are influenced by a large number of biosocial factors like maternal age, parity, education, religion, economic conditions and so on (Caldwell, 1979, 1982; Nag, 1981; Cochrane, 1983; Kost and Amin, 1992; Bicego and Boerma, 1993; Freeny and Feng, 1993; and others). For example,
demographic transition from high to low levels of fertility and mortality is considered to be associated with the economic development of a population, or rising in the income of a household. However, recent studies have also suggested that the effect of economic condition is rather slow in comparison with other social variables like education, particularly female education (Murthi et al., 1995). For example, Kerala recorded the lowest fertility rate in India during the 1980s, though the per capita income in the state was lower than that in many other states. Likewise, according to the National Family Health Survey in 1998-99 (IIPS, 2000), Mizoram had the lowest the per capita income in Northeast India, but the state had recorded the lowest fertility rates. The studies in Bangladesh by the World Bank (Cleland et al., 1994) have also indicated that the lower fertility in that country with low per capita income is mainly because of the efficient implementation of family planning programmes. Similarly, the effect of education on fertility rate varies from one population to another depending upon other socio-cultural factors.

Age at marriage
The negative effect of age at marriage on fertility has been reported in many studies (Mandelbaum, 1974; Mahadevan, 1979; Patnaik, 1981; Choudhury, 1984; Bharati and Dastidar, 1990; Sengupta and Gogoi, 1995; Verma et al., 1999; Khongsdier, 2005c). Cohen (1998) identified later marriage and greater use of modern contraception as being the driving forces behind the African fertility declines. Letamo (1996) suggests that in Botswana, rising age at marriage contributed to the fertility decline by increasing the proportion of never married women who have lower fertility compared to those married or living with a partner. As summarised by Lesthaeghe and Jolly (1995), the increase in the proportions of single women in the age-group 15–19 contributes to a lowering of overall fertility, in as much as it is only partially offset by an increase in premarital teenage fertility. A similar observation has also been made by Freeney and Feng (1993). Zathar (1988) has observed that the “Initial rises in mean age at marriage of women to around 18 in Pakistan may lead to higher marital fertility owing to higher fecundity and other factors which seem to lead to very spacing between consecutive births.”

Many studies conducted in India have also revealed that fertility rate declines with the increasing mean age at marriage (Agarwala, 1962; Driver, 1963; Gulati, 1969;
Raman, 1973; Patnaik, 1981; Bharati and Dastidar, 1990; Verma et al., 1999; Khongsdier, 2005c; and others). In Northeast India also, Khongsdier (2005c) has shown that the mean number of live births per mother decreases with the rise in age at marriage of the mothers. It may however be noted that age at marriage is also associated with different socio-economic factors. Husain (1970) has suggested that age at marriage has an inverse effect on fertility, but educational status of the mother exerts in turn a great influence on age at marriage. Some studies also show that age at marriage is associated with socio-economic conditions thereby it is difficult to assess its direct impact on fertility (Gulati, 1969, 1988). Nevertheless, it is obvious from the findings on other populations that age at marriage has significant inverse association with fertility rate. In northeast India, especially Meghalaya, there has been hardly any study on age at marriage and its effect on fertility rate (IIPS, 2000; Khongsdier, 2005c). Thus, it is imperative on the part of not only demographers but also the anthropologists to look into this problem in order to have a better understanding of the fertility trend in a population.

**Education**

Education, especially maternal education, is generally considered a key factor to development. It is closely related to demographic variables and other indicators of health and socioeconomic conditions of a population, or a nation as a whole. Female education is believed to have a great influence on the maternal and child health as it enhances the knowledge and skills of the mother concerning age at marriage, contraception, nutrition, prevention and treatment of diseases (Mosley and Chen, 1984). This also means that the higher infant and child mortality rates among the poorly educated mothers are due to their poor hygienic practices and lack of connection with the modern medical facilities. Moreover, maternal education is related to child health because it reduces the cost of public health programmes relating to information on health technology, increases household income and productivity of health inputs (McIntosh and Finkle, 1995). Thus it is suggested that the best health development agenda for the developing countries is to increase investment in formal education, particularly female education (Caldwell, 1979, 1982; Cochrane, 1983; Bicego and Boerma, 1993). In fact, the 1994 International Conference on Population and Development (ICPD) in Cairo has strongly recommended that all countries should take immediate steps to achieve the goal of universal primary
education before the year 2015, and to ensure that girls and women should get the widest and earliest possible access to secondary and higher levels of education (McIntosh and Finkle, 1995; Knodel and Jones, 1996). It is argued that about 75 per cent of 960 million illiterate persons in the world are women. India is one of the best examples of such a country with sex disparity in literacy rate till the last census, despite research evidences of the important role of female education in regulating demographic transition and other socio-economic parameters.

Besides, several studies have revealed that female education is more important than paternal education in exerting a negative effect on fertility, though the influence of the latter is also significant in certain studies (Murthi et al., 1995). Khongsdier (2003) has summarised the following reasons why female education is expected to reduce birth rates: First, educated women are likely to have more voice with regard to lightening the burden of repeated pregnancies because they have more control over household resources and personal behaviour. Second, educated women are likely to be less dependent on their children as a source of social status and old age security, thereby leading to a reduction in a desired family size. Third, educated women have higher aspirations for the better achievements of their children, which is conducive to a reduction in a desired family size. Fourth, educated women often have a higher age at first marriage, which is in turn affecting fertility rate. Fifth, educated women often have higher rate of adoption of family planning method, despite certain contradictory results.

**Economic Condition**

The effect of economic condition on fertility has been revealed in many studies (Choudhury, 1988; Lloyd, 1991; Adamchak and Mbizvo, 1994; Verma et al., 1999; Strulik, H. and Sikandar, S. 2002). Many studies revealed that there is an inverse relationship between fertility and occupation and/or economic condition (Stoeckel and Choudhury, 1969; Chang et al., 1979). In United States, during the period of urban growth and industrial development, higher economic status was typically associated with lower level of fertility Freedman (Thompson and Lewis, 1980). The World Bank (1974) has reported that the average fertility rate as well as the average gross reproduction rate in the low income countries is about two times higher then those in the high income countries. Rao (1977) has observed that some countries in South Asia like China, Sri
Lanka, Philippines, and Thailand have experienced a rapid decline in birth rate with the increase in national income. Recently, it has been reported that the high fertility rate in Sub-Saharan Africa is the most acute symptom of poverty (Dasgupta, 2000). Becker (1981) has suggested that the increase in household income owing to an increase in labour productivity would lead to a decline in fertility if the substitution effect were to dominate the income effect.

The United Nations' (UN, 1985) study outlines several conceptual frameworks on the relationship between women's employment and fertility. The major finding of the study was that the relationship between women's occupation and fertility appears to be strong in countries at higher levels of socioeconomic development, particularly in countries with strong family planning programs, and where women's status is relatively higher as measured by age at marriage and educational attainment. A similar observation was also made by Lloyd (1991) and Adamchak and Mbizvo (1999). Recently, the decline in fertility rate in China and Taiwan has also been attributed to higher level of social and economic development (Poston, 2000). In fact, many studies have made an attempt to correlate between low fertility and economic development. However, there is also considerable literature suggesting that standards of living as reflected in basic measures of social welfare like level of education and health care can be more relevant to fertility than the degree of economic prosperity and modernization (Freedman, 1982; Malhotra et al., 1995). This suggests that there has been controversy among the scholars regarding the relationship between fertility and economic condition (Dasgupta, 2000).

In India also, many studies have revealed that fertility rate is higher among the lower income groups than that among the higher ones (Agarwala, 1972; Mukhopadhyay, 1981; Choudhury, 1988). Verma et al. (1977) observed that settled agricultural Santals were economically better off and had relatively higher fertility than the economically depressed hunting gathering nomadic Birhors. But Driver (1963) observed that economic status had only some indirect effects on fertility in Central India. Jain (1975) has also suggested that the effect of income particularly that of occupation on fertility is "fragmentary and inclusive." Thus, it is necessary to carry out further studies on the relationship between fertility and economic condition of the populations, especially in Northeast India where there has been a lack of such studies (NFHS, 1999).
With respect to mortality, several studies have revealed the effects of biosocial factors such as household income, education, religion, maternal age, sex, and birth order (Ayeni and Oduntan, 1978; Basu et al., 1980; Martorell and Ho, 1984; Rutstein, 1984; Rao and Sastry, 1977; Amin, 1990; Redaiah and Kapoor, 1992; Kost and Amin, 1992; Nath et al., 1994; Arnold et al., 1998; Wagstaff, 2000; and many others).

Improvement in socioeconomic status is generally considered to be essential for improvement in children's health condition, thereby reducing infant and child mortality. In other words, improvement of the health of the poor can lead to reducing the health inequality between the poor and non-poor, and this is the central goal of many internal organizations, including the World Health Organization (Wagstaff, 2000). It is reported that infant and child mortality has been declining in many developing countries from the mid 1980s and throughout the 1990s. Rutstein (2000) has suggested that such a trend in infant and child mortality is no doubt associated with improvement in socio-economic status along with the improvement in a number of factors like nutritional status, environmental health conditions, breastfeeding and the use of health services. In this connection, it may also be mentioned that the World Bank (1974) has reported that mortality rate is independent of economic development. It has suggested that the decline in mortality rate in many developing countries is mainly due to important in the fields of public health and disease control methods.

In India, Murthi et al. (1995) have suggested that the relationship between mortality and poverty may deserve careful examination. They have observed that the association between poverty and child mortality is rather weak in India. “The question remains whether poverty has a strong effect or mortality or fertility after controlling for other explanatory variables.” The general opinion is that infant and child mortality is lower in the higher economic groups as they are able to afford better health care facilities, and they have higher educational standard, thereby becoming more conscious of the health of their children. Thus, although different factors are associated with mortality, the effect of household income has been revealed in many studies (Miller, 1981; Chen, 1982; Mosley and Chen, 1984). The above suggestion given by Murthi et al. (1995) may be taken into consideration with a view to having a better understanding of the effect of family income on infant and child mortality. Such type of further study is likely to be
more important especially in Northeast where there has been lack of information, except those given by the NFHS (1999) and few researchers (Saikia et al., 2001).

**PHYSICAL GROWTH**

The study of human growth has been an essential part of anthropological research since the birth of the discipline itself. Early anthropologists, especially Franz Boas are well known for their contribution to growth studies. **Growth** is defined as a regular process of quantitative increase in size or mass of different tissues and organs of the body especially from conception to adulthood. For example, the growth in height and weight can be measured from one age group to another or the number, weight and size of cells can be used to measure the growth of body organs like liver and kidney from one stage to another. On the other hand, **development** consists in the “progression of changes” in form and function, thus, it can be defined not only as a change in functional capacity due to increase in size or mass, but also as a unified network of the differentiation and modification that translates a single fertilized egg into a complex-multicellular individual of mature state (Bogin, 1999). For example, the development of skills and functional capacity to stand up and walk on two feet due to increase in size of locomotion parts of the body, or the development of an embryo into fetus, or the development of reproductive organs plus their functions, and so on. Thus, according to Bogin (1999), development refers to the “progression of changes, either quantitative or qualitative, that leads from an undifferentiated or immature state to a highly organized, specialized, and mature state.”

The study of human growth is also essential to understand not only the health and nutritional status of a population, but also the interaction between biology and culture. For example, the pattern of human growth is indirectly influenced by several socio-economic factors through their direct influence on nutrition and infection. Several studies have revealed that children belonging to different socio economic groups have shown differences in their growth pattern (Tanner, 1962, 1966; Garn, 1966, 1980; Eveleth and Tanner, 1976; Frisancho, 1978; Musaiger et al., 1989; Hazzaa, 1990; Terrell and Mascie-Taylor, 1991; Hauspie et al., 1992; Misuraca et al., 1995; Edward et al., 1996; Russo and Toselli, 1997; Das Gupta et al., 1997; Milani et al., 1999; Reddy and Rao, 2000; and many others).
Nutrition

Eveleth and Tanner (1990) have shown that populations living under chronic low dietary intakes have a pattern of growth characterized by (1) slow growth during childhood and adolescence, (2) late adolescence growth spurt and (3) a prolonged period of growth. Adequate nutritional intakes are generally considered to be necessary for normal growth and development as well as for prevention of deficiency diseases (Mitchell et al., 1976; WHO, 1986). Inadequate intake of protein and other nutrients during the preschool age period had an adverse effect on the child, leading to retardation in both physical growth and mental development (Jelliffe, 1966; Galler et al., 1990; Stinson, 1998). In Kenya, Ongeri (1975) has suggested that malnutrition, particularly protein calories, is a common cause of poor growth in preschool children. Hertzig et al. (1972) have observed through a controlled study of children in Jamaica that malnourished children were shorter, and had lower intelligence and smaller head circumference than controlled children in the same school or their sibs. In fact, small body size of children in developing countries is largely due to effects of poor diet and frequent infection (Martorell and Ho, 1984).

Greulich’s (1957) study on Physical growth and development of the American born and the native Japanese children has revealed that those children brought up in the United States were taller and heavier than their counterparts in Japan because of improved standard of nutrition and physical environment. Data from Malaysia (Chong et al., 1984) have also shown a positive effect of protein energy malnutrition on growth pattern of the pre-school and primary school children. In Nigeria (Antinmo and Hart, 1980; Nnanyelugo, 1983) have indicated that malnutrition in primary school children could be attributed to low nutrient intake, low socio economic conditions and unfavourable environmental factors. Lampl et al. (1978) have reported that among the New Guinean school children, protein supplement has contributed largely to a faster growth and malnutrition. Similar observation has been made by Addo et al. (1988) while studying the school children of Nigeria.

Turning to Indian situation also, Rao (1961) pointed out that the pattern of growth was strongly influenced by dietary intakes. Easwaran et al. (1972, 1974), observed that boys and girls in the ‘better fed’ groups were heavier and taller than those in ‘poorly fed’ ones. A study conducted by Satyanarayana et al. (1980) has indicated that the main
cause of growth retardation among the pre-school boys in rural Hyderabad is nutritional deficiencies. However, it is suggested that in a vast and multiethnic country like India, the extent and type of malnutrition among children varies from region to region, depending upon the geography, socio economic factors, food habits, level of literacy, climate, and religious cultural practices (ICMR, 1972; Gopalan, 1988; WHO, 1989).

**Economic condition**
Socioeconomic status plays a dominant role in determining growth and physical development of children as it has a positive relationship with nutritional intakes. Many studies have revealed the association between physical growth and socio economic condition of a population (Garn et al., 1984; Johnston, 1986; Lasker and Mascie-Taylor, 1989; Rao et al., 1990; Terrell and Mascie-Taylor, 1991, Hauspie et al. 1992; Khongsdier, 1993; Misuraca et al., 1995; Mockus et al., 1995; Post et al., 1997; Milani et al., 1999; Bogin 1999; and many others).

Bransby et al. (1956) observed that children from homes defined as ‘poor’ were consistently smaller and lighter than those from ‘good’ homes. Some studies suggest that within a given country children from economically advanced areas are taller and heavier than children belonging to the economically underprivileged areas (Ferro-Luzzi, 1967; Ferro-Luzzi et al., 1979). In American children, height and weight were found to increase with increasing annual income or educational level (Hamill et al., 1972).

According to Tanner (1986), growth may be described as “mirror of the conditions of the society” and height as a proxy for health. It is observed that growth retardation, or delay in growth appropriate for an individual or a population, takes place even in some sections of the populations in developed countries due to deprivation, illness, psycho-social stress and increased family size (Norgan, 2000). Growth retardation due to inadequate nutrition and infection is reported to be common in developing countries especially in the early stages of growth and development. It is generally agreed, on the basis of data from different continents, that variation in growth pattern of children in developed countries of Europe and North America on one hand and in the developing countries of Asia, Africa and Latin America on the other are mostly due to differences in their socio-economic status, and not because of genetic differences (Habicht et al., 1974, Stephenson et al., 1983; Eveleth and Tanner, 1990; Gopalan, 1992).
Abraham et al. (1975) also observed that in the United States, the boys and girls aged 1-17 years of above poverty level were taller, heavier and greater in skinfold thickness than those belonging to the below poverty level group. Rona et al. (1978) reported that children of unemployed fathers were shorter on average than those of employed ones. In England, it has been reported that children, belonging to the middle and upper classes are taller than those belonging to the unskilled working class (Goldstein, 1971). Amirhakimi (1974) conducted a study among the Iranian school children and found that the children of better economic condition are heavier and taller than those with low economic status. A similar observation has also been made by Lampl et al. (1978) while studying the New Guinean school children. Groenewold and Tilahun (1990) have observed the effect of income and father’s occupation on weight for age and weight for height of Ethiopian children. A study conducted on Malaysian children by McKay (1969) has also revealed that the mid upper arm circumferences of the higher income group children are greater than those of children with lower socio economic status. In developing countries such as Bolivia, low socioeconomic status of the family, poor nutrition and vigorous physical activity are seen as major factors affecting children growth (Beall et al., 1977; Stinson, 1980, 1982; Yip et al., 1988). Post et al. (1997) carried out a study among the high altitude Bolivian children and suggested that nutritional intake was influenced by socioeconomic status, but not by altitude.

Although many studies have suggested the positive effect of socio-economic status on growth pattern of children, there are also certain controversies which need to be better understood through further studies. For example, Rona and Chin (1982) have suggested that father’s social class and mother’s education are not related to the variation in triceps skinfold thickness and weight for height of the children. Similarly Sukkar et al. (1979) have also observed that weight and height of the children have hardly changed owing to improvement in economic condition. The rural Zapotec children living in the valley of Oaxaca (Mexico) have similar height and weight to the well nourished U.S. children (Malina and Himes, 1978). Lindgren (1976) have also found that, in Swedish urban area, the girls from the lowest socio-economic status have more weight for height than the higher strata. Mockus et al. (1995) have reported that there is no correlation between socioeconomic status and height or weight. The negligible prevalence rates of
wasting and low hemoglobin levels suggests that acute undernourishment in preschool children of Libya is not related to economic deficiency but to nutritional habits on the part of the caretaker (Bredan et al., 1984). Therefore some studies have also revealed that there are less difference between socio-economic groups in respect of growth rate.

In India, some studies have shown that within the same community children from the well-to-do sections had higher values of height and weight than their counterparts in poor economic groups (Mitra, 1939; Mukherjee, 1951; Dutta Banik et al., 1970; Bharati and Basu, 1990). Rajyalakshmi (1981) has also observed that the children of higher income groups are heavier and taller than those of lower income groups. The Indian Council of Medical Research (ICMR, 1972) has also reported that height, weight, subcutaneous tissue and other anthropometric variables are positively associated with socio-economic status. Similarly Vijayaraghavan et al., (1974) and Rao (1980) reported that the arm circumference and fat fold at triceps of Indian children belonging to low socio-economic groups were considerably smaller than those of well to do children of corresponding ages. The effect of socio-economic condition on growth pattern of Indian children also been revealed in other studies (Rao and Sastry, 1977; Satyanarayana et al., 1980; National Nutrition Monitoring Bureau, 1980; Bharati and Basu, 1990).

In north-east India, many growth studies have been published for the populations of Assam (Das, 1969-71, 1972; Hazarika, 1974; Das 1973, 1974; Choudhury et al., 1992; Das and Choudhury, 1992; Begum and Choudhury, 1999; see reviews Khongsdier and Ghosh, 1998; Choudhury and Begum, 2003). Some studies have been published for other populations of Northeast India (Gaur and Singh, 1995; Talwar and Singh, 1995; Khongsdier, 1996, 1999; Singh and Singh, 2000; Khongsdier and Mukherjee, 2003a, 2003b; Khongsdier et al., 2005). Most of the growth studies in Northeast India are concerned with the physiological changes and variation between populations. Only some studies used growth as an indicator of the nutritional status, and very few studies deal with the relationship between growth and socioeconomic conditions of the populations. Recently, it has been shown that growth and nutritional status of the Khasi children was greatly influenced by economic condition and by the intermixture with other populations (Khongsdier and Mukherjee, 2003a, 2003b). In another study, an attempt has also been made to assess the sex differences with respect to the nutritional status in the context of
patrilineal and matrilineal systems of society (Khongsdier et al., 2005). It is suggested that sex discrimination in Northeast India is not as strong as in other parts of India, although sex preference may exist in terms of lineage continuity. More growth studies are needed to carry out in populations of Northeast with a view to understanding the nutritional status of children in relation to socioeconomic condition and morbidity patterns.

ADULT BODY DIMENSIONS

Several studies have revealed the association between adult anthropometry or adult body dimensions and socio-economic conditions (Shapiro, 1939; Eveleth and Tanner, 1990; Naidu and Rao, 1994; Visweswara Rao et al., 1990, 1995; Nube et al., 1998; Reddy, 1998). For example, Rothammer and Spielman (1972) have suggested that socio-economic condition has a great influence on variation in adult body dimensions which are in turn a reflection of health and nutritional status of an individual, or a population. In India, Bharati (1989) has observed that almost all anthropometric measurements and indices considered under the study are higher in the higher income groups among the Mahishyas of West Bengal. Similarly, Rao et al. (1990) have found that both male and female adults belonging to the upper middle income group are taller and heavier than those belonging to the lower income groups. Recently, similar observation has been made among the south Indian population (Reddy, 1998). In Northeast India, there are hardly any studies on the relationship between adult anthropometry and socioeconomic conditions (Khongsdier, 1997, 2002, 2005c). Thus, it is quite imperative on the part of physical anthropologists to carry out such a study with a view to understanding the nutritional and socioeconomic status of the different populations of this part of the country.

ADULT NUTRITIONAL STATUS AND MORBIDITY

One of the major health problems in many developing countries is the widespread prevalence of under-nutrition and infectious diseases (WHO, 1990). Inadequacies in nutritional intake, or under-nutrition, can be considered a major scourge of many adverse effects on growth and health of individuals (Gordon et al., 1968; Chandra and Newberne, 1977; Chen et al., 1981; Chandra, 1981, 1983; Martorell and Ho, 1984; Mitra, 1985;
It is generally reported that the basic causes of under-nutrition and infections in developing countries are poverty, poor hygienic conditions and little access to preventive and health care (Mitra, 1985; WHO, 1990). Hence, assessment of the nutritional status of population has attracted the attention of not only the nutritionists and other biological scientists, but also the economists and other social scientists with a view to understanding the health and socioeconomic status of the population (Osmani, 1992). Nutritional status is defined as the physical expression of the relationship between the nutrient intakes, or bio-availability of nutrients, and the physiological requirements of an individual (Brown, 1984).

Of different methods, anthropometry is one that is generally used for measuring the magnitude of under-nutrition at both individual and population levels. Anthropometric measurements and indices like weight, height, mid upper arm circumference, skinfold thickness, weight for age, height for age, weight for height, indices of upper arm circumference, etc. (Jelliffe, 1966; Frisancho, 1990) are commonly used for assessing the nutritional status of children. In the case of adult individuals, Quetelet or body mass index (BMI = weight in kg/height in m²) and upper arm muscle area are widely accepted as one of the best indicators of the nutritional status of adult individuals and/or populations (James et al., 1988, Ferro-Luzzi et al., 1992; Shetty and James, 1994). It is suggested that the BMI may be more nutritionally than genetically related (Rolland-Cachera, 1993), despite the fact that there is a wide variation between human populations in weight and height (Eveleth and Tanner, 1990; Majumder et al., 1990). Thus the use of BMI as an anthropometric indicator of nutritional status may be more appropriate in a country with diverse ethnic groups like India. It is also reported that BMI is closely associated with morbidity and mortality (Garrow, 1981, 1988; Garrow and Webster, 1985; WHO, 1990; Shetty and James, 1994; Henry, 1994). However, literature on BMI of adult Indians is concerned mostly with populations in south India (Shetty, 1984; Ferro-Luzzi et al., 1992; Shetty and James, 1994; Naidu and Rao, 1994; Visweswara Rao et al., 1990, 1995; Reddy, 1998), but it was very limited in the Northeast region of the country (Bharati 1989; Khongsdier, 1997). Khongsdier (2001) used the anthropometric data published by the Anthropological Survey of India for 12 populations of Northeast India. The results indicated that the majority of adult
males in Northeast India were lean or thin in body composition as indicated by body mass index. Almost all of the 12 populations are characterized by a high prevalence of chronic energy deficiency. It was also observed that the prevalence of CED was lower in the tribal populations than in the Hinduized and Caste groups. It is suggested that further researches are needed to know about the morbidity and health status of the populations in Northeast India.

As for the relationship between morbidity and nutritional status, several studies in developed countries have revealed the relationship between obesity and morbidity/mortality (WHO/FAO, 2003). It is also well documented that mortality risk increases with the increase in BMI values (Garrow, 1981, 1988; Garrow and Webster, 1985; WHO, 1990). With regard to the lower value of BMI, a number of studies have suggested the higher mortality rate in individuals with low BMI (Waaler, 1984, Harris et al., 1993). Henry (1994) has suggested that BMI below 13.0 kg/m² in adult males and 11.0 kg/m² in adult females may be considered the lowest thresholds of mortality risk. Of course, it has been reported that the relationship between BMI and mortality is U-shaped (Troiano et al., 1996). However, it is not yet clear whether the BMI<18.5 kg/m², which is suggested as the cut-off point for screening CED individuals (James et al., 1988; Ferro-Luzzi et al., 1992; Shetty & James, 1994; WHO, 1995), is also associated with morbidity, especially in developing countries. In Bangladesh, it has been suggested that morbidity rates among adult males increases when the BMIs are below 17.0 kg/m² (James et al., 1988). Using probit analysis of data collected by IFPRI and the World Bank from four developing countries, viz., Philippines, Kenya, Pakistan and Ghana, Garcia and Kennedy (1994) have observed that the increase in morbidity is not consistent with the CED grades of BMI, although it is perceptible in Pakistan. However, a report from Brazil has indicated that there is a marked increase in morbidity among adult individuals with BMI below 18.5 kg/m² (de Vanconcellos, 1994). Also, Strickland and Ulijaszek (1993) have observed that the symptoms of self-reported illness are negatively associated with BMI among the Iban tribe of rural Sawarak. In the Indian subcontinent, less is known about such a relationship, although data from a South Indian population have revealed that mortality rate tends to increase with the decrease in BMI (Shetty and James, 1994).
In Northeast India, one study was conducted on the relationship between BMI and self-reported morbidity among the War Khasis (Khongsdier, 2002, 2005c). The results indicated that there was no significant relationship between BMI and morbidity, but morbidity was significantly influenced by poor socioeconomic condition. However, when BMI was separated into two components - body fat mass index and fat free mass index - the results indicated the significant relationship between self-reported morbidity and fat mass index but not with BMI (Khongsdier, 2005a). More studies are needed to carry out among populations in Northeast India in order to understand the relationship between anthropometric indices especially BMI and morbidity.

NUTRITIONAL ANAEMIA

According to the WHO Scientific Group (WHO, 1968), nutritional anemia is a “condition in which the haemoglobin content is lower than normal as a result of a deficiency of one or more essential nutrients, regardless of the cause of such deficiency.” Thus, it is suggested that data on haemoglobin content are very helpful in understanding the health and nutritional status of a population (Garn et al., 1977). The WHO Scientific Group has recommended that the normal values of haemoglobin content should be 13g/dl and 12g/dl for adult males and female, respectively. In the case of pregnant women the normal value is 11 g/dl.

Iron deficiency is the main cause of anemia, especially in developing countries (Khusun et al., 1999). It has been reported in many studies that the differences in haemoglobin level are associated with nutrition, socioeconomic conditions, age, sex, etc. (Vijayalakshmi and Devaki, 1976; Garn et al., 1977, Das and Mukherjee 1978; and others). Vijayalakshmi and Devaki (1976) have found higher level of haemoglobin content among those individuals who belong to the higher socioeconomic strata than those in the lower ones. Bharati (1983) has found a similar trend in the case of Mahishyas males of West Bengal but in case of females, the lower economic groups have higher haemaglobin level than those belonging to the higher economic group. Das and Mukherjee (1978) have reported that there is a gradual rise in haemoglobin level with the rise in age of males and females.
In Northeast India, little is known about such relationship between haemoglobin content and socio-economic conditions. One study among the War Khasi of Meghalaya has revealed that haemoglobin level is positively associated with the economic levels (Khongsdier, 1997).

As noted earlier, the review of related literature given above is far from being exhaustive, but it is obvious that there is an urgent need to carry out research relative to health and nutritional status of a population, especially in understanding the relationship between health and socio-economic factors. Such studies are very limited in Northeast India in general and in Mizoram in particular.

AREA OF STUDY
Mizoram, or the land of the Mizos (highlanders), was known as Lushai Hills District under the British Administration. It was made into a Union Territory in 1972, and it became a full-fledged state on 20th February 1987. It covers an area of about 21,087 sq. km with a total population of 891,058 as per census 2001 (Census of India, 2001). The density of population per sq. km is 42. It lies between 92° 11' and 93°.29' E. longitude and 21° 58' and 23° 35' N latitude. The state is bounded by Myanmar on the east, Tripura on the west, Assam and Manipur on the north, and Bangladesh on the south. Aizawl is the scenic capital of Mizoram, located at nearly 1220 meters above sea level.

Mizoram is divided into eight districts viz., Aizawl district, Aizawl North district, Aizawl East district, Aizawl West district, Aizawl South district, Lunglei district, Chhimtuipui West district and Chhimtuipui East district. Tribal groups like Lushais, Pawis, Paites, Raltes, Pang, Kukis and Hmars predominantly dominate the state. In the present study, we shall deal with the Hmars of Aizawl district.

The present study was carried out in four villages of Aizawl District, Mizoram. Figure 1 (see pp. viii) shows the location of the four villages namely, Tinghmun, Zohmun, Sakawrdai and Ratu. The sampling methods adopted for the selection of these villages will be described in the next chapter.
Topography
Mizoram is fully covered with ranges of hills, which run from the north to southern direction in parallel series, separated from one another by narrow valleys. The hills consist of sandstones and shale of tertiary age. The average height of the hills varies from 3000 ft in the west and slowly rises as one goes eastward where there are ranges over 6000 ft high. The highest peak is the Blue Mountain, locally called Phawnpui (7100ft) at Saikal Range. The sides of the hills are covered with dense forests and bamboo jungles. However, due to jhum cultivation and wanton destruction, many forest areas have become a barren land. The soil in the hills is generally loose, porous, sandy loam but clayey in the lower elevation, mixed with angular shales of varying sizes. As such, the water holding capacity is low. The soil in the valley is, however, rich alluvial, which are washed down from the hills as a result of the jhum cultivation and excessive monsoon rains.

Climate
Mizoram enjoys a fairly pleasant weather, where it is neither very hot nor too cold. The Tropic of Cancer runs through the middle of the District. There is a slight change of temperature during summer and winter. This is partly due to the arrival of monsoons during the hottest months of May, June and July. The coldest month is January, but by late April and May, the weather is usually hot, the temperature rising up to 30°C. The monsoon rain starts in early April and late October. Due to heavy rains, landslides are a common occurrence, causing loss of lives and property, and transport and communication are often disrupted during the monsoon.

From the month of October – December, the villages are full of damp fogs during morning and evening whereas the hill tops are comparatively free from the fogs. The Southern region gets a relatively heavy rainfall, and is also relatively open to destructive cyclonic winds from Bangladesh causing damages to crops and properties every year. The average annual rainfall in Mizoram was 2251.62 mm in the year 2003-2004 (DES, 2004).
Flora

The rainfall and temperature of the state being suitable, the forests are covered with dense evergreen trees bushes, creepers and grasses. Most of the flora of Mizoram resembles with that of the state of Manipur and Assam. *Rhododendron*, cotton, cane, *ikra*, bamboo, grass, cactus, ferns, *rhynchostylis retusa* (foxtail) orchids, wild flowering plants are available in the state. Paddy, maize, millet, pulses, cabbage, cauliflower, sweet potato, tapioca, chillies, brinjals, ladies fingers, etc. grow in the state. Fibreless ginger is a common crop and widely marketed to other neighbouring states. *Tejpat*, Dachini, Golmarich, etc. grow in the southern part of the state. Mustard, sesame, super sized potato, bananas, papaya, pineapple are common crops. Besides, sugarcane, orange, mango, tea, coffee, cocoa, rubber, cardamon, and cashew nut are also grown.

Fauna

The vegetation and climate of Mizoram offers an ideal sanctuary to wild animals. There are several sanctuaries like the Dampa Wild Life Sanctuary (572 sq.km), Ngengpui (Wild Life Sanctuary (110 sq. km) and Blue Mountain Wild Life Sanctuary (60 sq.km). The fauna consists of mithun (*Bos frontalis*), which is a semi-domesticate animal. Wild elephants are found in the foothills. Tiger, bison, buffalo, rhinoceros, barking deer, sambar, leopard, Himalayan black bear, Malay bear, wild dog, wild cat, rat, wild pig, monkey, jackal, snakes (viper, python, cobra, grass snakes) lizards, toads, eagles, vultures, skylark, owl, crow, hornbill, jungle fowl, etc. are common in the state. These wild animals are being gradually lost due to deforestation, hunting and jhum cultivation. The tribals of Mizoram eat all kinds of animals. Dogs are used for food, and are said to be similar to those eaten by the Chinese. The famous great hornbill bird is hunted mainly for their decorative purposes. Some of the animals especially rats damage crops.
THE PEOPLE
Origin and Characteristics

The term “Hmar” is believed to have originated from the term “Hmarh” meaning “tying of one’s hair in a knot on the nape of one’s head”. According to Hmar tradition, there were once two brothers, namely, Hrumsawm and Tukbemsawm. Hrumsawm, the elder one, used to tie his hair in a knot on his forehead because of a sore on the nape of his neck. After his death, all his descendents followed the same hair style and the Pawis, who live in South Mizoram, are believed to be the progeny of Hrumsawm. The younger brother, Tukbemsawm, however, tied his hair in a knot on the back of his head. The Hmars, who continued Tukbemsawm’s hairstyle, are believed to be the descendants of Tukbemsawm (Songate, 1967). The Hmar’s tradition maintains that the original home of the Hmar is called “SinJung”, though it is difficult to ascertain the exact location of “Sinlung” today.

Several theories have been put forward regarding the origin of the Hmars, but it appears historically evident that the Hmars originally came from Central China. A Hmar historian, H. Songate (1956), proposes that the original home of the Hmars might be the present Tailing or Silung in South East China bordering the Shan state of Myanmar. According to Songate (1956), “The Hmars left Sinlung because of the waves of Chinese immigrants and political pressure drove them away to the south. The exact time of departure from Sinlung and the original route they followed is not known to this day. However, traces have been found in poems and legends that they came to the Himalayas, and the great mountains made it impossible for them to continue their southward journey. So, they turned eastward of India from there.”

The Hmars are mainly distributed in Churachandpur, Tipaimukh and Jiribam divisions of Manipur State. A good number of Hmars are also found in North Cachar hills (Assam), Meghalaya, Mizoram and Tripura. The present study deals with the Hmars of Aizawl district in Mizoram.

Physically, the Hmars are a strong and sturdy race and belong to the Mongoloid stock, with a flat broad nose and short stature, and well developed legs. The skin is
usually yellow brownish in colour. The face is broad and flat and body is fairly well built with scanty body hairs. The men seldom have hair upon their faces. (Allen et al. 1979).

The Hmars have their own dialect, which has a close affinity to the Lushais and invariably resemble Paites and Kukis. Linguistically, they belong to the Kuki-Chin family. It was the Christian missionaries who introduced the Roman script to the Hmar language in the 19th Century.

The Hmars are divided into 24 clans and each of these clans is again divided into 180 sub clans/families. Clanship does not regulate marriage rules and an individual can select his mate from any clan including his own. Widow re-marriage is not uncommon. Being a patriarchal society, the father heads the family and lineage is traced through the male line. The general rule of inheritance is that the youngest son inherits all parental property. Women are not allowed to inherit any property.

**Occupation**

Agriculture is the mainstay occupation of the Hmar. Most of them are engaged in jhum cultivation. Although they mainly cultivate rice in the jhums, they also cultivate other crops and vegetables like maize, castor, cucumber, watermelon, sweet gourd, watermelon, beans, etc. in the jhums. Thus, they raise mixed crop in the jhums. If the rain comes in time they can reap a good harvest. In case of failure of the rain the crops also fail and the people remain half-starved. The Hmars are also good horticulturists. They cultivate fruit plants like pineapple, orange, lemon, etc. by terracing the gentle hill slopes. They sell their produce in the weekly market, but the price they get for their agricultural products is not reasonable at all.

Weaving is an important household industry in every Hmar family. Every Hmar women is an expert weaver and most of the domestic requirements for clothes are met from the family looms. They weave attractively and design clothes (PUON). Formerly, they grew cotton from which yarns were spun. But, nowadays, in most cases yarns are purchased from the market.

Besides weaving, manufacturing of cane and bamboo goods required for domestic use is also another important cottage industry of the Hmars. Carpentry and blacksmithy are the two other trades followed by the Hmars. Some Hmars are also engaged in services and business.
Food habits

In the last 20 years, there have been no significant changes in patterns of dietary intake. Cereals remain the staple food among the Hmars, providing most of the energy intakes. However, wheat, maize and millets are the substantial cereals, which are prepared for consumption in various ways. Large quantities of cooked rice, meat, and vegetables are consumed with various kinds of chutney, ginger, garlic, chilies, and spices. Two heavy meals of almost identical preparation a day is consumed and all else are comestibles of little significance. Since jhum cultivation cannot supply all the vegetables and meat, they constantly go to the forest seeking for vegetables, and hunting for deer, fowls, trap small games like squirrels, birds, etc. In preparation, nothing is discarded; teeth, brain, claws, innards are all included. The Hmars eat lots of hot chilli (pepper) but with very little spice. Some of the famous dishes are CHARTANG (mixture of meat, vegetable and hot pepper), HMEPAWK (stew), and CHANGALHME (vegetable or meat cooked with hot pepper and soda from the ashes, Pudaite, 1963). With a meal, occasionally, he sips the HMETUI (the liquid in which the curry is boiled). Beer of rice or ZU was openly served before they became Christians, especially during successful hunting expeditions, harvest festivals, and return of a good friend from a long journey. Among the Christians, tea is served in place of rice beer. They smoke indigenous “meiziel” or Mizo cigarette and other non-local cigarettes. They also use indigenous pipe for smoking indigenous tobacco. They sip nicotine water or “tuibur” frequently and chew betel leaves and areca nut.