STUDY ON DEMOGRAPHY AND GROWTH PATTERN AMONG THE KHASI CHILDREN OF SHILLONG, MEGHALAYA

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CHAPTER - 1
INTRODUCTION

The study of human evolution and variation are the two major objectives of physical anthropology. These two objectives of study are overlapping in physical anthropology, and they cover a vast area of biological interest ranging from simple anthropometric study to molecular study of human evolution and variation. Recently, efforts have also been made to understand the relationship between human biology, especially to those aspects relating to health and nutrition, and various socio-cultural factors (Strickland Tuffrey, 1997). In fact, it is now believed that the human biological processes are largely influenced by various sociocultural aspects of the human society. Thus, it is quite imperative 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 population.

From an evolutionary point of view, demographic parameters like fertility and mortality are very important to understand the genetic make up a population. It is theoretically belied that natural selection, one of the major evolutionary forces, is operating on human population through differential fertility and mortality (crow, 1958, Johnston, 1973). Similarly, other demographic parameters like population size, mating patterns admixture rate, migration, etc., are very helpful for understanding the biological characteristics of the population (Basu, 1969; Ghosh, 1976; Khongsdier and Ghosh, 1994). However, it may be noted that demographic parameters like fertility and mortality are also largely influenced by various socioeconomic factors (Davis and Blake, 1956; UN, 1967, Mandelbaum, 1974, Mitra, 1978; Mosley and Chen, 1984; Mahadevan, 1986; World Bank, 1999; Caldwell *et al.*, 1999; and others). So, it is quite imperative on the part of physical

anthropologists to undertake a study on the effect of socioeconomic conditions on demographic parameters, particularly on fertility and mortality.

Besides demographic aspects of population physical growth and development of children is another important field of anthropological research. By the term growth, we mean " quantitative increase in size or mass" of an organism, while development refers to "progression of changes, either quantitative or qualitative, that leads from an undifferentiated or immature state to a highly organized, specialized, and mature state" (Bogin, 1999). The pattern of human growth serves as a type of mirror that reflects the biocultural evolution of human population. "Human biocultural evolution produced the pattern of growth and development that converts a single fertilized cell, with its complement of deoxyribonucleic acid (DNA) into a multicellular organism composed of hundreds of different tissues, organs, behavioral capabilities and emotions" (Bogin, 1999).

According to Tanner (1988), "The study of growth is important in elucidating the mechanism of evolution, for the evolution of morphological characters necessarily comes about through alteration in the inherited pattern of growth and development. Growth also occupies an important place in the study of individual differences in form and function of man, for many of these also arise through differential rates of growth of particular parts of the body relative to others ". Further, Eveleth and Tanner (1990) have also observed " A Child's growth rate reflects, perhaps better than any other single index, his state of health and nutrition; and often indeed his psychological situation also. Similarly the average values of children's height and weight reflect accurately the state of a nation's public health and the average nutritional status of its citizens, when appropriate allowance is made for differences, if any, in genetic potential. This is especially so in developing and disintegrating countries". Therefore a well-designed growth study is very important tool for assessing the health status of the population concerned. Since human growth and development is also largely influenced by socio-environmental factors like nutrition, infection, occupation, income and religion, it is very vital for understanding the biocultural variation and evolution of human populations (Tanner 1988, Eveleth and Tanner, 1990, etc.)

In the light of the above circumstances, demographic parameters and physical growth are not only helpful in understanding, the process of human evolution and

variation, but also reflect the health and economic condition of a population. In India, growth studies are very recent in origin (as reviewed by Sharma, 1992), which still warrants further researches. So, it may be essential to conduct more researches on physical growth and development of children with a view to understanding the economic conditions and health and\or nutritional status of the different populations\communities. It may be worthwhile to mention here that in the North-Eastern Region of the country, very few growth studies have so far been published (Das and Das, 1969-71; Das, 1973, 1974; Hazarika, 1974;Choudhury *et al.*, 1992). Moreover, all these studies have been carried out among some populations of Assam only (Khongsdier and Ghosh, 1998). Similarly, demographic studies of populations are very few in number in this part of the country (Nag, 1965; Baruah, 1983; Khongsdier, 1991, 1992, 1993, 1995;Das and Das 1992)

With this end in view, we have undertaken a study on demography and growth pattern among the Khasi children of Shillong in Meghalaya with a view to understanding the following objectives:

1. To understand the demographic structure of the three religious groups of the Khasis, namely, Christians, Muslims and Niam Khasis of Shillong.
2. To understand the growth pattern and nutritional status of children aged 3 to 18 years.
3. To assess the effects of some socioeconomic factors like religion, income of household, etc., on demographic parameters, and growth patterns of children.

AREA OF STUDY

Location and Topography

Meghalaya is essentially a small tribal state in the north eastern region of India. It lies between 25° 47' and 26° 10' N latitude and 89° 47 and 92° 87 E longitude. The state covers an area of about 22, 429 km. It is bounded by Assam on the north, east and north west, and by Bangladesh on the south and south west.

Initially, Meghalaya was a part of Assam, which was composed of only two districts, namely, the united Khasi and Jaintia Hills district and Garo Hills district. It was bifurcated from Assam as an autonomous state of April 2, 1970, and subsequently a full fledged Statehood was given on January 21,1972. The Khasi Hills district was itself bifurcated on 12th October 1976 into two districts known as East Khasi Hills district with

its headquarters in Shillong and the West Khasi Hills Districts with its head quarters at Nongstion.

Several hills in the Khasi Hills district have a firm place in mythology and traditions of the Khasi people. For example, Shillong peak (Lum Shillong) is the highest peak (1964m) in the Khasi Hills. It associated in the legends of the Khasi with U 'Lei Shillong (Lei being the abbreviated form of Blei God), the tulelar deity of the old kingdom of Shillong and progenitor of the royal family, *Ka Pah Syntiew*. The base of the peak is the source of four important rivers – the Umngot, Um-Iew, Um-Jasai (an important tributary of the Um-lam or Barapani) and Um-Khen, from which water supply of Shillong is obtained.

Climate: Because of the considerable variations in altitude and exposure, differences in climatic condition do exist within the Khasi hills. Shillong is situated about 1500 m above sea level. Its climate is pleasant, neither extremely cold nor hot. The temperature rises above 24° C – 34° C in the summer and falling below 4° C in winter. The average temperature and annual rainfall vary from one region to another. But Cherrapunji and Mawsynram areas receive the heaviest rainfall in the world (1270 cm).

Geological Composition

Meghalaya may be broadly divided into five Geological formations, namely Archean Gneisses complex, Shillong group of Rocks, Lower Gonduana Rocks, Cretaceous Tertiary Sediments and sylhet Traps (Bhakta, 1992). Shillong Group of Rocks are exposed in the central parts of the Khasi hills comprising mostly quartzite. Rocks of this group rest unconformably over the gneissic rocks with basal thick bed of conglomerate in the western part. The mildly folded sediments have suffered low grade metamorphism and are dissected by numerous faults. These rocks are intruded by ultra basic and acidic sills and dykes. The granite intrusive along the axial region of the Shillong group of rocks around Mylliem is termed as Mylliem granite. Several other granite bases such as Kyllang Plateau are intrusive into the gneissic complex in different parts of the region.

The Khasi hills area is endowed with a number of economically important minerals, the major ones being limestone, coal, uranium, sillimanite and clay.

Flora and Fauna: The vegetation of Khasi hills may be broadly classified into two major types, viz., the Tropical and warm temperate types. The forest of Mehglaya is the rich source of timber. The important timber-yielding free species are Khasi pine (*Pinus Khasiya*), sal (*Shore robustra*), teak (*Tectana grandis*) gamari (*Gmelina or borea*) etc. Different types of bamboo also grow in abundance.

Major crops of this state are paddy, maize, millet, pulses, potato, and ginger, turmeric, black pepper, sugarcane and oil seeds. Among the vegetables, cabbage, cauliflower, bean, radish, chilly, onion, lady's finger, carrot, peas and brinjal are extensively cultivated. The cultivated fruits include guava, orange, lemon, banana, naspati (*Pyrus senensis*), papaya (*Carica papaya*) black berry (*Prunus nepulems*), etc.

About 250 species of orchids have been reported form this region which include species ranging form tiny ones to tall one or more meters high (Gazetteer of India, 1991) Ferns are also found in abundance. The above mentioned flora of Khasi hills are mostly found in Shillong area.

The fauna of Meghalaya include a unique assemblage of Indo-Chines elements of Oriental and Palaearctic fauna (Gazetteer of India, 1991). The tropical and subtropical evergreen forests ensure the survival of rich mammals and also other groups of animal life. Of mammals, the Khasi hills possess some interesting animals like the hillock (*aibcon*), the only ape in India (*Hylobates*), the golden cent (*Felies temminckei*), the leopard (*Felids bengalensis veer*), the jungle cat (*Felis chaus*), the Himalayan black bear (*Selenarctos thebethanus*), the banking deer (*Muntiacus muntjak*) and the Panglen (*Manis pentadaetyla*).

Different types of birds are also found in East Khasi hills of Meghalaya. Snakes and lizards are also abundance. Besides, the Khasi Hills also reveal a number of interesting amphibians and fish species. Insects of the region present an equally interesting assemblages of fauna in the state. It may however be noted that most bird and animal species tend to decrease in number due to increasing deforestation.

THE PEOPLE

According to 2001 census, the total population in 2306069 of which 1167840 are males and 1138229 females. In East Khasi Hills, the total population is 6,60,994 of which males-

3,33,187 are males and 327807 females. The sex ratio is 984 females per 1000 males with a literacy rate of 76.98%.

The people of Meghalaya are mostly tribals, among which the Khasis and Garos are the most dominate tribal groups. The other tribal populations like the Hajongs, Nagas, Mizos, etc. along with some non-tribal populations like Bengalis, Assamese, Nepalis, Biharis, Panjabis, etc. have also settled in Shillong.

The Khasi tribe consists of five major sub-groups, namely, the Wars, Khynriams (Upland Khasis), Jaintias (Pnars or Syntengs), Bhois and Lyngngams. The Khynriams are mostly found in upland region of the East Khasi and West Khasi districts of the State. The Jaintia Hills district is dominated by the Jaintias. The Bhois predominantly live in the Ri-Bhoi district on northern parts of the Khasi Hills. The Lyngngams are mainly confined to the southern and western parts of the West Khasi Hills district.

Physical Characteristics and Affinity

Form the anthropological point of view, the Khasis (or Khynriams, Pnar, Bhois, Wars and Lyngngams) belong to the Indo-Mongoloid of the Mongoloid racial stock (Das, 1981). Das (1987) has described that the "Khasis have brown skin color. Their head hair is dark brown with a reddish tinge in color, straight or flat, wavy in form and coarse in texture. They have scanty beard and moustache. The color of eye is brown to dark brown. The eye slit is mostly oblique and palpebral fissure is medium. Eye fold is present in most of the cases. They are short in stature. Their head is mosocephalic and nose in mesorrhine". Regarding the four sub-groups of the Khasis, Das (1978) says that these four divisions (i.e., Khynriams, Pnars, Bhois and Wars) do not deviate much form the average Khasis in relation to stature and trunk height. He, however, points out that the "Pnars and the Bhois show most often deviation in higher magnitude and that these two populations are standing porpoise to one another in relation to average Khasis". It may be mentioned that the people have so far treated the Khynriams, Pnars, Bhois, Wars and Lyngngams as one and the same ethnic group. Marwein (1987) says that the Khasi are" known sometimes by different names at different places. The names are either confined to a particular Syiemship or state or a particular geographical region". All these sub-groups claim to have descended from the same origin, i.e., *U Hynniew Trep Hynniew Skum* (Seven Huts). Recently, the

government of Meghalaya has published one volume of Meghalaya (DIPR, 1991). In this volume, it is clearly stated that these Khasi groups are of the same ethnic origin. They share common traditions and customs, though there may be some variations, owing to different geographical conditions and admixture with other communities.

All the sub-groups of the Khasis follow the matrilineal system of the society and linguistically they speak a different dialect of the Monkhmer language, which belongs to the Austric (Austro-Asiatic) group. So far as the Austric language in concerned, it is believed to be spoken by the earliest inhabitants of the country, particularly the Australians and their descendants (Ghosh and Khongsdier, 1997). At present, besides the Khasis, other peoples like the Kols, Mundas, Nicobarese of Nicobar islands, etc., are the Austric speakers in India. Das (1987) has reported that the Wanchoo of Arunachal Pradesh also use some Austric words in their language.

With regard to the position of the Khasi, Dixon (1922) says"... the Khasis in spite of their linguistic isolation among the peoples of Assam, are racially closely related to the majority of the Burmese tribes. With them they represent a very old western drift of south-western Asia peoples unlike their neighbours, however, they have succeeded in retaining their old speech". Haddon (1924) has also tentatively suggested the presence of ancient dolichocephalic platyrrhine (Pre-Dravidian) type among the Khasis. Linguistically, Chatterjee (1951) says "In Burma Indo-China lived speakers of Austric language, who are largely of Proto-Australoid race from India". Accordingly, Das (1978) has proposed that that the "Khasi is an Australoid population speaking the Austric language. Their physical features were modified by a strong intrusive Mongoloid strain. They have retained their language but have undergone remarkable changes in physique".

The other possibility is that the Khasis are a Mongoloid people, who came from south-east Asia as suggested by many scholars like Gurdon (1907), Chatterjee (1951), Bareh (1967), Das (1979), and others. According to Gurdon (1907). "The Khasis are an offshoot of the Mon people of Further India in the light of historical fact." Chatterjee (1951) says, " They would appear to be a Mongoloid people who have adopted the language of the earlier race, the Austrics (or Proto-Australoids), after they have come down from south Tibeto-Burman area of dispersion. They may have changed their speech to the Austric (Mon khmer) Khasi even while they were in Burma." He has also pointed

out that the admixture of proto-Australoids and Mongoloids "in very early times in Burma and Indo-China is very likely, this mixture producing the ancient Rmen or Mon people of central and southern Burma, the Palaungs and Was of upper Burma, as well as the Khmers, the Chams, the Stings, the Bahnars and other Austric or Austro-Asiatic speakers of Saim and Indo-China". It may be mentioned here that the Proto-Australians are known by different names like Pre-Dravidians, Australoids, Veddids and Nishadas. The Proto-Australoids are similar to Caucasoids in respect of many characteristics. Sometimes, they are also considered a sub-division of the Caucasoids known as Archaic Caucasoids (Das, 1970). In view of the above suggestions, it appears that the Khasi are a Mongoloid people, who might have learned their language form the Australoids (or Proto-Asutraloids) on their way to India or they might be one of those peoples resulting form the admixture between the Mongoloids and Proto-Austraoids (Australoids), somewhere in Burma or Indo-China. Some scholars (like Gurdon, 1907; Bareh, 1967; Das, 1970; and others) have also supported this view on the basis of cultural evidence. It may however, be noted that there are also some cultural similarities between the Khasi and the Kolarian tribes of Central India.

Occupation

The community was basically a land owning community, the land belonging to the individual proprietress. Along with the advent of Christianity, drastic economic changes also came about in this area. Previously, jhuming (shifting) was the chief mode of cultivation besides the dry land cultivation of rice. The forest resources were immense and the supply of wood, bamboo and cane was another lucrative business. However, after independence and the opening up of greater opportunities there was a rapid rate of urbanization with the result that people got attracted toward towns. Those who were educated got white-collar jobs. The young are usually attracted by vehicles and take up driving as a profession. The men take up job as laborers at various construction sites. Some people are also engaged in business and services. Traditional industries were never important as occupations (Syiemlieh, 1994). The main occupations today are jobs in offices, teaching, contractor and the professional services where there are a large number of Khasis as university and college teachers, engineers, doctors, etc. There is no bonded

labour, child labour exists but not in disturbing proportions and there has been little change in the occupational pattern, as industrialization has made no important in terms of the employment.

Religion

The majority of the Khynriam Khasis of Shillong have embraced Christianity, while next to Christian group are the Niam Khasis- believers of Khasi traditional religion (Ka Niam Khasi). There are also a few Khasi Muslims in Shilling, i.e., those Khasis who have converted to Islam through marital alliance with the Muslims who migrated from Bangladesh and other parts of India.

Among the Khasis, Christianity dates back to about 150 years when Krishna Chandra Pal converted two Khasi people in a village, called Pandua (Pyrdiwah) on the border of the Khasi hills and Sylhet District (Bhat, 1975)

But the number of converts to Christianity among the tribal was few, until Thomas Jones of the Wales Presbyterian Mission in 1841 propagated the use of the Latin alphabet to write the tribal dialect. At present there are different Christian denominations like Presbyterian, Roman Catholics, Church of God, Church of Christ, Seven day Adventist, United Pentecostals church, etc. In the present study, data on various denominations were not be taken into consideration. By 'Christians' we mean only those Khasis who believe in Christianity. The spread of Christianity in the Khasi and Jaintia Hills has brought about tremendous change in the field of education (Nag, 1965; Das Gupta, 1984). Nag (1965) has shown that the Christian Khasi have better education standard and economic condition that their non-Christian counterparts. "The spread of education is perhaps the most significant effect of Christianity among the Khasi" (Nag, 1965).

The people, who are still following their traditional religion, are monotheistic, though others are of the opinion that the Khasi religion is animism (Gurdon, 1907; Bareh, 1967, Bhowmik, 1971) and demon worship (Natarajan, 1977) and so on. This is due to the fact that the others have a vague understanding of the Khasi religion as said by Gurdon (1907), "The Khasi have a vague belief in God, the Creator". They believe in one Supreme God, the Creator and Master of Universe (*U Blei Nongbuh Nongthaw*). They also believe in life after death and the presence of God and evil spirit (Marwin, 1987). The breaking of

eggs and sacrifice of birds and animals like fowl, pig, cow, goat etc., are their important religious rites and ceremonies. The priest locally known as *U Nongknia or Nongshat Nongkhein* performs these religious rites either for the individual cause or for that of the community as a whole. They do not have any religious scripture, or any common place of worship. "To a khasi, religion is a personal contract between man and God," (Hipshon Roy, 1990). It may also be mentioned here that the movement for revivalism of the traditional religion (Ka Niam Khasi) has also been started under the leadership of the *Seng Khasi Organization*, established first on August 23, 1899.

As already mentioned, some Khasis have also embraced Islam through the marital relationship mainly between the Khasi females and other Muslim males who migrated from Bangladesh and other parts of India like Assam, Uttar Pradesh and Bihar. Historically, the Khasi are also believed to have trade relationship with the Mughal emperors through their viceroys at Murshidabad during the 17th century (Irshad Ali, 1992). So, the Khasis came into contact with the Muslims mainly through trade and commerce. Some of them also visited the Khasi hills as wonderers and hunters. As a result, a good number of them have settled in the Khasi hills and, in course of time, these Muslims adopted the Khasi customs (Irshad Ali, 1992). Gradually, they have settled down in the area and accepted the local women as spouses. This group so mainly confined within the state capital of Meghalaya. No specific census work has ever been attempted amongst them. Hence even rough estimate of the number of individuals is not available. Unlike the Muslims of the other states, the Khasi Muslims do not share a common dialect. The dialect varies form household to household (Roy, 1994). The Khasi Muslims are non-vegetarians, beef-eaters, but they abstain form taking pork. The staple food is rice. They regularly consume available vegetables and fruits. After marriage, most of the women adopt the elaborate style of cooking as praised by the Muslims, especially on festive occasions. Due to religious sentiments, they try to abstain form alcoholic beverages (Roy, 1994). The marriage is performed according to Islamic rules (Roy, 1994). In fact, the Khasi mothers, who get converted to Islam and her children, are known as Muslims. "But for all practical purposes they are treated as Khasis". (Irshad Ali, 1992). Nowadays, it has been reported that among these Muslim Khasi there is a compromise between Islam and matrilineal

system of society with regard to patterns of Kinship, residence, inheritance, etc (Mathur 1975, Ali Irshad, 1992).

Food Habits

The food habits of the Khasis are simple. Rice is their staple food. The Khasis are non-vegetarians and take pork, beef, chicken and fish, depending upon their economic status. They are rice eater, but have also taken wheat flour as snack. The principal pulse taken taken by the people is lentil, which is available in local market. In the case of vegetables, potatoes, sweet potatoes, pumpkin, tomato, onion and various kinds of green leafy vegetables are some of their favorites. Besides a variety of mushroom, which is found in abundance in this hilly regions, form a part of their regular diet. Milk is not a part of their regular diet. Instead, tea without milk is a beverage which is continuously taken duting the day. Traditionally, rice bear or Ka-kiad used to be fermented in each house for daily consumption. With the increased urbanization, rice beer has been replaced by distilled liquor and other spirits bought from the market. Seasonal fruits, available locally, are consumed by the Khasis. They have also the habit of taking betel nut leaf and lime.

CHAPTER VIII
SUMMARY

roduction

man evolution and variation are the two major objectives of study in physical hropology. These two objectives of study are overlapping, and they cover a vast area biological interest ranging from simple anthropometric study to molecular study of nan evolution and variation. Recently, efforts have also been made to understand the ıtionship between human biology, especially to those aspects relating to health and rition, and various socio-cultural factors (Strickland and Tuffrey, 1997). In fact, it is v believed that the human biological processes are largely influenced by various iocultural aspects of the human society. Thus, it is quite imperative on the part of sical anthropologists to undertake such studies with a view to understanding not only processes of human evolution, but also the health and nutritional aspect of human ulation.

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socioeconomic conditions on demographic parameters, particularly on fertility and mortality.

Besides the demographic aspects of population, physical growth and development of children is another important field of anthropological research. By the term growth, we mean a " quantitative increase in size or mass" of an organism, while development refers to a "progression of changes, either quantitative or qualitative, that leads from an undifferentiated or immature state to a highly organized, specialized, and mature state" (Bogin, 1999). The pattern of human growth serves as a type of mirror that reflects the biocultural evolution of human population. "Human biocultural evolution produced the pattern of growth and development that converts a single fertilized cell, with its complement of deoxyribonucleic acid (DNA) into a multicellular organism composed of hundreds of different tissues, organs, behavioral capabilities and emotions" (Bogin, 1999).

According to Tanner (1988), "The study of growth is important in elucidating the mechanism of evolution, for the evolution of morphological characters necessarily comes about through alteration in the inherited pattern of growth and development. Growth also occupies an important place in the study of individual differences in form and function of man, for many of these also arise through differential rates of growth of particular parts of the body relative to others". Further, Eveleth and Tanner (1990) have also observed "A Child's growth rate reflects, perhaps better than any other single index, his state of health and nutrition; and often indeed his psychological situation also. Similarly the average values of children's height and weight reflect accurately the state of a nation's public health and the average nutritional status of its citizens, when appropriate allowance is made for differences, if any, in genetic potential. This is especially so in developing and disintegrating countries". Therefore a well-designed growth study is very important tool for assessing the health status of a population. Since human growth and development is also largely influenced by socio-environmental factors like nutrition, infection, occupation, income and religion, it is very vital for understanding the biocultural variation and evolution of human populations (Tanner 1988, Eveleth and Tanner, 1990).

In the light of the above circumstances, demographic parameters and physical growth are helpful not only in understanding the process of human evolution and variation, but also reflect the health and economic condition of a population. In India, growth studies are very recent in origin, which still warrants further researches. So, it may be essential to conduct more researches on physical growth and development of children with a view to understanding the economic conditions and health and/or nutritional status of the different populations. It may be to mentioned here that very few growth studies have so far been published in Northeast India (see review, Khongsdier and Ghosh, 1998). Moreover, almost all studies have been carried out among some populations of Assam only. Likewise, demographic studies of populations are very limited in number in this part of the country (Khongsdier, 2001).

With this end in view, we have undertaken a study on demography and growth pattern among the Khasi children of Shillong in Meghalaya with a view to understanding the following objectives:

1. To understand the demographic structure of the three religious groups of the Khasis, namely, Christians, Muslims and Niam Khasis of Shillong.
2. To understand the growth pattern and nutritional status of children aged 3 to 18 years.
3. To assess the effects of some socioeconomic factors like religion, income of household, etc., on demographic parameters, and growth patterns of children.

MATERIALS AND METHODS

Study Area and population

Khasi population is mainly distributed in Khasi and Jaintia hills of the State of Meghalaya. The term "Khasis" is a generic name referring to any one or all the five major subgroups, namely, Khynriams, Pnars, Bhois, Wars and Lyngngams. However, in the present study, we are mainly concerned with the Khynriams, who are also known as the Khasi proper.

The fieldwork was conducted in different intervals between November 1996 and February 1998 in Shillong. No sampling technique was applied for the selection of samples at both individual and population levels. However, an effort was made to include

in our study the three major religious groups, namely, Christian Khasis, Khasis of traditional religion (referred to herein as Niam Khasis), and Muslim Khasis. The Christian Khasis and Niam Khasis are distributed all over the Khasi hills, but the Muslim Khasis are mainly concentrated in Shillong, the capital of the state. Therefore, the present study was confined to Shillong only. According to our list of Muslim households prepared with the help of Islamic Organization of Shillong, the Muslim Khasis are restricted to certain localities such as Laban, Bishnupur, Garikhana, although some of them are also scattered in Nongthymmai, Laitumkhrah, Lawsohtun and Lummawbah areas. Therefore, data for the present study were collected from 584 households of the three religious groups inhabiting in the above mentioned localities of Shillong.

Demographic data: The nature of demographic data collected for the present study was based on those parameters suggested by the World Health Organization Working Group (WHO, 1964, 1968). Structured schedules were prepared relating to household census, fertility, mortality and socioeconomic parameters, and these schedules were completed through in-depth interview with the heads or elder members of households. A household schedule was used for the collection of data on individual records and socioeconomic parameters like name of informant, age, sex, marital status, relationship to head of the household, date and place at which record was taken, clan, tribe, religion, occupation, education, monthly income, community affiliation, total number of family members, place of birth, place of residence, etc. The fertility and mortality schedules were used for collection of data on pregnancy records of each mother, which include total number of conception, total number of live-births, birth order; age, sex and marital status of each offspring; number of dead children, sex, date of birth, age at death, causes of death, if any, number of reproductive wastage (abortions and still- births).

Data on Growth of Children: A cross-sectional method of study was followed for collection of data on physical growth of 2719 children aged 3 to 18 years (Eveleth and Tanner, 1990), taking into consideration the following anthropometric measurements:

Weight (kg)

Height vertex (cm)

Sitting height (cm)

Biacromial diameter (cm)

Bi-iliac diameter (cm)

Head circumference (cm)

Mid upper arm circumference (left) (cm)

Chest girth (cm)

An attempt was made to follow as far as possible the standard techniques of taking the measurements as described in Weiner and Lourie (1981). For assessing the nutritional status of children, we have adopted three anthropometric indices - weight for age, height for age and weight for height - which are considered as the indicators of nutritional status. These indices were derived as percentage of the international standard or reference, i.e., the growth reference of the U.S. National Centre for Health Statistics (NCHS, 2000).

Socio-economic Categories

In the present study, three important socio-economic variables were taken into consideration. These include religion, monthly income of the household and level of education. These socio-economic variables were classified arbitrarily into a different group and/or category with a view to understanding their influence on demographic characteristics and growth and nutritional status of the study population. Our classification may be briefly described as follows:

Religious groups: The Khasi population (mostly Khynriams) of the present study is divided into three broad religious groups, namely, the Christian Khasis, Niam Khasis and Muslim Khasis. By *Christian Khasis*, we mean those Khasis who have embraced Christianity or those Khasis who are Christians by faith, and the *Niam Khasis* refer to those Khasis who have followed and maintained their traditional religion. On the other hand, the Muslim Khasis are those Khasis who have embraced Islam, and the children belonging to this religious group are by and large the product of the intermixture between the Khasi females and Muslim males.

Income groups: The interval estimation based on standard deviation of the per capita monthly income of household was adopted for classifying the three economic groups (Khongsdier, 1997). Accordingly, the three economic groups were classified as follows:

Above ($\bar{X} + 4SD/\sqrt{N}$) = High income group (HIG)

($\bar{X}$ - 4SD/√N) to (Mean + 4SD/√N) = Middle income group (MIG)

Below ($\bar{X}$ - 4SD/√N) = Low income group (LIG)

Educational Level: The data on educational attainment of individuals in the present study were arbitrarily classified as follows: Individuals who were unable to read and write were classified as **Illiterate.** The individuals who were able to read and write and those who attended school up to standard IV were grouped into **Primary** level of education. **Secondary level** of education includes all those persons who attended school up to below matriculation. The individuals with education up to matriculation and above are included in the category of **Higher level** of education due to inadequacy of data.

Statistical Analyses: The data collected for the present study are quantified and analysed statistically, using SPSS Window software. The data are presented in terms of means, standard deviation, standard error and proportions or percentages. The differences between two means were tested, using t-student test, while the differences between more than two means were determined, using one-way analysis of variance (ANOVA). Analysis of covariance was also carried out for testing the differences among means, allowing for the effects of other covariates. The differences between proportions were tested, using chi-square test. Multiple regression analysis was also carried out for understanding the effects of socio-economic factors on demographic parameters and growth patterns of children. Logistic regression analysis was used for analyzing the effects of maternal age, education, income and religion on infant mortality.

FINDINGS OF THE PRESENT STUDY

The findings of the present study are presented in three chapters. In chapter IV, we deal with the demographic characteristics of the three religious groups. The growth and nutritional status of children are presented in Chapters V and VI, respectively.

Demographic characteristics: The findings on important demographic characteristics of the three religious groups are as follows:

1. According to Sundbarg's classification of population, a population is said to be *progressive* when the number of persons in relation to the total population are

40.0%, 50.00% and 10.00% in the age groups 0-14, 15-49 and 50 + years, respectively. The population is referred to as *stationary* if these frequencies are 33.00%, 50.00% and 17.00%, respectively; while the frequencies of 20.00%, 50.00% and 30.00%, respectively, are the characteristics of *regressive* population (Khongsdier, 2001). Following these classifications of population, the three religious groups of the Khasi population are found to be *progressive type*.

2. The over all sex ratio, i.e., the number of males per 100 females, is found to be 96.54, 95.14 and 97.99 in the Christians, Muslims and Niam Khasis, respectively, which is low despite absence of statistical difference from the ideal sex ratio of 1:1 for all the religious groups.
3. The mean age at marriage is much higher in males than in females for all religious groups. Among males it is found to be 25.48 ± 0.19, 25.45 ± 0.17 and 25.94 ± 0.21 years in the Christians, Muslims and Niam Khasis, respectively. In the case of females, these mean values are 20.32 ± 0.21, 20.30 ± 0.19 and 20.35 ± 0.25 years, respectively. The mean age at marriage among the Muslim, Christian and Niam Khasi women of the present study is higher than those reported for the populations of Assam (Sengupta and Gogoi, 1995), but it is more less similar to that reported for the War Khasi (Khongsdier, 2001).

Fertility

1. The mean live births per mother living in wedlock till the age of 45 are found to be 4.50 ± 0.13, 4.89 ± 0.18 and 4.82 ± 0.15 in the Christians, Muslims and Niam Khasis, respectively. Although it is slightly higher in the Muslims and Niam Khasis, the one-way analysis of variance (ANOVA) indicates that the differences between religious groups are not statistically significant ($F = 190$, $P > 0.05$). These mean live births to women living in wedlock for the three religious groups are similar to those reported for the Christian (4.08) and Non-Christian (4.91) War Khasis (Khongsdier, 2001).
2. With regard to all married women of all ages, the mean live births are 4.93 ± 0.14, 5.31 ± 0.17 and 5.18 ± 0.15 in the Christians, Muslims and Niam Khasis, respectively, and the mean surviving children are 4.51 ± 0.11, 4.77 ± 0.14 and 4.61 ± 0.13, respectively. Thus, it indicates that the mean live births and surviving

children are higher in the Muslims and Niam Khasis in comparison with the Christians, despite the absence of statistical significance (Live births: F= 1.57, P > 0.05; Surviving children: F = 1.01, P> 0.05). In comparison with other populations, the three religious groups of the present study have higher live births than the Christian (4.81) War Khasis (Khongsdier, 2001) and the Kochs of Garo Hills (Kotal, 2001).

3. The age specific fertility rate is found to have reached its peak point in the age group 25- 29 years in all the religious groups, and the total fertility rates are 5.38, 5.85 and 5.85 in the Christians, Muslims and Niam Khasis, respectively. Thus, it indicates that the fertility rates are slightly higher in the Muslims and Niam Khasis when compared with the Christians. The total fertility rate in these three religious groups is more or less similar to the War Khasi, but much higher than that reported for the state of Meghalaya (NCHS, 1999) and the Kochs of Garo hills (Kotal, 2001), although it is not as high as that reported for the Dalus (Patra and Kapoor, 1996).

Mortality

1. The infant mortality rates (i.e., number of deaths before 1 year of life per 100 live births) are 6.82%, 8.39% and 8.60% in the Christians, Muslims and Niam Khasis, respectively. Thus, the infant mortality rates are lower in the Christians than in the Muslims and Niam Khasis, despite the absence of statistical difference ($\chi^2 = 3.60$, DF = 2, P > 0.05). With respect to juvenile mortality, the frequency is more or less same in the Christians (1.74%) and Muslims (1.68%), but it is higher in the Niam Khasis (2.33%), though the differences between the religious groups are not statistically significant ($\chi^2 = 1.79$, DF = 2, P > 0.05).

2. The infant mortality rates in the Christians of the present study are similar to Christian War Khasis (6.89%), while the rates in the Muslims and Niam Khasis are similar to the Non-Christian War Khasi (Khongsdier), and for the state of Meghalaya (NCHS, 1999). However, the religious groups of the present study have lower infant and juvenile mortality rates than the Dalus (Patra and Kapoor, 1996) and Chapra Kochs (Kotal, 2001) of Garo hills.

3. With respect to reproductive wastage, it is found that the still birth rates (i.e., number of still-births per 100 pregnancies) are 3.16%, 3.18% and 3.56% in the Christians, Muslims and Niam Khasis respectively, and the abortion rates to these three religious groups (i.e., number of abortions per 100 pregnancies) are 4.32%, 4.64% and 4.60%, respectively. Thus, the rates of reproductive wastage (i.e., number of abortions and still-births per 100 pregnancies) are 7.47%, 7.82% and 8.16% in the Christians, Muslims and Niam Khasis, respectively. It appears that the Muslims and Niam Khasis are more or less similar in the frequency of reproductive wastage, and it is slightly higher in the Christians, despite the absence of statistical difference ($\chi^2 = 0.42$, DF = 2, $P > 0.05$). Like in the case of infant mortality, the frequencies of reproductive wastage in the three religious groups of the present study are similar to those reported for the War Khasis (Khongsdier, 2001), but higher than those reported for the Dalus (4.93%) of Garo hills (Patra and Kapoor, 1996).

Socio-economic Correlates: In this thesis, an attempt has also been made to show the relationship between the demographic parameters and socio-economic factors like age of mothers, age at marriage, education of mothers, and income of household for all the three religious groups. The findings may be briefly described as follows:

1. It is found that the mean number of live births per married woman decreases with the rise in age at marriage. It holds true for the Christians, Muslims and Niam Khasis. The results of the multiple regression analysis on the effect of age at marriage on the number of live births after controlling for other factors like age, educational level, and income are shown in Chapter IV. It is found that the coefficient of regression (b± SE) on the effect of age at marriage (independent variable) on the number of live births (dependent variable) is negatively significant for all the religious groups (Christians: $b = -0.220 \pm 0.033$, $t = 6.74$, $P < 0.0001$, Muslims: $b = -0.218 \pm 0.041$, $t = 5.43$, $P < 0.0001$, and Niam Khasis: $b = -0.186 \pm 0.044$, $t = 4.27$, $P < 0.0001$). Thus, the present findings indicate that age at

marriage is a very important factor in controlling the fertility rates for all the religious groups.

2. As regards education, the coefficient of regression on the effect of education (independent variable) on the number of live births (dependent variable) is negative, but not significant in the Christians ($b = -0.136 \pm 0.098$, $t = 1.39$, $P > 0.05$) and Muslims (-0.002 ± 0.124, $t = 0.02$, $P > 0.05$), although it is negatively significant in the Niam Khasis (-0.448 ± 0.127, $t = 3.52$, $P < 0.0001$). Thus, the present findings indicate that the education is not as important as expected in controlling the fertility rates among the Muslim and Christian Khasis, but it is certainly important in the Niam Khasis.

3. It is also found that the mean number of live births tends to decrease significantly with the increasing level of income level of the mothers for all the religious groups. The results of the multiple regression analysis (Chapter IV) show that the effect of income on the number of live births after controlling for other factors like age, age at marriage, and educational level is negatively significant for all the religious groups (Christians: $b = -0.832 \pm 0.151$, $t = 5.52$, $P < 0.0001$, Muslims: $b = -0.739 \pm 0.189$, $t = 3.92$, $P < 0.001$, and Niam Khasis: $b = -0.987 \pm 0.161$, $t = 6.12$, $P < 0.0001$). Thus, the present findings indicate that the income of the household is a very important in controlling the fertility rates in the present population, irrespective of religious groups.

In view of all the socio-economic factors, the fertility rate in the present population is negatively associated with the age at marriage and income levels of mothers. The effect of education, on the other hand, is not clearly perceptible in the present study, except among the Niam Khasi mothers, which indicates that educational level of the mothers is also very important in regulating the fertility rate. The effect of religion on fertility rate is not significant, although the total fertility rate is more or less same among the Muslims and Niam Khasis, but it is lower in the Christians.

With respect to infant mortality (Chapter IV), it is found that the regression coefficient ($\beta \pm$ standard error) of infant mortality (dependent variable) on maternal age is positively significant (0.021 ± 0.008, $P < 0.011$), and it is negatively significant with respect to education (-0.150 ± 0.074, $P < 0.043$) and income (-1.283 ± 0.125, $P < 0.000$).

On the other hand, the effect of religion on infant mortality is not statistically significant (0.051 ± 0.101, P > 0.05). Thus, it indicates that maternal age, education and income are very important in influencing infant mortality in the present population.

GROWTH PATTERN

In the present study, we have described the growth pattern of the Khasi both boys and girls taking into consideration the body weight, height, sitting height, biacromial diameter, bi-iliac diameter, head circumference, arm circumference and chest circumference.

Estimation of adult height: According to fourth degree polynomial model by which the height is equal to $64.19 + 8.59(Age) - 0.47(Age)^2 + 0.03(Age)^3 - 5.46\ (Age)^4$ cm for boys and to $65.53 + 7.79(Age) - 0.43(Age)^2 + 0.04(Age)^3 - 0.001(Age)^4$ cm for girls, the estimated value for adult height is found to be 154.20 cm for males and 146.83 cm for females. This indicates that the girls have reached their adult height by the age of 18, while the boys still continue to grow. The present observation seems to confirm that observation among the Assamese Muslim girls of Assam, though it is not so in the case of boys (Begum and Choudhury, 1990).

Growth Pattern in Comparison With NCHS and ICMR Growth References

In order to have a better understanding of the growth status of the children in this study, an attempt has been made to compare their weight and height with those given by the U.S. National Centre for Health Statistics (NCHS, 2000) and Indian Council of Medical Research (ICMR, 1972). We have restricted only to weight and height as data on other anthropometric measurements are not available in the latest NCHS growth reference.

With respect to weight, it has been observed that the mean weight of the Khasi boys is more or less to the 25th percentiles of NCHS growth reference from 3 to 6 years of age. From 6 to 8 and 13 to 16 years of age, the curve for the mean weight of Khasi boys lies between 5^{th} and 10^{th} percentiles, and it is closer to the 10^{th} percentile from 8 to about 11 years of age. From 11 to 13 years, it is closer to the 5^{th} percentile of the growth reference, and from 16 years onwards the growth curve for the Khasi boys lies below the

5th percentile. It may be mentioned that the 50th percentile of the NCHS data is generally considered as 100 per cent normal growth for children.

Like in the case of boys, the mean weight of girls falls at 25th percentile of the NCHS reference from 3 to 6 years of age, and thereafter it drops into 10th percentile up to about the age of 10. From 10 years onwards, the growth curve for the weight of Khasi girls lies more or less between 5th and 10th percentiles of the NCHS reference.

It is found that the mean weights of Khasi boys and girls are far below the 50th percentile of the NCHS growth reference especially at higher age groups. It is likely that ethnic difference in growth pattern does exist especially children in the higher age groups. In order to have a better understanding of this problem, an attempt has also been made to compare the present findings with the growth reference given by the Indian Council of Medical Research (ICMR, 1972), although it has been criticized that the ICMR growth reference does not represent all sections of the Indian population. It is also suggested that the children belonging to the high economic class of the Indian population show more or less similar pattern of growth to those in the developed countries (Gopalan, 1992). Therefore, it is recommended to use the international growth reference, i.e., the NCHS data, for assessing the growth and nutritional status of Indian children. Accordingly, it is not surprised if this is the reason that the ICMR or other authorities have not published any new data on growth of Indian children.

It is observed that the mean weight of the Khasi boys is above the 50th percentile of the ICMR reference from 3 to 18 years of age. A similar trend is observed in the case of girls (Chapter VII). The Khasi girls are more or less in the 75th percentile of the ICMR reference from 3 to 6 years of age, and thereafter they are similar to the boys in which the growth curve lies between 75th and 50th percentiles. Thus, the Khasi boys and girls are heavier than the ICMR children, but much lighter than the American children.

Height

It is observed that the Khasi boys are more or less in the 5th percentile of the NCHS reference from 3 to about 6 years of age, and thereafter the growth curve of Khasi boys falls much below the 5th percentile. Similarly, the growth curve for girls is more or less in the 5th percentile from about 3 to 7 years, and thereafter it falls below the 5th percentile, except at 12 years of age, which is characterized by an adolescent growth spurt in girls.

Plotted against the ICMR percentiles, the mean height for boys is comparable to the 25th percentile from 3 to 4 years of age, and thereafter it fluctuates between 10th and 25th percentiles up to about 15 years of age. From 15 years of age, the growth curve for boys falls below the 10th percentile of the ICMR reference. Nevertheless, the present findings indicate that the Khasi boys are much shorter than the American boys, especially from the age of 7 onwards, but they are comparable to the Indian children as reported by the ICMR. In the case of girls, the growth curve is at about 50th percentile at the age of 3 years, it lies about 25th percentile of the ICMR growth reference from 4 to 10 years of age, and thereafter it fluctuates below and above the 25th percentile up to about 13 years of age. The curve tends to lie between the 10th and 25th percentiles from 13 years of age. Overall, it indicates that the girls are more comparable to the ICMR reference than the boys, although they are much shorter than the American children.

Comparison with Neighbouring Populations

Very few growth studies have been carried out in Northeast India. Recently, two growth studies were published: one among the War Khasis of Meghalaya (Khongsdier, 1996a) and the other among the Assamese Muslims of Assam (Begum and Choudhury, 1999). Thus, we shall restrict our comparison with only the War Khasi and Assamese Muslims children.

Weight

The Khasi boys are found to be more or less similar to the Assamese Muslim and War Khasi boys in weight from 3 to 11 years (Chapter VII). Thereafter, the Assamese Muslim boys are heavier than the Khasi boys of Shillong and War area, except at about 13 years of age when all the three groups of boys show a similar pattern of growth in weight. The War Khasi boys lie in between the Assamese and Khasi boys from 11 to 13 years, and thereafter they are more or less like the Khasi boys of the present study. As far as girls are concerned, all the three groups of girls are by and large similar in weight from 3 to 10 years of age. From 10 to 16 years of age, the Assamese Muslim girls are heavier than the Khasi and War Khasi girls, and thereafter they are surpassed by the Khasi girls of the present study. In comparison with the War Khasi girls, the Khasi girls of the present study are slightly lower in weight from 10 to 14 years of age, and thereafter they are heavier than the War Khasi girls.

Height

The Khasi boys are found to be shorter than the War Khasi and Assamese Muslim boys for all age groups. Thus, it is in contrary to expectation that the Khasi boys of Shillong may be taller than their counterparts in the War Khasi area. Instead, it is also seen that the War Khasi boys are slightly taller than the Assamese Muslim boys from 3 to 5 years of age. From 5 to 7 years of age, they are more or less similar in height, and thereafter they are surpassed by the Assamese Muslim boys. Like in the case of boys, the War Khasi girls are taller than the Assamese Muslim girls from 3 to 5 years, and they are in between the Khasi and Muslim girls from 6 to 14 years; thereafter they tend to be in the same height with their coevals in Shillong.

Sitting Height

It is observed that the Khasi boys are lower in sitting height than the War Khasi and Assamese Muslim boys across age groups, i.e., from 3 to 18 years of age (Chapter VII). The mean sitting height of the War Khasi boys is higher than that of the Assamese Muslim boys from the age of 3 to 6 years; they are more or less similar from 6 to 9 years of age, and thereafter, they are surpassed by Muslim boys. A similar trend is observed in the case of girls, which indicates that the Khasi girls have the lowest sitting height across age groups, except from 17 years of age when they tend to have a similar sitting height with the Assamese Muslim girls. From 3 to 6 years of age, the War Khasi girls are higher in sitting height than both the Khasi and Assamese Muslim girls, and from about 14 to 15 years of age they are shorter in sitting height than the Khasi girls.

Head Circumference

Like in the case of height and sitting height, the Khasi boys have a lower head circumference than the War Khasi and Assamese Muslim boys across age groups (Chapter VII). On the other hand, the mean head circumference in the War Khasi boys is in the middle of those for the Khasi and Assamese Muslim boys from 3 to 13 years of age, and thereafter it is higher in the latter than in the former. Unlike in the case of boys, the mean head circumference in Khasi girls is higher than that for the War Khasi girls from 6 to 7 years, and it is also higher than that for the Assamese Muslim girls from 16 to 17 years of age. Nevertheless, the War Khasi girls have broader head than the Khasi girls of the present study across age groups, except from 6 to 7 years which is higher in the latter. With respect to the difference between the War Khasi and Assamese Muslim girls,

it is observed that the latter have broader head than the former from 3 to 12 years of age, and thereafter it is higher in the former.

Mid Upper Arm Circumference

It can be seen that like in the case of other measurements the arm circumference is lower in the boys of the present study when compared with the War Khasi and Assamese Muslim boys (Chapter VII). This is true in all the age groups. On the other hand, the War Khasi and Assamese Muslim boys are more or less similar in mid upper arm circumference, although it is higher in Assamese Muslims from 3 to 4 years and 14 years onwards. Like in the case of boys, it is found that the mean value of mid upper arm circumference is lower in the girls of the present study when compared to the War Khasi and Assamese Muslim girls across age groups. Further, the growth curve for the mid upper arm circumference of the War Khasi girls is more or less similar to that for the Assamese Muslim girls from 10 to 12 years, and it higher in the War Khasi from 7 to 8 years. In other age groups, the mean value of mid upper arm circumference in the Assamese Muslim girls is higher than that in the War Khasi girls.

In view of the above comparison, it is obvious that the Khasi children of the present study are much shorter and lighter than the American children, but they are more or less comparable in weight and height to the Indian children as reported by the ICMR. In comparison with neighbouring populations, the children of the present study are by and large similar in weight to the War Khasi and Assamese children, especially from 3 to about 11 years of age. But they are shorter than the War Khasi and Assamese children in all age groups, and it is true in the case of sitting height as well. Similarly, the head and mid upper arm circumferences are lower in Khasi children of the present study when compared with the War Khasi and Assamese Muslim children.

Growth Status and Socio-economic condition

In order to understand the effect of socio-economic condition on the growth status of Khasi children, we have made an attempt to show how the growth of children is related to religion and income of the households. It is found that religion and income of the household are very important in influencing the growth pattern of children in the present study (Chapter V). It may, however, be noted that the differences between religious groups are mainly due to the differences between the Muslim children and the Christian

and Niam Khasi children. It is found that the Muslim children are heavier and taller than the Christian and Niam Khasi children, and there is not much difference between the Christians and Niam Khasis in respect of growth pattern, except in few cases.

NUTRITIONAL STATUS

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). This physical expression of the relationship between nutrient intakes and physiological requirements of a person can be measured by a number of methods. Of different methods, anthropometry is one that is generally used for measuring the magnitude of undernutrition 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, body mass index, indices of upper arm circumference, etc., (Jelliffe, 1966; Frisancho, 1990) are used for assessing the nutritional status of children. In the present study, we have taken into consideration three anthropometric indices, i.e., weight for age, height for age and body mass index (BMI, for assessing the nutritional status of children in the present population.

Weight for age

Weight for age, expressed as percentage of individual weight to the median or 50^{th} percentile of the international population reference (i.e., NCHS reference or standard) is generally considered as one of the indicators of underweight. It is found that the mean weight for age is higher in girls than in boys from 3 to 7 years of age, except at the age of 5 when both boys and girls show a similar mean value (Chapter VI). It is also found that the differences between boys and girls in respect of mean weight for age are not statistically significant from 8 to 14 years of age, although the girls are higher in mean value at the age of 13, that is, during the maximum growth spurt of their adolescent period. On the other hand, the mean weight for age is significantly higher in girls than in boys from 14 to 18 years, which indicates the great sex dimorphism during adolescent period.

Following the cut-off points suggested by Comez *et al.* (1956), the frequencies of mild, moderate and severe forms of underweight are 44.71%, 30.42% and 1.85% in boys and 48.32%, 22.59% and 1.32% in girls, respectively (Table 6.2). It indicates that most

of the underweight children are in the categories of mild and moderate degrees of undernutrition. Overall, it suggests that the prevalence of underweight is higher in boys (76.98%) than in girls (72.22%), and the difference is statistically significant ($\chi^2 = 24.94$, DF = 3, $P < 0.000$).

Height for age

In the present study, height for age is expressed as percentage of individual weight to the median of the NCHS population reference. It is widely accepted as one of the best indicators of stunting or short stature due to inadequate nutrition or undernutrition. Like in the case of weight for age, the differences between boys and girls in height for age are not significant from 3 to 13 years of age, despite the significant difference at the age of 12 (Chapter VI). But from 14 years onwards, the mean height for age is significantly higher in girls than in boys.

Following the cut-of points proposed by Visweswara Roa *et al.*(1986), about 95% of boys and girls in the present population are stunt. Whether stunting or short stature of these children should be regarded as growth retardation, thereby indicating of high undernutrition, is a moot question of interest. It has been suggested that the use of national and international population references for assessing the nutritional status of children in terms of height for age may lead to overestimation of undernutrition in children of the short stature population like the Khasis (Khongsdier, 1996b). In the present study, an attempt has also been made to show the different levels of growth retardation as per the ICMR reference of height for age. It shows that about 84.85% of boys and 77.41% of girls have a growth retardation, although the frequency is lower than that derived from the NCHS standard. So the present findings seem to confirm those observations made among the War Khasi (Khongsdier, 1996b). The same is true in the case weight for age since weight is also correlated with height.

With regard to sex differences in nutritional status, which is to a great extent independent of standard, the prevalence of growth retardation, especially those children with moderate and severe forms of undernutrition, is significantly higher in boys than in girls ($\chi^2 = 58.85$, DF = 3, $P < 0.000$). Whether or not these findings are associated with the matrilineal system of the society is a different question because we do not have data

on child care of the society. But the results of the present study indicate that girls are better than boys in nutritional status.

Body mass index

Body mass index (BMI) is generally considered as the best indicator of fatness or thinness and wasting due to chronic energy deficiency (Ferro-Luzi *et al.*, 1992). It is obtained as weight (kg) divided by height (m^2) of the individual, and it is independent of age. It is found that there is not much difference between boys and girls in respect of BMI, although it is significantly higher in boys than in girls at the ages 13, 17 and 18.

As regards the nutritional status according to BMI, we have followed the cut-off point of 15.0 for the children aged 3 to 9 years (Visweswara Rao *et al.*, 1986), whereas the cut-off point of 18.5 proposed by Ferro-Luzi *et al.* (1992) has been adopted for assessing the nutritional status of children aged 10 to 18 years. It is observed that the frequencies of mild, moderate and severe forms of chronic energy deficiency in the children aged 3 to 9 years of age are respectively 12%, 6% and 8% in boys and 18%, 6% and 8% in girls. Thus, the frequency of mild chronic energy deficiency is about 6% higher in girls than in boys, although the difference between sexes is not statistically significant ($\chi^2 = 6.44$, DF = 3, $P > 0.05$). In the case of children aged 10 to 18 years, about 95 % of boys and girls are well nourished in the present population.

In view of these results, it is obvious that the children in the higher age groups are better in nutritional status than those in the lower age groups, i.e., 3 to 9 years of age. Another important point is that the nutritional status of children according to BMI is much better than that observed with respect to weight for age and height for age. This may be due to the fact that weight for age and height for age are derived as percentage of the median of the international population reference, whereas BMI is directly obtained as a proportion of weight to the square of height of an individual, thereby it is independent of the so-called standard weight or height. As observed in other populations, BMI seems to be the better indicator of nutritional status than any other indices taken for the present study.

Nutritional Status and Socio-Economic Condition

It is generally reported that the widespread of undernutrition in developing countries is associated with poor hygienic conditions and socio-economic condition of the populations (Mitra, 1985; WHO, 1990). Therefore, 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. In the present study, we have also been an attempt to show the prevalence of undernutrition according to religious and income groups of the population. This may be described as follows:

Religion

With respect to religious groups, it is observed that the mean values of all these anthropometric indices are higher in the Muslim children than in the Christian and Niam Khasi children (Chapter VI). After adjusting for the effect of economic condition, the one way analysis of covariance (ANCOVA) indicates that the differences in anthropometric indices between religious groups are highly significant for both boys and girls, except the BMI in girls. According to Scheffe's multiple range test, the Muslim boys are significantly higher than the Christian boys in weight for age (Difference ± standard error:5.01 ± 0.81, $P < 0.000$) and height for age (1.70 ± 0.39, $P < 0.000$). With respect to BMI, there is an absence of significant difference according to Scheffe's test, but it is significant according to Least Square Significance Difference (0.94 ± 0.44, $P < 0.03$). The differences between the Muslim and Niam Khasi boys are also significant in respect of all indices (Weight for age: 6.88 ± 0.79, $P < 0.000$; Height for age: 2.07 ± 0.38, $P < 0.000$; BMI: 0.96 ± 0.43, $P < 0.03$). On the other hand, the differences between Christian and Niam Khasi boys are significant only in respect of weight for age (1.87 ± 0.72, $P < 0.03$). Nevertheless, it is clear that the Muslim boys are heavier than the Christian and Niam Khasi boys in respect of all anthropometric indices, thereby suggesting that the Muslim boys are better in nutritional status.

Among girls the differences between Muslims and Christians according to Scheffe' test are significant in respect of weight for age (3.89 ±0.84, $P < 0.000$) and height for age (1.86 ± 0.35, $P < 0.000$), but not in respect of BMI. But the differences between Christian and Niam Khasi girls are not significant in respect of all indices,

except in the case of weight for age (2.08 ± 0.76, $P < 0.02$). Thus, it indicates that the Christian and Niam Khasi children are by and large similar in height for age and BMI, although the former are higher in weight for age than the latter.

In order to have a better understanding of the effect of religion on nutritional status of Khasi children, an attempt has also been made to show the percentage distribution of weight for age according to three religious groups. It is found that about 62.54%, 79.23% and 84.04% of the boys in Muslims, Christians and Niam Khasis, respectively, are underweight (Table 6.9). Among girls, these frequencies of underweight are found to be 61.98%, 75.11% and 76.74%, respectively. The Chi-square values indicate that the differences between religious groups in respect of weight for age are highly significant (Boys: $\chi^2 = 70.82$, DF = 6, $P < 0.000$; Girls: $\chi^2 = 46.87$, DF = 6, $P < 0.000$). Thus, the Muslim Khasi boys and girls are better in weight for age when compared to their counterparts belonging to Christianity (Boys: $\chi^2 = 38.75$, DF = 2, $P < 0.000$; Girls: $\chi^2 = 20.20$, DF = 2, $P < 0.000$) and Niam Khasi (Boys: $\chi^2 = 66.58$, DF = 2, $P < 0.000$; Girls: $\chi^2 = 40.94$, DF = 2, $P<0.000$). On the other hand, the Christian Khasi children are heavier than the Niam Khasi children, although the differences are not statistically significant in the case of boys (Boys: $\chi^2 = 4.04$, DF = 2, $P > 0.05$; Girls: $\chi^2 = 8.56$, DF = 2, $P < 0.01$). Thus, the Muslim children are heavier than the Christian and Niam Khasi children, and the differences between the Christian and Niam Khasi children are significant only in the case of girls, i.e., the Christian girls are heavier than the Niam Khasi girls.

Like in the case of weight for age, the Muslim Khasi children are taller than the Christian and Niam Khasi children. It is found that the prevalence of stunting or growth retardation in boys is about 94.69%, 96.57% and 95.60% respectively in the Muslim, Christian and Niam Khasis. In the case of girls, these frequencies are 92.05%, 94.47% and 97.37%, respectively. The Chi-square values indicate that the differences in the percentage distribution of normal, mild, moderate and severe forms of nutritional status in respect of height for age are highly significant for both boys and girls (Boys: $\chi^2 = 24.89$, DF = 6, $P < 0.001$; Girls: $\chi^2 = 40.32$, DF = 6, $P < 0.000$).

It indicates that the children of Muslim Khasi are less retarded when compared with the Christian and Niam Khasi children, despite the fact that the prevalence of

stunting is high in all the religious groups. With respect to the difference between the Christian and Niam Khasi children, the frequency of mild and moderate forms of growth retardation is higher in the Christian boys than in the Niam Khasi boys, but the frequency of severe form is higher in the latter than in the former. However, these differences between the two religious groups are not statistically significant (χ^2 = 1.54, DF =3, P> 0.05). In the case of girls, the situation is reverse, which shows that the prevalence of mild and moderate forms of growth retardation is higher in the Niam Khasis than in the Christian Khasis, but the frequency of severe form of growth retardation is higher in the latter than in the former, although these differences are not statistically significant (χ^2 = 6.94, DF =3, P> 0.05). So the Christian and Niam Khasi children are by and large similar in the prevalence of growth retardation. The significant differences between religious groups as indicated by the overall Chi-square test are mainly due to the differences between the Khasi Muslims children and other religious groups.

On the basis of BMI, in the age group 3 to 9 years, about 19.74%, 24.88%% and 31.15% of boys and 21.18%, 19.34% and 29.36% of girls in the Muslims, Christians and Niam Khasis, respectively, have suffered from chronic energy deficiency. Thus it indicates that the prevalence of chronic energy deficiency is lower among the Muslims than that among the Christians and Niam Khasis, though it is lower among the Christians in the case of girls. However, the Chi-square test indicates that the differences between religious groups are significant only in boys (χ^2 = 18.76, DF= 6, P < 0.01) but not in girls (χ^2 = 7.81, DF= 6, P > 0.05). In the age group 10-18 years, the differences between religious groups in respect of BMI are not statistically significant for both boys and girls. Thus, it indicates that religion plays little role in influencing the BMI of the children in the present study, although the influence of religion on weight for age and height for age seems to be important. It clearly shows that the Muslim children are heavier and taller than the Christian and Niam Khasi children. One possible explanation of such a trend in the Muslims may be due to intermixture, i.e., the Muslim children are by and large the product of the intermixture between the Khasi females and the Muslim males who migrated to Meghalaya from other parts of India.

Economic Condition

With the exception of few cases, the mean values of weight for age, height for age and BMI are lower in the LIG when compared to the MIG and HIG (Chapter VI). Adjusting for religion, the ANCOVA test also indicates that the differences between income groups are significant in all anthropometric indices for both boys and girls. According to Scheffe's test, the LIG children are significantly lower than those in the MIG and HIG in respect of all the three anthropometric indices, irrespective of the difference between LIG and MIG in respect of BMI for girls (1.20 ± 0.36, $P < 0.004$). Likewise, the differences between MIG and HIG children are highly significant for weight for age, height for age and BMI.

In order to have a better understanding of the effect of economic condition on the nutritional status of the children in the present study, we have also made an attempt to show the prevalence of undernutrition according to three income groups. With respect to weight for age, it is found that about 81.90%, 76.60% and 67.73% of the boys and 79.52%, 72.94% and 58.96% of girls are underweight in the LIG, MIG and HIG, respectively. It indicates that the proportion of underweight children decreases with the rise in income levels of the household. The Chi-square values also indicate that the differences between income groups in respect of the distribution of children according to different degrees of underweight are highly significant for both boys ($\chi^2 = 107.09$, DF = 6, $P < 0.000$) and girls ($\chi^2 = 62.08$, DF = 6, $P < 0.000$). Thus, it suggests that the income of household is very important in influencing the nutritional status of children according to weight for age as has been observed with regards to ANCOVA test.

With respect to height for age, the prevalence of stunting is very high in all the income groups for both boys and girls, but the percentage is higher in the lower income groups when compared with the HIG. Such a trend is also observed with respect to the prevalence of severe forms of growth retardation, which is much higher in the LIG and MIG when compared with the HIG. These differences between income groups in respect of height for age are statistically significant for both boys ($\chi^2 = 102.50$, DF = 6, $P < 0.000$) and girls ($\chi^2 = 99.15$, DF = 6, $P < 0.000$). This clearly indicates that income of the household plays a very important role in influencing the height for age of the children of the present study.

With respect to BMI, the differences between income groups in respect of BMI are not significant in girls for both the age groups 3-9 and 10-18 years. But in the case of boys, the income of household seems to be important and the differences between income groups are significant for both the age groups. For the age group 3-9 years, the prevalence of chronic energy deficiency in boys is about 31.11%, 22.75% and 21.09% in LIG, MIG and HIG, respectively. These frequencies are about 8.36%, 1.04% and 3.90% respectively in the age group 10-18 years. Thus, it is obvious that the prevalence of chronic energy deficiency is higher in the LIG when compared to the MIG and HIG, and the influence of the income of household is clearly significant in BMI of boys, although it is also perceptible in girls.

CONCLUDING REMARKS

The findings of the present study were broadly presented into demographic, growth and nutritional aspects. As regards demographic aspects, it is observed that the three religious groups of the Khasi population are found to be *progressive type*, i.e., all the three religious groups are characterized by a fairly high rate of fertility. The total fertility rate in these three religious groups is more or less similar to the War Khasi, but much higher than the Kochs of Garo hills. Although it is slightly higher in the Muslims and Niam Khasis, the differences between religious groups in fertility rates are not statistically significant, indicating the insignificant effect of religion on fertility rate in the Khasi population. In other words, it is obvious that Family Planning Programme has gain little momentum in the Khasi population, irrespective of religious groups. Moreover, it is also observed that education of the mothers does not play a significant role in regulating the fertility rate among the Muslim and Christian Khasis, although it is important in the Niam Khasi women. This insignificant effect of education on fertility rate in the Muslims and Christians is in contrast to the observation in other populations (Murthi *et al.*, 1995), and it is difficult to give any clear-cut explanation. It is well known that Islam does not expressly forbid the voluntary restriction of birth, but children are regarded as the richest blessing that Allah bestows and therefore any attempt to prevent fertility is against the wishes of God (Choudhury, 1982). Of course, it generally reported that Muslims have higher fertility rate followed by the Hindus and Christians (Irudaya Rajan and Rao,

1991). Likewise, the Bible does not specifically prohibit birth control, but certain Christian denominations like the Catholic Church are against the use of artificial means of birth control (Irudaya Rajan and Rao, 1991). Thus, it is likely that even education of the mothers may not become so important in such a situation.

In the present study, the term Christians" refers to all Christian denominations including the Roman Catholics. Unfortunately, we have not collected data on specific Christian denomination and, therefore, we are not in position either to refute or support the contention that fertility rate is higher in the Catholics than in any other Christian denominations. We hope that further studies will throw much more light in this regard. The effect of other factors like age at marriage and income of the household on fertility rate seems to be very important in the Khasi population, irrespective of religious groups. The effect of age at marriage on fertility is by and large universal since the reproductive period is shorter in the case of those mothers with higher age at marriage. On the other hand, the significant effect of the income of household on fertility rate in this population is likely to be related to the fact that people belonging to the higher economic groups are more conscious of the socio-economic welfare of their children. It is likely that they have higher aspiration for better education and higher economic status, thereby reducing the birth rate with a view to providing their children with such facilities.

With regard to infant mortality, it is observed that the rate increases with the increasing age of the mothers. This may be due to the fact that mothers of higher age groups have higher fertility rate, which is theoretically correlated with higher infant mortality rate. The inverse relationship between infant mortality and educational as well as income level is according to the general observation in other populations, which indicate that mothers belonging to the higher educational and income levels are more conscious of the health of their children, and they have more access to modern medical amenities, etc. On the other hand, religion does not seem to play very important role in influencing infant mortality rate.

According to the present findings the girls have reached their adult height by the age of 18, while the boys still continue to grow. In comparison with international and national growth references, the Khasi children of the present study are much shorter and lighter than the U.S. NCHS children, but they are more or less comparable in weight and

height to the ICMR children. In comparison with neighbouring populations, the children of the present study are by and large similar in weight to the War Khasi and Assamese children, especially from 3 to about 11 years of age. But they are shorter than the War Khasi and Assamese children in all age groups, and it is true in the case of sitting height as well. Similarly, the head and mid upper arm circumferences are lower in Khasi children of the present study when compared with the War Khasi and Assamese Muslim children.

These findings may have certain implications for ethnic or genetic variation in growth and nutritional status of population. It is obvious that the anthropometric indices like height for age and even weight for age in relation to the so-called international standards (references) cannot be used as indicators of the nutritional status in a short stature population like the Khasis, especially in children of higher age groups (Khongsdier, 1996b). Thus, BMI may be considered a better indicator of the nutritional status of children in the present study. It is likely that differences in stature between populations may be related not only to nutrition, but also to physical environment and genetic factors (Payne, 1992). However, this does not mean to reject the international references completely; their use is very important for comparative studies.

The differences between income groups seem to confirm the earlier observations that children belonging to the higher economic groups are better in growth and nutritional status than their counterparts in the lower economic strata (Gopalan, 1992). The simple reason is that children in the higher economic strata have better nutrition and health facilities. But the most significance of the present findings is the differences between religious groups in respect of growth and nutritional status. It is found that the Muslim children are heavier and taller than the Christian and Niam Khasi children, and there is not much difference between the Christians and Niam Khasis in respect of growth pattern, except in few cases. One possible explanation of such a trend in the Muslims may be due to intermixture, i.e., the Muslim children in the present study are by and large the product of the intermixture between the Khasi females and the Muslim males who migrated to Meghalaya from different areas.