

**A STUDY OF REPRODUCTIVE AND CHILD HEALTH
AMONG THE LOIS OF IMPHAL VALLEY**

ABSTRACT

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**FOR PARTIAL FULFILLMENT OF THE DEGREE OF DOCTOR OF
PHILOSOPHY IN ANTHROPOLOGY**

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ABSTRACT

In their attempt to understand human variation and evolution, anthropologists have also realized the need to understand the relationship between human biology and culture, especially to those aspects relating to health and nutrition, and various socio-cultural factors. The study of genetic diversity and its linkage, for example, with health and culture has become a major interest in biological anthropology. In fact, it is now believed that human biological processes are largely influenced by various socio-cultural aspects of the human society. Thus, it is important on the part of physical anthropologists to undertake such studies to understand not only the process of human evolution and variation but also the health and well-being of human populations.

This thesis is an attempt to deal with the reproductive and child health among the Lois of the Imphal Valley with a view to understanding how certain indicators of the reproductive and child health are associated with demographic, biological and socio-economic variables in both rural and urban areas. According to the United Nations (UN, 1994), "Reproductive health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity, in all matters relating to the reproductive system and to its functions and processes." It includes the right of access to appropriate health-care services that will enable women to go safely through pregnancy and child birth and provide couples with the best chance of having a healthy infant. It also includes sexual health which is concerned with the enhancement of life and personal relations and not merely counseling and care related to reproduction and sexually transmitted diseases.

There are different parameters or indicators of child and reproductive health. From the biological anthropological point of view, demographic variables (e.g., fertility, mortality and reproductive wastage), antenatal care, delivery characteristics and adoption of family planning methods, anemia, maternal and child morbidity (self-reported illness), immunization of the children, breast feeding and supplementation, educational and health facility, knowledge of sexually transmitted diseases (STDs), nutritional

anthropometry of the mothers, physical growth and nutritional status of the children may be considered as important indicators of the child and reproductive health. An attempt to understand the relationship of these indicators with various cultural, social and economic factors may be very helpful in understanding the reproductive and child-health of a population.

OBJECTIVES

Our brief review of literature (which is given Chapter II of the thesis) has revealed that various biological, socio-cultural, and environmental factors have a great influence on reproductive and child health. It has also revealed that maternal mortality and morbidity, demographic variables and family planning, anemia, nutritional status, growth and development of children are widely used as the indicators of reproductive and child health. Such studies on the reproductive and child health are very limited in Northeast India particularly in the populations of Manipur, except those carried out by the National Family Health Survey at the state level (IIPS, 2000).

Therefore, we have undertaken a reproductive and child health study among the Lois of Imphal Valley in West district of Manipur with the following objectives:

1. To understand the reproductive and child health of both rural and urban areas in term of demographic variables, maternal morbidity, hemoglobin level, body dimensions, family planning services and practices, antenatal care and immunization coverage.
2. To assess the nutritional status of children aged 3 to 7 years, using anthropometric measurements and indices.
3. To understand the effects of biological and socio- economic factors on the reproductive and child health.

MATERIALS AND METHODS

Chapter III of the thesis deals with the materials and methods adopted for the present study. They may be briefly presented as follows:

Sampling Method

The present study was carried out among the Lois in Imphal West District of Manipur during the month of March to September of 2003 in both rural and urban settings. There are eight Loi areas in Manipur valley (TDD, 1994), of which four areas are in Imphal

West District. The data for the present study were collected from three areas (37.50% of total villages), namely, Sekmai in urban area, Koutruk and Phayeng in rural areas. These three areas were selected according to simple random sampling by using random numbers (Snedecor and Cochran, 1967). According to this sampling method, the list of eight areas and their population in Imphal District was prepared based on the information from the District Gazetteer (TDD, 1994).

No random sampling was applied for selection of subjects/informants from each of the selected villages due to operational difficulties in the field. An attempt was made to cover 600 households, i.e., about 45% of the total 1330 households in all three selected villages. The study included 625 married women (aged 15-49) who were willing to co-operate with the present work.

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; Mahadevan, 1986). The entire demographic data were collected through pedigrees and schedules from all the six hundreds households in the three villages, viz., Sekmai, Koutruk and Phayeng. Information on age, sex, marital status, tribe, religion, occupation, income, education, community affiliation, place of birth, place of residence, etc. was collected from the heads of the households or elder members who were capable of furnishing all the relevant information as per household schedule.

The fertility schedule was completed by filling-in the information on the number of conceptions, number of live births, number of reproductive wastages (abortion and still births), sex, present age, age at death and birth order from all the ever married women. Pedigrees were also collected for cross-checking of data on reproductive history of the mothers. Sometimes, information given by the mothers was cross-checked from their respective husbands. It may be mentioned that great difficulties were experienced in the assessment of age, particularly that of the elderly women because many of them were not aware of their real age. Consequently in such cases, the age was estimated with the help of other persons in the household/village, or with reference to local important events and the age of the individuals who looked to be in the same age groups. So, there could be some mistakes, in some cases, in the estimation of age.

Data on Family Planning

Information about knowledge and use of contraceptive methods were collected from 549 married women (aged 15-45 years) through structured schedules. The nature and types of data were based on those suggested by the Ministry of Health and Family Welfare (2000), which are as follows.

1. ***Awareness of Family Planning***: These included questions related to knowledge of contraceptives/family planning methods.
2. ***Adoption and Methods of Family Planning***: These included questions about adoption of contraceptives and duration of use. The contraceptive methods are classified into *modern* and *traditional* categories. The modern contraceptives methods include pill, intra uterine device (IUD) like copper T, condom, female sterilization and male sterilization. The traditional contraceptives methods include rhythm or safe period, withdrawal, use of herbal medicines, etc.
3. ***Sources of Family Planning Methods***: These included questions about the sources of modern contraceptives methods. The sources are divided into two categories, namely, *Hospital sources* (which included both government and private hospitals) and *Pharmacies and shops*.

Data on Maternal and Child Health Care

Data on maternal and child health care were collected through schedules similar to those for the National Family Health Survey-2 (NFHS-2) (IIPS, 2000). Information was collected on pregnancy and birth histories, details of antenatal and delivery care received during the last pregnancy for each woman (aged < 45 years). Information was collected from 549 women regarding health problems during their pregnancies and whether they received any antenatal check-ups. Women who received antenatal check-ups were asked about the timing of the first antenatal check-up, the total number of check-ups. In addition, the respondents were asked whether they received tetanus toxoid injection and iron/folic acid tablets or syrup during their visits to antenatal care centres. In short, an attempt was made to follow as far as possible those guidelines given by the National Reproductive Health Programme (MHFW, 1997).

Data on immunization of children (aged 3-7 years) were also collected from the parents with special reference to six preventable diseases, namely, tuberculosis, diphtheria, pertussis, tetanus, poliomyelitis and measles. Parents were asked whether

they had the immunization card of their children. If card was available, the dates when the child received vaccinations against each disease were recorded. Parents' report on vaccinations was also recorded although record on the card was unavailable. If the mother could not show a vaccination card, she was asked whether the child had received any vaccinations.

Anthropometric Data

Standard techniques of measurements described by Weiner and Lourie (1981) and Sen (1994) were followed while taking the measurements of weight, height and sitting height on adults and children. For assessing the nutritional status of children, we had taken three anthropometric indices, namely, weight-for-age, height-for-age and weight-for-height - which are considered as the indicators of nutritional status. These indices were derived as z-scores of the international standard or reference, i.e., the growth reference of the WHO/U.S. National Centre for Health Statistics (WHO, 1983, 1995). Body mass index (BMI = weight in kg/height in meter squared) was used for assessing the nutritional status of women by following the standard cut-off points (WHO, 1995).

Data on Morbidity and Hemoglobin Level

Data on haemoglobin content of 551 adults were collected using Sahli's Haemometer by following standard techniques (WHO, 1980). The cut-off points of 13.0 g/dl and 12.0 g/dl were taken for screening the adult men and non-pregnant women, respectively (WHO, 1968). The cut-off point of 11.0 g/dl was used for assessing the anemic status of pregnant women. Data on morbidity were based on "self-reported illness experience" of a subject as generally adopted in surveys, which did not involve a clinician (Strickland and Uljiaszek, 1993; Garcia and Kennedy, 1993). The term "morbidity" in this study was defined simply in terms of the number of 'days ill' and /or 'days unable to work' in the last four weeks before the survey. Each subject included in the study was asked whether or not she had been ill at any time in the last four weeks? If the answer was yes, she was asked how many days had she been in bed or unable to work due to illness? A subject who reported at least two days ill was classified as being "ill". The study was symptom-based in which the reported symptoms were grouped into five categories as suggested in many studies (Strickland and Uljiaszek, 1994; Strickland and Tuffey, 1997; Sadana, 2000).

SOCIO-ECONOMIC CATEGORIES

In the present study, three important socio-economic variables were taken into consideration. These include religion, monthly income of the households and educational level. These socio-economic variables were classified arbitrarily into different groups and/or categories to understand their influence on demographic characteristics, maternal health and nutritional status of the study population. Our classification may be briefly described as follows:

Income groups: Data on household income were collected directly from the head of the household and they were cross-checked taking into consideration some aspects of socio-economic conditions like housing condition, types of occupation, land holding, and monthly expenditure. 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), which is as follows:

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

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

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

Where N stands for the number of households and \bar{X} is the average monthly per capita income of the households. In the present study, the average per capita monthly income of the 600 households of both rural and urban populations was found to be Rs.831.50 /-with a standard deviation (SD) of Rs.540.16. Thus, following the above interval method, the households with per capita monthly income of below Rs.743/- were classified as LIG, while the range of Rs.743 /- to Rs 919.02/- were considered as MIG, and those household with per capita monthly income of above Rs.919.02/- were classified as HIG.

Educational Level: The data on educational attainment of individuals in the present study were arbitrarily classified as follows: The category **Illiterate** includes those individuals who were unable to read and write and those who had no education but could read or write their names. The individuals who attended school up to standard V were grouped into **Primary** level of education. The individuals with educational level from VI to X standard were grouped into **Secondary level**, and the individuals with educational standard of more X-standard are included in the category of **Higher Secondary level** of education.

Family Size: The family size was classified into three categories. The individuals who lived in a household with less than 5 family members were considered as having a **Small Family Size**. The **Average/Medium Family Size** includes those individuals who lived in a household with 5-6 family members. The individuals who lived in a household with more 6 family members were grouped in the category of **Large Family Size**.

STATISTICAL ANALYSES

The data collected for the present study are quantified and analysed statistically, using SPSS Window software, in which the level of significance was set at 5%. 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 (2-tailed), 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 and health parameters that are not dichotomous in nature. Logistic regression analysis was used for analyzing the effects of socio-economic factors on health and nutritional indicators that are dichotomous in nature, e g., whether under-nourished or not, or whether or not the respondent adopted family planning methods. In other words, using logistic regression analysis, we can predict whether or not adoption of family planning methods, for example, depends on maternal education after adjusting for the effects of age, income level and religion. Depending on the types of models, logistic regression is useful for many ways. In the present study, logistic regression coefficients were also used to estimate odds ratios for each of the independent variables in the model.

FINDINGS

The findings of the present study are presented in Chapters IV and V. Chapter IV deals with the maternal health and nutritional status, whereas Chapter V deals with the child health and nutritional status. The findings on maternal health and nutritional status may be briefly presented as follows:

Demographic Indicators

In the present study, we have observed that the Loi population is *progressive* in both rural and urban areas, that is, more than 40% of the total population belonged to the age

group 0-14 years. The overall sex ratio does not deviate significantly from the ideal sex ratio of 1:1 in both rural and urban areas. The same is true in the reproductive age group, i.e., 15-49 years, suggesting that there is no sex difference in mortality during reproductive age for both rural and urban populations. There is also no significant difference between rural and urban areas in the proportion of females who are married at the age of 24 years and below. However, the mean age at marriage is significantly higher in the urban women (21.87 ± 0.27 years) than in the rural women (20.95 ± 0.23 years). The same is true with respect to the mean age at first child birth. It is found that the mean age at marriage among the Loi women is higher than those reported for many populations of Assam (Sengupta and Gogoi, 1995; Gogoi, 2002) and Meghalaya (Khongsdier *et al.*, 2001; Khongsdier, 2005).

Fertility Differentials

1. It is found that the mean numbers of live-births to mothers of all ages is 2.56 ± 0.06 . It is more or less similar for both rural mothers (2.61 ± 0.09) and urban mothers (2.50 ± 0.85). The age-specific fertility rate (ASMFR) reaches its peak when the mothers are aged 25-29 years (Figure 4.3). The total marital fertility rate (TFMR) is found to be 3.98 for rural and 3.87 for urban areas. Pooling together for both rural and urban areas, the TMFR is 3.91. The fertility rate among the Loies is lower than that reported for many populations in Northeast India (Limbu and Khongsdier, 2000; Murry *et al.*, 2005; Khongsdier, 2005; Varte, 2006).
2. In addition to adoption of family planning methods, age at marriage and maternal education, the important factors affecting fertility rate among the Loi women is the economic condition as measured by household income. The effect of household income on live-births is significant even after adjusting for other factors. The significant effect of the household income on fertility rate in this population is likely to be related to the contention 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 in order to provide their children with such facilities (Mukherjee, 2002; Varte, 2006).

Reproductive Wastage

1. The prevalence of reproductive wastage (i.e., abortions and still births) is 6.32% and 4.88% in rural and urban areas respectively. Although it is higher in rural areas, the difference is not statistically significant. Pooling the data together for rural and urban areas, the overall prevalence of reproductive wastage among the Lois is 5.62%.
2. This rate of reproductive wastage among the Loi women is similar to that reported for the Nepalese (5.92%) of Manipur (Singh, 2006) and Semsá (5.90%) of Assam (Limbu and Khongsdier, 2000) but lower than that reported for the Meitei (7.85%) of Manipur (Singh, 2006) and Munda (8.83%) of Assam (Gogoi, 2002), Pnar (6.18%) of Jatinga (Khongsdier *et al.*, 2001), Khasi (8.16%) of Meghalaya (Mukherjee, 2002) and higher than Hmars (4.11%) of Mizoram (Varte, 2006).
3. The prevalence of reproductive wastage is associated with generation of mothers and education when other factors like residence, religion, household income, age at marriage, family size and ANC visit are also included in the regression model. In other words, older women are likely to have higher prevalence of reproductive wastage than younger women. It is also found that mothers without education or with lower educational levels are likely to have a higher prevalence of reproductive wastage.

ANTHROPOMETRIC INDICATORS OF NUTRITIONAL STATUS

1. The nutritional status of women was assessed by using body mass index (BMI), which is derived from anthropometric measurements of body weight and height as internationally recommended (WHO Working Group, 1986; WHO, 1995). It is found that the mean BMI is significantly higher in urban ($22.28 \pm 2.59 \text{ kg/m}^2$) than in rural ($21.81 \pm 2.81 \text{ kg/m}^2$) areas ($t = 2.17, p < 0.03$).
2. Considering the cut-off point of 18.5 kg/m^2 for screening undernourished individuals (Ferro-Luzzi *et al.*, 1992; WHO, 1995), the overall prevalence of underweight is higher in rural (14.74%) than urban (10.54%) areas, although it is not statistically significant. The over prevalence of underweight is 12.64%, which is lower than those reported for several populations of Northeast India, such as Caste groups like Brahmins, Kalitas, Jogis, Kaibartas and Hinduised groups like Ahoms, Kochs and Rajbhanjis (Khongsdier, 2001). They are also lower than the tribal groups like

Lalungs, Miris (Khongsdier, 2001), War Khasis (Khongsdier, 2002) and Hmars of Mizoram (Varte, 2006). In short, it indicates that the nutritional status in the present populations is better than many populations in Northeast India.

3. Using the cut-off point of 23.0 kg/m^2 for screening overweight individuals, it is also found that the prevalence of overweight is significantly lower in rural mothers (23.08%) than in urban mothers (36.10%). This indicates that overweight is likely to be a major nutritional problem especially in the next decade or so.
4. Logistic regression analysis indicates that underweight is significantly associated with only two variables, namely, pregnancy status and household income. As for overweight, it is positively associated with cormic index and household income. Of socioeconomic factors, we may suggest that household income is very important factor for regulating underweight and overweight in women of the present study.

HEMOGLOBIN CONTENT

1. The overall mean hemoglobin level is $11.78 \pm 1.02 \text{ g/dl}$. There are no significant differences between age groups and between urban and rural areas. There are also no significant differences between age groups. The mean hemoglobin content in the age group 15-29 years is $11.86 \pm 1.04 \text{ g/dl}$ for rural and $11.70 \pm 0.97 \text{ g/dl}$ for urban areas. In the age group 30-49 years, the mean is $11.79 \pm 0.97 \text{ g/dl}$ for rural and $11.77 \pm 1.06 \text{ g/dl}$ for urban areas.
2. It is found that hemoglobin level is significantly correlated with pregnancy status (pregnant and non-pregnant), underweight, maternal education, paternal education and household income.
3. Following the cut-off points suggested by the WHO Scientific Working Group (WHO, 1968), the prevalence of anemia among pregnant women is higher in urban (36.84%) than in rural (20.83%) areas, although it is not statistically significant ($\chi^2 = 1.35$, $df = 1$, $p > 0.05$). In the case of non-pregnant women, the prevalence of anemia is more or less similar between urban women (40.89%) and rural women (40.33%). It is also found that the prevalence of anemia is higher among non-pregnant women (68.45%) than among pregnant women (38.71%), although it is not statistically significant ($\chi^2 = 2.70$, $df = 1$, $p > 0.05$). Thus, despite the absence of statistical differences, the present findings are inconsistent with the general observation that the prevalence of anemia is higher in rural than

in urban areas, or among the pregnant women than among the non-pregnant women. However, the sample size for pregnant women in the present study is very small. Accordingly, the results may not be considered as being representative of the population.

4. The logistic regression analysis indicates that of many variables included in the model, only household income is significantly associated with the prevalence of anemia.

ANTENATAL CARE CHARACTERISTICS

1. It is found that that there is no significant difference between urban (86.81%) and rural (85.40%) areas with respect to awareness of ANC services ($\chi^2 = 0.06$, $df = 1$, $p > 0.05$).
2. The proportion of women attending ANC services is higher in urban (81.82%) than in rural (78.83%) areas, despite the absence of statistical difference ($\chi^2 = 0.77$, $df = 1$, $p > 0.05$).
3. As for the proportion of those who attended ANC services at least four times, it is found to be significantly lower in rural (32.12%) than in urban (42.18%) areas ($\chi^2 = 5.95$, $df = 1$, $p < 0.05$).
4. Of women who attended ANC services, about 71.53% in rural areas and 80.72% in urban areas made their first ANC visit during the 1st trimester of pregnancy. This rural-urban difference is statistically significant ($\chi^2 = 14.00$, $df = 1$, $p < 0.05$). Thus, the present findings suggest that the Loi women are not only aware of ANC services but also participated to a great extent.
5. As regards the nature of ANC services, it is found that about 59.72% of rural women and 72.44% of urban women, who attended ANC during pregnancy, have received iron and folic acid tablets during their visit to private and government ANC centres. This-rural-urban difference is also statistically significant ($\chi^2 = 7.97$, $df = 1$, $p < 0.01$). With respect to tetanus and toxoid injections, there are differences between rural and urban areas ($\chi^2 = 12.99$, $df = 2$, $p < 0.001$). It is found that the proportion of pregnant women, who received at least 2 doses of tetanus and toxoid injections, is significantly lower in rural (81.48%) than in urban (92.89%) areas ($\chi^2 = 12.94$, $df = 1$, $p < 0.001$). Therefore, it indicates that

the nature of ANC services is poorer in rural than in urban areas as generally expected.

6. An attempt has also been made to understand the effects of socioeconomic factors on ANC attendance during pregnancy by using three models of logistic regression analysis. Of many covariates, it is found that mother's age, maternal and paternal education are important factors in influencing women to attend ANC services.

OBSTETRIC MORBIDITY

1. It is found that the prevalence rates of different obstetric problems are higher in rural than in urban areas, with the exception of excessive fatigue which is higher in urban than in rural areas. However, the rural-urban differences are not statistically significant except in the case of night-blindness and blurred vision, which is significantly higher in rural (6.69%) than in urban (2.21%) areas ($\chi^2 = 6.32$, $df=1$, $p > 0.05$).
2. With respect to the effects of biosocial factors, it is found that obstetric morbidity is independently associated with maternal age, household-income, maternal and paternal education. When only these variables are included in the logistic regression model, obstetric morbidity is significantly associated only with household-income. It also suggests that paternal education is more important than maternal education in influencing obstetric morbidity.

DELIVERY CHARACTERISTICS AND COMPLICATIONS

1. It is found that home delivery is more common in rural (72.84%) than in urban women (45.14%) and hospital or private clinic delivery is higher in urban women (54.86%) than in rural women (27.16%). These rural-urban differences with respect to place of delivery are highly significant ($\chi^2 = 39.51$, $df = 1$, $p < 0.0001$).
2. In rural areas, women are mostly helped by mid-wives (53.09%) as compared to the assistance received by them from the medical doctors and/or nurses. On the other hand, women in urban areas are generally assisted by medical doctors and/or nurses (71.60%) during delivery. These rural-urban differences are also statistically significant ($\chi^2 = 31.60$, $df = 1$, $p < 0.0001$).

3. With respect to delivery complications, there are no significant differences between rural and urban areas ($\chi^2 = 1.68$, $df = 1$, $p < 0.05$).
4. Although there are no significant differences between rural and urban areas in respect of delivery complications, the present findings indicate that there are significantly rural-urban differences in respect of place of delivery and types of assistance received by women during delivery.
5. Of many biosocial factors considered in the logistic regression analysis only maternal age and ANC visit are significantly associated with delivery complications.

SELF-REPORTED MORBIDITY

1. It is found that the rural-urban differences in respect of different types of self-reported morbidity are not statistically significant. The prevalence of overall morbidity (based on the number of women who experienced at least one type of health problem during the last one month before the survey) is higher in rural (34.62%) than in urban (27.80%) areas, although it is not significant. Pooling the data for both rural and urban areas, the prevalence of overall morbidity is 31.20%.
2. Logistic regression analysis indicates that self-reported morbidity is positively associated with nutritional status and anemia. It is also negatively associated with household income, maternal education and paternal education.

FAMILY PLANNING METHODS

1. It is found that the awareness of AIDS is very high in both rural (99.30%) and urban (99.46%) areas. Similarly, awareness of family planning methods is very high in both rural (94.52%) and urban (97.81%) areas. The adoption of family planning methods is higher in urban women (46.21%) than in rural women (42%), although it is not statistically significant ($\chi^2 = 0.98$, $df = 1$, $p > 0.05$).
2. It is found that condoms and loop are the most common methods used in both rural and urban areas. It is further observed that private and Government primary health centers or hospitals are the main sources of contraceptive methods.
3. Of the different factors considered in the present study, adoption of family planning methods is found to be positively associated with maternal age, household income, maternal education and paternal education.

CHILD HEALTH AND NUTRITIONAL STATUS

In Chapter V, we have presented our findings on selected indicators of children's health and nutritional status in terms of infant and juvenile mortality, anthropometric indicators of nutritional status, immunization coverage and self-reported morbidity. Following are the major findings:

INFANT AND JUVENILE MORTALITY

The infant mortality rates (i.e. number of deaths before 1 year of life per 100 live births) of both rural and urban areas are 2.08 and 1.02%, respectively. The infant mortality rate is higher in rural area than in urban area, although it is not statistically significant ($\chi^2 = 2.93$, $df = 1$, $p > 0.05$). Pooling the data for rural and urban areas, the infant mortality is 1.57%. On the other hand, the juvenile mortality is very low in both rural (0.37%) and urban (0.26%) areas. Both infant and juvenile mortality rates are moderately low in the present population as compared to other populations in Northeast India. No statistical analysis was made to find out the factors affecting infant and mortality rates in the present population due to small sample size. As a matter of fact, only 25 cases of infant deaths (1.57%) were reported out of 1597 live-births for both rural and urban areas.

SELF-REPORTED MORBIDITY

1. Self-reported morbidity for children refers to the health problems of children as reported by the parents. It is observed that the rural-urban differences in the prevalence of health problems among girls are not clearly consistent. The prevalence of cold and respiratory disorders is higher in urban girls (5.29%) than in rural girls (3.98%), whereas the prevalence of intestinal disorders is higher in rural girls (5.97%) than in urban girls (4.33%). Nevertheless, the rural-urban difference in the overall prevalence of morbidity is not statistically significant, although it is slightly higher in rural girls (11.44%) than in urban girls (10.58%).
2. Unlike in the case of girls, the prevalence of the three different types of self-reported morbidity is higher in rural than in urban boys. Similarly, the overall prevalence of morbidity is higher in rural boys (13.57%) than in urban boys (7.29%), and the difference is statistically significant ($\chi^2 = 4.10$, $df = 1$, $p < 0.05$). The estimated odds ratio (OR) at 95% confidence interval (CI) indicates that the

rural boys were about 2 times higher in morbidity than their urban counterparts (OR = 2.00, CI = 1.01-3.93, $p < 0.05$).

3. Using logistic regression analysis, it is found that morbidity is positively associated with under-nutrition and negatively associated with household income. Thus, we may suggest that under-nutrition and household income are important factors in influencing morbidity patterns among the Loi Children of the present study.

ANTHROPOMETRIC INDICATORS OF NUTRITIONAL STATUS

In the present study, we have taken three important anthropometric indices, i.e., weight-for-age, height-for-age, and weight-for-height for assessing the nutritional status of the children aged 3-7 years, following the cut-off points given by WHO expert committees (1983, 1995). We have also made an attempt to correlate these indices with certain socioeconomic variables such as household income, family size, place of residence, maternal and paternal education, morbidity status, immunization status, etc.

1. The prevalence of underweight as indicated by weight-for-age is higher in rural (26.13%) than in urban (21.88%) areas. The odds ratio (OR) for rural-urban difference in the overall prevalence of underweight is found to be 1.26, that is, the risk of being underweight is about 1.26 times higher in rural than in urban boys. However, this rural-urban difference in the prevalence of underweight is not statistically significant. A similar case is observed among girls. The prevalence of underweight is higher in rural (28.86%) than in urban (23.56%) areas. The risk of being underweight in rural girls is about 1.31 times as compared to urban girls, despite the absence of statistical difference. Thus, there are no significant differences between rural and urban children in the prevalence of underweight, although it looks as if it is higher among the rural children.
2. With respect to the prevalence of stunting as indicated by height-for-age, it is found to be 35.68% in rural and 21.35% in urban boys. The risk of being stunting in rural boys is more than 2 times as compared to urban boys (OR = 2.09, 95% CI: 1.33-3.28, $p < 0.001$). The prevalence of tall stature is also higher in urban (11.46% than in rural (8.54%), although it is not significant. As for girls, there are

no significant differences between rural and urban areas, although the prevalence of stunting is higher in rural (37.81%) than in urban (35.58%) areas.

3. The prevalence of wasting as indicated by weight-for-height is also higher in rural (6.53%) than in urban (3.13%) boys, although it is not statistically significant. The same is true among girls in which the prevalence is higher in rural (7.96%) than in urban (4.33%) areas, despite the absence of statistical difference. It is also found that obesity also exists in both boys and girls, and the prevalence is higher in urban than in rural areas, although it is not significant.
4. In order to understand the effects of biosocial factors on the nutritional status of children, an attempt has been made to group them into two major groups, namely, normal and undernourished. Undernourished children refer to those children who suffered from at least one of the three nutritional problems, namely, underweight, stunting and wasting as indicated by anthropometric indicators. The overall prevalence of under-nutrition, as defined above, is found to be much higher in girls (44.74) than in boys (36.32%), and the difference is statistically significant ($\chi^2 = 5.88$, $df = 1$, $p < 0.01$). Using logistic regression analysis, it is found that under-nutrition is positively associated with sex and morbidity, and negatively associated with family size and household income. Thus, it may suggest that under nutrition among the Loi children is highly associated with sex, morbidity status, family size and household income.

IMMUNIZATION COVERAGE

In the present study, we have considered four important vaccinations, namely, BCG, measles, polio and diphtheria. It is found that the rural-urban differences are inconsistent and not statistically significant. It is observed that the overall immunization rate (i.e., the number of those who received at least two vaccinations) among girls is higher in rural (60.20%) than in urban (57.21%) areas, but it is not statistically significant ($\chi^2 = 0.38$, $df = 1$, $p > 0.05$). On the other hand, the immunization rate in boys is higher in urban (69.27%) than in rural (65.83%) areas. But the differences are not statistically significant ($\chi^2 = 0.53$, $df = 1$, $p > 0.05$).

As for sex differences, it is found that the immunization rate is higher in boys than in girls for both rural (girls = 60.20%, boys = 65.83%) and urban (girls = 57.21%, boys = 69.27%) areas. The differences are found to be statistically significant in urban

areas ($\chi^2 = 6.23$, $df = 1$, $p < 0.01$), but insignificant in rural areas ($\chi^2 = 1.36$, $df = 1$, $p > 0.05$). Although these findings indicate to certain the existence of gender bias with respect to immunization coverage, the logistic regression analysis indicates that the sex differences disappeared after adjusting for other covariates. It is found that immunization is negatively associated with morbidity status and family size, and positively associated with maternal education and paternal education. Thus, it suggests that immunization coverage among the Loi children is highly associated with morbidity status, family size maternal and paternal education.

CONCLUDING REMARKS

Rural-urban differences

Rural populations are generally poorer and have lower levels of education than their urban counterparts. There are fewer hospitals and physicians in rural communities; the time taken to travel to health care providers is often greater and public transportation less available. These problems may be magnified in rural areas far distant from any urban center even in the developed countries like the USA (Ormond *et al.*, 2000). It may be hypothetically assumed that the situation is more aggravated in developing countries like India (IIPS, 2000). However, the present study indicates that rural-urban differences with respect to maternal and child health indicators are by and large not significant, except in few cases. The main reason is that the differences in socio-economic conditions like education and income are controlled while analyzing the rural-urban differences with respect to different maternal and child health indicators.

However, the absence of statistical differences with respect to demographic indicators like fertility, reproductive wastage and infant mortality is not mainly due to differences in socio-economic condition between rural and urban areas. Instead, other factors like family planning programmes and health services may play important role. For example, age at marriage is significantly lower in rural than in urban areas. The present study indicates that awareness of family planning methods is very high in both rural and urban areas. There is also no significant difference between rural and urban areas with respect to adoption of family planning methods. Similarly, it is found that that there is no significant difference between urban and rural areas with respect to awareness and attendance of ANC services. Thus, it is likely that the absence of rural-urban differences with respect to in fertility and mortality (infant and reproductive wastage) is

mainly due to the successful family planning programs and health care services in Manipur as compared with other states in Northeast India (IPPS, 2000).

The success of family planning programs and public health services can also be assessed in terms of obstetric morbidity, delivery complications, anemia and self-reported morbidity, and immunization coverage. The present study failed to get any significant differences between rural and urban areas with respect to these health indicators. Thus, although socio-economic inequality does exist between rural and urban areas, it is likely that successful implementation of planning programs and public health services would bring about a balance between rural and urban areas in respect of certain health indicators among the Loi women and children of the present study. Earlier studies have also suggested that greater women's autonomy, involvement of social organizations, political will for implementing health care services, increased standard of living are operating synergistically to lower fertility and mortality in Manipur (Kumar, 1995).

With respect to nutritional status, overweight among the Loi community is likely to be a major nutritional problem especially in the next decade or so. There are also significant differences between rural and urban areas with respect to the prevalence of overweight among the Loi women. On the other hand, under-nutrition is the major health problem among children. The overall prevalence of under-nutrition among children is significantly higher in rural than in urban areas. The prevalence of overweight is also higher in urban than in rural areas, although it is not statistically significant. The rural-urban difference in BMI or nutritional status is mainly because of the differences in socio-economic factors like education and economic conditions. In addition, individuals in urban areas are likely to be more sedentary in lifestyles with less physical activity, and thereby they are likely to be overweight.

Anthropological Implications

The present study has clearly revealed that maternal and child health status in the higher socio-economic groups, whether in terms of educational or income level, is by and large better than that in the lower ones. On the basis of these findings, the moot anthropological question is that whether being in poor socio-economic condition is also indicative of being victims of natural selection? Natural selection acts primarily at the individual level. The simple definition of natural selection given by Darwin (1859) is the

“preservation of favorable individual differences and variations, and the destruction of those which are injurious.” He further clarified that “under the term of “variations,” it must never be forgotten that mere individual differences are included.” Thus, natural selection operates primarily at the individual level through differential survival and reproduction. The aggregate or average differential survival and reproduction of a given number of individuals may be considered its action at a group or population level.

Like the present study, there is considerable evidence that the health and nutritional status of the poor is worse than is the rich. Mortality rates due to malnutrition, infections and other causes of deaths are much higher in the lower socio-economic classes (Khongsdier, 2006). The significance of these inequalities also influenced the writings of Malthus (1803) and Darwin (1871, 1859). According to Malthus (1803), the “constant tendency in all animated life to increase” would prevent any permanent amelioration of poverty in the lower classes. In Central and South Asia, the positive checks including epidemics and consequences of “indigence and bad nourishment” would fall heavily on those in the lowest socio-economic strata “before any considerable degree of want had reached the middle classes of the society” (Malthus, 1803). Acknowledging this important observation of Malthus, Darwin (1871) wrote, “As all animals tend to multiply beyond their means of subsistence, so it must have been with the progenitors of man; and this would inevitably lead to a struggle for existence and to natural selection.” Although Darwin did not say that natural selection is stronger among the poor, he also observed the “greater death-rate of infants in the poorest classes ... as well as the greater mortality, from various diseases, of the inhabitants of crowded and miserable houses, at all ages” (Darwin, 1871). It was Franz Boas (Boas, 1938) who argued that natural selection in humans operates primarily through social stratification. In addition, malnutrition, associated with poor environmental conditions in the lower socio-economic strata, is suggested to be a strong force of natural selection especially among children and reproductively-active women (Segraves, 1977). Thus, the view that socio-economic inequality mediates the process of natural selection in human populations seems to have originated with Darwin himself (Strickland & Tuffrey, 1997).

Natural selection is a blind natural force that preserves the beneficial variations and eliminates the injurious ones. The process of preserving the beneficial variations is also known as the *survival of the fittest* in the *struggle for existence*. According to

Malthusian and Darwinian points of view, the struggle for existence, or competition for survival, is due to the increase in population beyond the means of subsistence. The short supply of resources, therefore, increases competition in different forms including social stratification in which “members of the privileged class may own even up to or over 10,000% of what a poor person owns” (Cohen, 1998). The high prevalence of malnutrition and infections is a clear evidence of poor access to adequate nutrition and health amenities among the lower socio-economic classes. From this point of view, one may argue that social stratification mediates natural selection in human populations in the form of malnutrition, infections and ill health, which ultimately lead to higher morbidity and mortality in the lower strata of social stratification. However, this argument is based simply on differential survival or *survival of the fittest* due to limited resources mediated by social stratification. There is no evidence that the operation of natural selection in the lower socio-economic strata of the society is genetic in nature (Khongsdier, 2006). Therefore, equality of economic opportunity in a society, for example, enables a man to choose any occupation, which is most suited for him by his abilities and willingness to strive for his survival and well-being.

Policy implications

The present study indicates that almost health indicators are better in Loi population of Manipur as compared to those reported for populations in Northeast India. Accordingly, if this trend is similar to all populations in the state, Manipur should be considered a model state in Northeast India as far as maternal and child health indicators are concerned. For example, the infant mortality in the present population is slightly lower than that reported for Kerala (IIPS, 2000). It is also observed that awareness of AIDS and family planning programs is very high in the present population, although the rate of adoption of modern contraceptives needs to be intensified. Similarly, immunization coverage is better in the present population of Manipur as compared to other states in Northeast India.

The major concern, according to the findings of the present study, is the tendency to high prevalence of overweight especially in urban areas needs to be checked with different preventive measures including increased physical activity and dietary measures. Recent reviews has revealed that although under-nutrition remains a major health problem in many developing countries, over-nutrition is also emerging with the

improvement in socio-economic condition and/or increasing urbanization (Popkin, 2002, Khongsdier, 2005c). Consequently, the double burden of under- and over-nutrition exerts considerable impact on the economy and health system in many developing countries. In general, many countries in Asia are in this situation due to "changing dietary pattern towards energy-dense and high fat diets, together with a more sedentary lifestyle arising from increasing urbanization" (Florentino, 2002). The increasing urbanization, changes in standards of living, dietary patterns and occupational work patterns are the key factors to risks of the epidemic of obesity and associated morbidity and mortality. Therefore, the spread of overweight and obesity in the Loi population needs to be monitored and prevented, but it should not be done at the expense of the efforts to alleviate under-nutrition. It is observed in the present population that the prevalence of under-nutrition in children is still high especially in rural areas. The present study suggests that child welfare programs like integrated child development schemes in the state needs to be implemented with greater intensity in the near future.

Another implication for policy making is that the prevalence of under-nutrition is much higher in girls than in boys especially in rural areas. Also, the rate of immunization coverage is higher in boys than in girls. It is often argued that discrimination against females is very high in South Asian populations because of the patrilineal system of societies. In Northeast India, recent analysis on the nutritional status of the adolescents in both patrilineal and matrilineal societies did not confirm such an observation (Khongsdier *et al.*, 2005). It is observed that the nutritional status is better in females than in males in both matrilineal and patrilineal societies. However, the present findings among the Loi children seem to be more corroborated with those observed in other parts of India and many other populations of Southeast Asia where the nutritional status of boys are far better than that of girls. Earlier studies have suggested that women in Manipur enjoy higher status (Kumar, 1995). It is also suggested that bride price is still practiced in the Loi society, thereby enhancing the status of women especially those in the lower socio-economic group (Ghosh and Ghosh, 1997). Accordingly, it is expected that the nutritional status and immunization coverage should not be different between the sexes of children. On the contrary, the present study suggests that more attention should be given to improve the immunization and nutritional status of children, especially that of female children below 7 years of age. As for immunization, it is likely to be associated

with socio-economic conditions like parental education. Therefore, educational policy especially relating to increased female education should be more intensified.

Limitations

The present study on maternal and child health has many limitations. The covariates taken in the study are also limited. But we hope that the findings of the study will stimulate different research questions that enhance our knowledge of the health and well-being of mothers and children in Northeast India. The present study is limited to one population of Imphal valley. It indicates that almost health indicators are better as compared to those reported for populations in Northeast India. However, it is not clear whether this trend is similar to all populations in the state, especially among tribal populations in hill areas of the state. More studies are needed to carry out in other populations especially among tribal populations to have a clear idea of the health and nutritional status in the state of Manipur.

The present study is not concerned with sex discrimination, which is generally reported for Indian populations. It simply indicates that the nutritional and immunization status is better in boys than in girls. More studies are needed to carry out to understand whether there exists sex discrimination in different populations of Manipur. Moreover, the study is concerned mainly with the reproductive health of women, without paying much attention to the reproductive health issues concerning men, or both men and women. Future studies should also focus on issues relating to male reproductive health, especially the role of men in improving the reproductive health of women. In addition, future studies should also focus more on breast feeding and infant feeding practices which are not covered in the present study.

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