PATTERNS AND DETERMINANTS OF UNDERNUTRITION AMONG WOMEN AND CHILDREN IN ORISSA
EVIDENCE FROM NFHS-2, 1998-99

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Dissertation submitted in partial fulfillment of the requirements for the award of the degree of Master of Philosophy in Applied Economics of the Jawaharlal Nehru University

Rudra Narayan Mishra
M.Phil Programme in Applied Economics
(2001-2003)

CENTRE FOR DEVELOPMENT STUDIES
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I hereby affirm that the work for this dissertation, "Patterns and Determinants of Undernutrition among Women and Children in Orissa: Evidence from NFHS-2, 1998-99", being submitted as part of the requirements of the M.Phil Programme in Applied Economics of the Jawaharlal Nehru University, was carried out entirely by myself and has not formed part of any other Programme and not submitted to any other institution/University for the award of any Degree or Programme of Studies.

Rudra Narayan Mishra

Date: - 29th June 2003

Rudra Narayan Mishra.

Certified that this study is the bona fide work of Rudra Narayan Mishra, carried out under our supervision at the Centre for Development Studies.

U.S. Mishra

Dr. Udayashankar Mishra
Associate Fellow

PK Panda

Dr. Pradeep Kumar Panda
Associate Fellow

Dr. K.P. Kannan
Director
Centre for Development Studies

TO
UNDERNOURISHED MOTHERS AND CHILDREN

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ABSTRACT OF THE DISSERTATION

PATTERNS AND DETERMINANTS OF MATERNAL AND CHILD UNDERNUTRITION IN ORISSA- EVIDENCE FROM NFHS-2, 1998-99

Rudra Narayan Mishra

M.Phil Programme in Applied Economics, Jawaharlal Nehru University, 2001-2003

Centre for Development Studies

This study describes and analyses the problem of undernutrtition among women and children in Orissa. Precisely it looks into the patterns and determinants of maternal and child undernutrition. Orissa, is one of the few states in India where undernutrtion among women is at a very high level. Around 63.0% women of age group 15-49 are found to be anaemic and 48.0% have less than 18.5 kg/m^2 (norm) of Body Mass Index (BMI). Again with regard to the incidence of undernutrition among the children, it has also remained at very high level (44% of children are stunted and 54.4% of children are underweight). Hence, here an attempt has been made to study the nutritional status of both the groups and find out whether there is any difference in maternal and child undernutrition across different socio-economic groups, across regions and across rural-urban areas?

For this purpose we have used data from National Family Health Survey -2, 1998-99. Both clinical (anaemia) and anthropometric indicators (BMI) for mothers, and stunting under weight and waisting indicators for children have been used to find out the prevalence of undernutrition. For data analysis purposes, bi-variate and multivariate tabulations are used and the relevant association between nutritional outcome measures with varied set of characteristics is examined. A further understanding of the determinants of maternal and child undernutrition is facilitated with bi-variate and multivariate logistic regression.

The study found that woman from low economic status, of tribal and scheduled caste households, having less education; working in agriculture, have higher prevalence of undernutrition in terms of both anaemia and BMI indicators. Similarly women from rural residence shows higher prevalence of undernutrition compared to their urban counterparts. The regional break-up has shown women from northern Orissa and western Orissa to be more vulnerable to all kinds of undernutrition compared to the eastern and southern Orissa.

To analyse child undernutrition, we have considered clinical indicators like anaemia and anthropometric indicators like height-for-age (stunting), weight-for-age (underweight), and weight-for-height (waisting). For child undernutrition we found that fathers' education and occupation, mother's education, household economic status, social background of the households, family size and childcare practices are the important determinants of the nutritional outcome. Children from rural households are found to be at higher risk of under-nourishment compared to their urban counterparts among all the social groups based on all the indicators taken. Children from northern and western Orissa are also found to be more undernourished (in more than one-nutrition indicators) compared to southern and eastern Orissa.

The study emphasises women and children from tribal and scheduled caste households to be the most vulnerable groups as far as under-nutrition of any kind is concerned. This pattern is found to be consistent across different economic groups, rural-urban divide as well as different regions. So the study recommends both short term measures (educating mothers about better child care practices and introducing better sanitation and hygiene in the household) as well as long term measures (like generating income for these households, creating assets in these households and promoting health and education facilities in the backward regions).

CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

1.1 Introduction

Nutrition has its relevance in development literature given the concern for deprivation in quality of life between the developed and the developing world. When we talk about nutrition, we mean a society should ensure the availability of a proper balanced diet for all its members. By that we mean everybody should have a meal which not only fulfil the calorie requirement of the individual but also ensure the availability of important Vitamins and Minerals, which is required for maintaining a balanced mental and physical growth of an individual and to keep intact the self immune capacity of the body. From development point of view this is very important because it will maintain the quality of the life and ensure better progress of the society [Beherman and Deolikar (1988), Gopalan (1993), Ravallion (1991), Foster and Howard (2000), working paper no. 256 of World Bank (1991)]. However generally nutrition levels are assessed in terms of malnutrition. One common definition of malnutrition may be over-consumption or under consumption of any essential nutrient. Nutritionist Jean Mayer; 2001 classified malnutrition in four ways. We will discuss them one by one.

1) **Over-nutrition:** When the person consumes more than calories required, it leads to Over-nutrition. This is a common nutritional problem in high-income countries where people consume more calories, saturated fats, salt and sugar. The over-nutrition outcomes are obesity, diabetes, hypertension, and excess amount of salt and sugar in the body than required.

2) **Secondary malnutrition:** When malnutrition occurs not due to nature of diet but due to improper digestion or absorption of food, then secondary malnutrition occurs. It may happen due to prolonged illness like diarrhoea, respiratory illness, measles, and intestinal parasites like hooking worms, taping worms etc.

3) **Dietary deficiency or micro nutrient malnutrition:** It occurs due to deficiency of Vitamin-A, Iodine, Iron etc. This will lead to night blindness, goitre, and anaemia. Apart from that these deficiencies will lead to under development of

brain. Iron deficiency will reduce capacity to work and increase susceptibility of infection. It is a significant contributor to child mortality and maternal mortality.

4) **Protein-calorie malnutrition:** It is also known as protein-energy malnutrition. It happens due to under consumption of calories or protein. Only ensuring adequate protein supply could solve this problem. The deficiency will lead to fatal nutritional disorders like kwashiorkor and marasmus. They are fatal during childhood. This deficiency is primarily due to extreme poverty.

Among all the mentioned forms of malnutrition the first category of malnutrition i.e. overnutrition, is rich people's problem though it has economic costs and implications. The second category i.e. secondary malnutrition is more of a health and sanitary problem. It may be partly due to economic factors. The last two forms of malnutrition i.e. malnutrition due to dietary deficiency and protein-calorie deficiency are purely related to availability of nutrition, which in turn clearly depends upon economic factors like income, employment, initial economic endowments etc.

1.2 Background

The present study attempts to address the determinants of nutritional status among women and children. They are most vulnerable groups as far as undernutrition[1] is concerned. The most visible and widespread manifestation of malnutrition is growth failure in childhood. In case of women, it is anemia or lower Body Mass Index. Broadly the determinants of malnutrition may be understood in following categories.

1) **Individual factors:** - The individual factors are assumed to be having a strong bearing on the nutritional status among children and as well as women. In case of children the birth order of the child, his/her age, the quality of food he/she is taking, the mother's health status, mother's education level, mother's work status, child's own health status as well as the households' economic status are important. In case of the maternal nutrition a women's level of education, work status, age, her command over economic resources as well as the nature of the job are important factors [Hignnis and Alderman (1996), Beherman. (1988), Deolalikar

[1] Situation caused by insufficient off-take of nutrition and energy, which reduces normal activity, rowth and resistance to disease.

and Beherman (1987), Beherman (1988), Strauss and Thomas (1996), Shan. and Alderman (1997)].

2) **Household factors:** - Mainly in this category we consider availability of food which is influenced by factors like income, assets of the family, and skill of the wage earners of the family. It also includes parental education, nature of the occupation of the family, family size, sanitation facilities, water supply etc. [Beherman and Deolalikar (1987), Strauss and Thomas (1996), Ruel et al (1999), Levin et al (1999), Pal (2000), Engle et al (1999)]

3) **Community factors:** - It includes the socio-economic strata the family belongs to, the overall level a community is described in terms of education, health, the status of the women , the prime occupation of the community, religious practices etc. [Svedberg (1999), Beherman (1988), Pal (2000), Gupta (1989), Hinggis and Alderman (1996), Leslie et al (199), Morris et al (1999), Sen and Sen Gupta (1983)]

4) **Factors at the national level:** - The national factors are described in terms of whether the concerned country/region was colonised or not in the past, the overall economic status of the country, social sector expenditure, political institution it has, the situation of law and order and last but not the least it's international relation. We find in many countries of Africa (like Burundi, Somalia, Ethiopia, Rwanda, Angola, Ivory Coast etc.) the long drawn civil war is one of the major causes for nutritional deficiency among women and children. In case of Iraq the international sanction has forced many children to suffer from inadequate availability of food and medicine which definitely has a bearing on their nutritional standard. [Sen and Dreze (1979 and 1981), UNDP, WDR and WHO Reports (various issues).]

Based on the above line of argument, I propose to examine the nutritional status of women and children of India. Though the primary objective is to describe its pattern and determinants, the study will also focus on the strength of such determinants in explaining variation in nutritional status of women and children. In the process, it will re-examine the established notion of undernutrition and it's bearing with under-development.

Though there exists studies on this topic, most of them are regional or community based small sample surveys. They could be categorised in three ways: - a) Case Controlled analysis where we take two or more samples and compare them. b) Panel Data analysis where we follow a selected sample(s) over a period of time. c) Cross sectional analysis where we observe the sample(s) at a point of time. Most of the studies are based on the third category. We will also do a cross section analysis. Because our data (NFHS-2) do not allow for a time trend analysis. The causes are mentioned below in the concerned section.

1.3 Why NFHS?

There are few data sources available in India for Nutrition analysis. To start with in India, we have NSSO 48^{th} and 55^{th} round that provide information on Nutrition intake in India. It is collected by a governmental organisation called National Sample Survey Organisation. It covers the whole country including Union Territories. We also have National Family Health Survey (1992-93 and 1997-98) which provides information on the antropometric measurement of nutrition and different household and individual details associated with such outcomes. We also have National Nutrition Monitoring Bureau (NNMB) data to examine nutritional status. There is another data source called District Nutrition Profile (DNP). From NSSO data we can calculate nutrition intake of different households across income groups, region and states. From NFHS the nutrition status can be gauged on the basis of antropometric measure which will convey both short term and long term implications. The NFHS data has advantage over NSSO (which is also a point data) in terms of socio-economic indicators. The NSSO 55^{th} rounds (1999-2000) only take into account the age, sex, and rural/urban variation in nutrition intake across different Monthly per capita expenditure groups (MPCE). It is calculated for household as: ***total consumer expenditure by the household for last 30-days/Household size.*** It tells us that a person's MPCE is understood as that of the household to which he or she belongs. It uses 30 days recall period. But the major draw back lies in its approach that nutrition status of an individual is a function of his/her household income and his/her individual calorie intake across different age and sex group. Though it takes into account the rural/urban background nothing has been mentioned about the variation in nutrition status due to different castes, religions work status and varying health and social backgrounds of

the concerned individual. But the NFHS-2 has all these indicators available. So we opt for this data set. NFHS is also better data set for analysing this sort of problems than National Nutrition Monitoring Bureau (NNMB) because of following reasons.

1) It has adopted a follow-up approach. Where children once selected are followed up from their birth to attainment of three years of age. The objective of this approach is to study the impact of intervention schemes on child nutrition. In some cohorts they will provide children the requirements of good nutrition and in other cohorts they will not intervene. Their objective is to find out the most suitable intervention policy. But their indicators are more clinical and biological in nature. They focus less on the socio-economic indicators compared to NFHS.

2) They do not have information on maternal nutrition, which is one of the core objectives of the study.

There are mainly two approaches to measure the incidence of malnutrition among vulnerable groups of the society. i) Calorie/nutrition intake approach [Sukhatme (1971, 1977), Gopalan (1977), Srinivasan (1991), Beherman and Deolalikar (1987 and 1988) Strauss and Thomas (1990), and ii) antropometric approach. [Strauss and Thomas (1996), Leven et al (1999), Kakawani (1993), Svedberg 1991 and 1999), pal (2000), Osmani (1993)]. But over the years it has been agreed upon that antropometric approach is a better measurement than calorie approach. This specific debate will be detailed at length in the section on ***Methodology***.

1.4 More about the NFHS-2

This NFHS-2 Data has been collected in the year 1998-99. United States Agency in International Development or USAID collected this Data. International Institute for Population Sciences, Mumbai (IIPS) is the nodal agency for the survey in India. It covers the 25 out of 26 states. The newly formed states of Chattishgarh (out of Madhyapradesh), Jharkhand (out of Bihar), Uttaranchal (Out of Uttarpradesh) are not included. It also excludes the Union Territories. How ever it is important to remember here that in 1992-93 also NFHS had conducted a survey. But two data are not comparable because in the previous case the numbers of cases are more. It has no information on maternal nutrition, which will be one of the main objectives of our analysis. For child nutrition too additional information are available in NFHS-2 while

compared with NFHS-1. Therefore we do not attempt for a comparative analysis. Instead we will go for one time-point analysis or cross section analysis. It covers all most all the major states and regions except Tripura and three newly formed states and union territories. For female nutrition we have 89,199 eligible women aged between 15-49 for the whole country. For child nutrition we have 32,393 cases altogether for India. But our thesis specifically aimed to explore the dynamics in maternal and child nutrition in one of the 25 states i.e. Orissa. For that we have 4425 eligible women (15-49 aged groups) for maternal nutrition analysis and 1282 eligible children (4-36 months) for child nutrition analysis. This data also tells about the food habits of the selected women. It talks about the maternity factors, which are more important in understanding the nutritional status of women. So it can be used as an indicator towards maternal nutrition. It has information on maternal nutrition indicators like Anaemia and Body Mass Index. These indicators are widely accepted. For child nutrition analysis we have information on anthropometric indicators like height-for-age, weight-for-age, height-for-weight, prevalence of anaemia among the children and their BMI. We also have information on the occupation, education, health status, nutrition status, basic amenities, and demographic features of the respondent's household and the village she lives. The data allows us to create new variables, which will suit to our analysis. So for our purpose the NFHS-2 is appropriate data set to look into correlates of child and maternal nutrition. It uses three sets of questionnaire.

Household questionnaire: Household questionnaire provides information about all the members in the household. It reflects on age, sex, education, and marital status of the family members. It also focus on the prevalence of diseases like asthma, tuberculosis, malaria, and jaundice which still claims a large number of life. It also gives information on the assets of the household like their possessions of agricultural land, other household articles, livestock etc. It also has information on the quality of housing, and availability of basic facilities within the household. In addition, it has information on their addiction to tobacco, liquor, and smoking. It also includes the individual child's (of age group 0-36 months) anthropometric scores like height, weight, BMI and anaemia which help us to find out the pattern and determinants of child undernutrition.

Women's questionnaire: Women's questionnaire provides information for ever-married women of age group between 15-49. It focuses on the background of the respondent, her reproductive behavior, quality of care, she has access to, her knowledge about family planning, her status in the household, the way she takes care of her child during pregnancy and aftermath, her awareness about aids etc. Here for the first time they include BMI of women along with prevalence of anemia, which will help us to measure the maternal nutrition. The BMI score is given for individual. So we can measure the nutrition status of women using this score.

Village questionnaire: The village questionnaire collects information on the infrastructures available in the village and also the development programs and their outcomes. The village head is the respondent here. However we will consider information in the Household questionnaire as well as the individual questionnaire (which will help us in analysing maternal and child malnutrition).

1.5 Objectives

These are the following objectives of my thesis.

1) To study the pattern and determinants of the child nutrition in Orissa.

2) To study the pattern and determinants of the maternal nutrition in Orissa.

3) To find out the rural-urban variation in these patterns with respect to it's different correlates.

4) To find out weather the determinants for both urban-rural areas are same as far as undernutrition is concerned, in each case.

1.6 Why Orissa?

Because Orissa is a backward state in terms of conventional economic and social indicators, it is also home to a large section of SC/ST population (40% of total population), which are likely to be vulnerable to this particular problem. Nearly 50% of the population lives below poverty line [source NSSO; 2001]. According to NFHS-2 around 24% of male and 48.7% of female are illiterate. Only 33.8% households have electricity, 13.5% households have latrine facility and 18.8% have pucca house.

Orissa is the lowest ranking state in terms of BMI. Out of total eligible women 48% have low BMI. Sixty three percent (63%) of women suffer from anemia. Child Mortality Rate (25.5) and Infant Mortality Rate (81) are also high. With respect to underweight children it stands second in India after Madhya Pradesh. So it may be worth while to look in to Orissa from this perspective i.e. prevalence of undernutrition among it's population, especially women and children who are more susceptible to this. The study attempts to find out factors responsible for this deprivation, which may have policy implications. The following table speaks more about this.

Table 1.1 Rank of Orissa in all India based on Socio-Economic Indicators.

INDICATORS	*NATIONAL AVERAGE*	*BEST AMONG STATES*	*ORISSA'S RANK*	*Gaps from National Average*
Persons below poverty line	26.01	Jammu and Kashmir (3.48)	25th (47.15)	21.14 (H)
Employment participation of male	51.9	Tamilnadu (58.1)	11th 52.8	0.7 (H)
Employment participation of female	25.68	Mizoram (47.63)	18th (26.42)	0.74 (H)
Literacy(male)	74.5	Kerala (92.9)	15th (76%)	1.5 (H)
Literacy(female)	51.4	Mizoram (89.4)	19th (51.3)	38.1 (L)
HH with electricity	60.1	Delhi (97.7)	24th (33.8)	26.3 (L)
HH with water supply	77.9	Punjab (98.9)	17th (65.3)	12.6 (L)
Latrine facility	35.9	Mizoram (97.7)	25th (13.5)	22.4 (L)
Living in Pucca house	32.0	Delhi (88.2)	21st (18.8)	13.1 (L)
Women exposed to any media	59.7	Delhi (92.7)	22nd (44.3)	15.4 (L)
Infant Mortality Rate	67.6 per '000	Kerala (16.3 per thousand)	21st (81 per '000)	13.4(H)
Child Mortality Rate	29.3 per '000	Kerala (2.6 per '000)	17th (25.5 per '000)	3.8 (L)
% of women with BMI below 18.5 Kg./m^2	35.8	Arunachal Pradesh (10.7)	1ST (48)	12.2(H)
% of women with Anaemia	51.8	Kerala (22.7)	21st (63.0)	11.2(H)
% of stunted children	45.5	Goa (18.1)	17th (44.0)	1.5 (L)
% of under weight children	47.0	Sikkim (20.6)	23rd (54.4)	7.4 (H)

- *Source for poverty line is Health Information of India, 1999, Ministry of Health and Family Welfare (Reproduced in Indiastat.com).*
- *For work participation among female and male, source is Women and Men in India 2001, Ministry of Statistics and Programme Implementation, Govt. of India. (Reproduced in Indiastat.com).*
- *For all other figures, source is NFHS-2 (1997-98).*

Here (H) refers to higher than national average and (L) refers to lower than national average

1.7 Methodology:

The methodology followed for the study is like this. First a thorough review of literature has been done. It includes all the three types of study found in the literature.

1) Intervention/follow-up studies
2) Case control studies
3) Cross section studies.

In this area mainly the third type of the study was found to be overwhelming. Our study will also be a cross section kind of analysis. We will focus on anthropometric approach (indicators) as far as measurement of undernutrition is concerned. Anthropometric approach is considered as more reliable measurement over calorie intake approach due to the following reasons.

1) Calorie intake approach is based on data collected from households, on their consumption of major food items in last 7 days or 30 days. This is called reference period. In India, NSSO i.e. National Sample Survey Organisation collects data on calorie consumption of the people. It also collects data on amount of protein and fat consumption among the Indian population. The major draw back in this approach is that during this reference period; the food consumption might be too high or too low for a particular individual. This approach ignores the requirement of calorie of a person in terms of age and sex. It also does not take into account the variation due to the factors like body weight, nature of work, state of current health of the person concerned. So the norm level i.e. the average calorie requirement of a person cannot be adjusted to short term variations in food intake due to seasonal, climatic or changing health conditions.

2) The calorie intake approach takes into account total quantity of food consumed by a particular household during the reference period including the food taken by the household members outside the household. It also takes into account the food taken by relatives from the sample households, food served in family celebrations, food taken by household servants and food given to pets in the household. That might overestimate the calorie consumption for the sample household.

3) In calorie intake approach we use a conversion factor to know what amount of different nutrients (both macronutrients; calorie, fat and protein and micronutrients; different vitamins and minerals) one individual can derive from the given amount of different food items. That might not hold good if the food items vary in quality for the given quantity.

4) In calorie intake approach any body consuming below the required norm is considered undernourished. It ignores the effects of inter-personal and intra-personal variations in calorie requirement i.e. one individual's calorie requirement might vary from time to time in given period due to change in climatic condition, changing work pattern and state of the health of the individual. Also calorie requirement among the individuals from similar age, sex, work pattern, climate and health status also likely to vary due to difference in their genetics.

5) A calorie-adequate diet is not necessarily a balanced diet containing adequate amount of protein, fat and other micronutrients like vitamins, minerals etc.

6) An adequate or balanced food does not necessarily ensure better nutritional status if the absorption capacity of the individual is not good. Because absorption of nutrition from a given diet depends upon the host of health related factors which in turn depends upon living condition in the household, state of hygiene and sanitation, and availability of safe drinking water etc. On the whole these set of factors are governed by indicators like household economic status, country's economic well being as well as the region, the individual belongs to, along with the state's emphasis on health and education (especially for the female folk who have an important role in family health). [For detail discussion on the advantage and disadvantage of calorie intake approach as well as antropometric approach see, Osmani; 1992, Gopaln; 1992, Srinivasan 1981, Svedberg; 2002, Sen; NSSO 55th Round;1999-2000, Kakawani; 1989, 1992, Foster and Leather; 1999]

Based on all these above arguments the anthropometric approach is preferred to calorie intake approach, because it reflects the past nutritional status interms of body mass index (BMI), stunting, underweight, middle upper arm circumference and waisting. The stunting reflects whether individual has attained required adequate height given the age. Similarly underweight reflects whether the body has adequate weight for given age. The body mass index can be used to assess the thinness and

obesity, because this index relates individual weight to her height. Middle upper arm circumference (MUAC) use the thickness of middle upper arm as the indicator of nutritional status. Weight-for-height also relates body weight to given body height. The prevalence of anaemia, which results from iron deficiency also, affects the growth of human cells and intum the antropometric status of the body. Weight for age will reflect short-term changes in nutrition status, as it is highly correlated with weight for height and arm circumference, two commonly used measures of acute nutritional stress (Kelle et al; 1990).

Though all these anthropometric indicators mentioned above are regarded as superior indicators to measure nutritional status of the individuals of different age and sex, there major drawbacks are to fix a norm like that of calorie intake approach. In international comparisons we use National Centre for Health Statistics (NCHS) norms, which is based on median height and weight of American people. This measure is developed by World Health Organisation (WHO, Geneva), United Nations University (UNU, Tokyo) and National Centre for Health Statistics (NCHS, Newyork) in early 80's. The basic assumption behind this nutritional measure is 'genetic potential theory', which tells that given the conditions, all the children in the world of different races are capable of attaining same height and weight for given age and sex. It ignores the impact of climate geographical variations, which might affect the growth of the body. In India, Indian council for Medical Research (ICMR, NewDelhi) and National Institute for Nutrition (NIN, Hyderabad) have developed nutritional antropometric indicators for Indian population across different age, sex and work groups. The height and weight for reference categories across different age and sex groups, of these two institutes vary from each other as well as from international standard. [See ICMR and NIN bulletins and various issues]. Despite that researchers show that anthropometric indicators can capture the past nutritional status as well as short terms variation in nutritional status (interms of body weight), better than calorie intake approach. [For details see Osmani; 1992, Sen;1989, Svedberg; 2001, 2002, Hadad and Smith; 1999].

Having decided for our nutrition indicators we selected the probable determinants. First the determinants found in the literature are listed. We consider only those determinants, which have shown significant effect in earlier studies in determining child and maternal nutrition. Then we search those probable determinants from

NFHS-2. If a particular determinants is not available we take it's proxy if it is there. If the proxy was not found then we drop the probable determinant. After selecting determinants we will go for cross tabulations to determine the patterns in both maternal and child undernutrition. We will use Both binomial or multivariate logit analysis to quantify those associations. This will help us to find out the significant determinants of nutrition in each case. Then in case of maternal nutrition we will go for constructing an Index for maternal depletion. This will help us to find out the relationship between event of experiencing maternity and event of being anaemic or of low BMI.

The basic conceptual framework followed by us in this study is called food-health-care conceptual framework. This framework is a widely used analytical tool explaining causal factors and their interactions at three main levels known as immediate, underlying and basic. The synergistic interaction between inadequate dietary intake and disease accounts for much of the high morbidity and mortality in developing countries of Asia, Africa and Latin America. The framework tells that three groups of underlying factors contribute to inadequate dietary intake and infectious diseases. They are household food insecurity, inadequate care and poor health services and an unhealthy environment. These underlying causes are, in turn, dictated by basic causes (like existing socio-economic and political conditions) that relate to the amount, control and use of various resources. This framework developed by UNICEF Can be adapted to all possible age groups and their nutritional outcomes. Here we use the same framework for both maternal and child undernutrition analysis. The framework is presented in figure 1.1.

We have found following determinants or proxies from the literature and NFHS-2 to study the patterns and determinants of maternal and child undernutrition. They are presented in the tables 1.2 and 1.3 respectively in next page.

1.8 Chapterisation Scheme

The chapters will be in following orders.

Introduction

Literature Review.

Patterns and Determinants of Child Undernutrition in Orissa

Patterns and Determinants of Maternal Undernutrition in Orissa

Summary and Conclusion

In the introduction chapter we have discussed the meaning and definition of undernutrition and it's various forms. We also discussed the background of the study, why we choose this particular state, the data source and it's limitation, the methodology to be adopted and probable chapterisation scheme.

The second chapter titled "Maternal Undernutrition: A Review of Evidence" discusses the major findings of the earlier researchers. It also critically looked into their methodology, data source, conclusion derived and deficiency in their arguments.

The third chapter titled "Analysis of Maternal Nutrition in Orissa" tries to understand the patterns of maternal undernutrition in Orissa in terms of maternal anaemia and body mass index (BMI). It also discusses about the determinants found from the logit models.

The fourth chapter titled "Child Undernutrition: Review of Evidence" also find out the major findings of earlier researchers on child undernutrtion. Like chapter-3 it is also critically looked into their methodology, data source, conclusion derived and deficiency in their arguments.

Like chpater-3, in chapter-5 the entire focus is on patterns and determinants of child undernutrtion in Orissa.

We have divided the literature review in to two chapters, because we are dealing with two separate issues of maternal and child undernutrition. Same reason holds good for why we have two separate analysis chapters on maternal and child undernutrition.

The chapter-6 holds discussions on major findings of the study and tries to reach at certain conclusion. Here limitation of the study is also discussed in detail.

Table 1.2 Set of Determinants found in the Literature and NFHS-2 for Analysis of Maternal Nutrition.

Different factors	*Determinants found in literature*	*Determinants found in NFHS-2*
Demographic factors	1) Age Groups for women 2) Height of the women	1) Available 2) –do-
Household factors	1) Household Size 2) Household composition 3) Work status of the women 4) Hours spend on different types and nature of work 5) Health care expenditure 6) Level of education 7) Decision about having no. of child 8) marital status 9) food intake/calorie intake 10) age at first child birth 11) Types of household	1) Available 2) –do- 3) –do- 4) a) –do- b) We also have information on mode of wage payment 5) –do- 6) –do- 7) –do- 8) –do- 9) –do- 10) –do- 11) –do-
Infrastructure available to the concerned household where the mother is living	I have not come across any literature considering these items as determinants of maternal malnutrition.	1) Kind of toilet the household using 2) Source of drinking water 3) Not available 4) Pucca/semi-pucca/Kaccha 5) Available
Community factors	1) Region of the household 2) Caste of the house hold 3) Tribe to which the household belongs 4) Religion of the household	1) Available 2)–do- 3)–do- 4) –do-
The determined variables will be (1) BMI of the mother and (2) Incidence of anaemia with mother		

The next table presents the similar exercise for maternal nutrition analysis, as it has been done in case of child nutrition.

Table 1.3 Set of Determinants found in the Literature and NFHS-2 for analysis of Nutritional Status of Children.

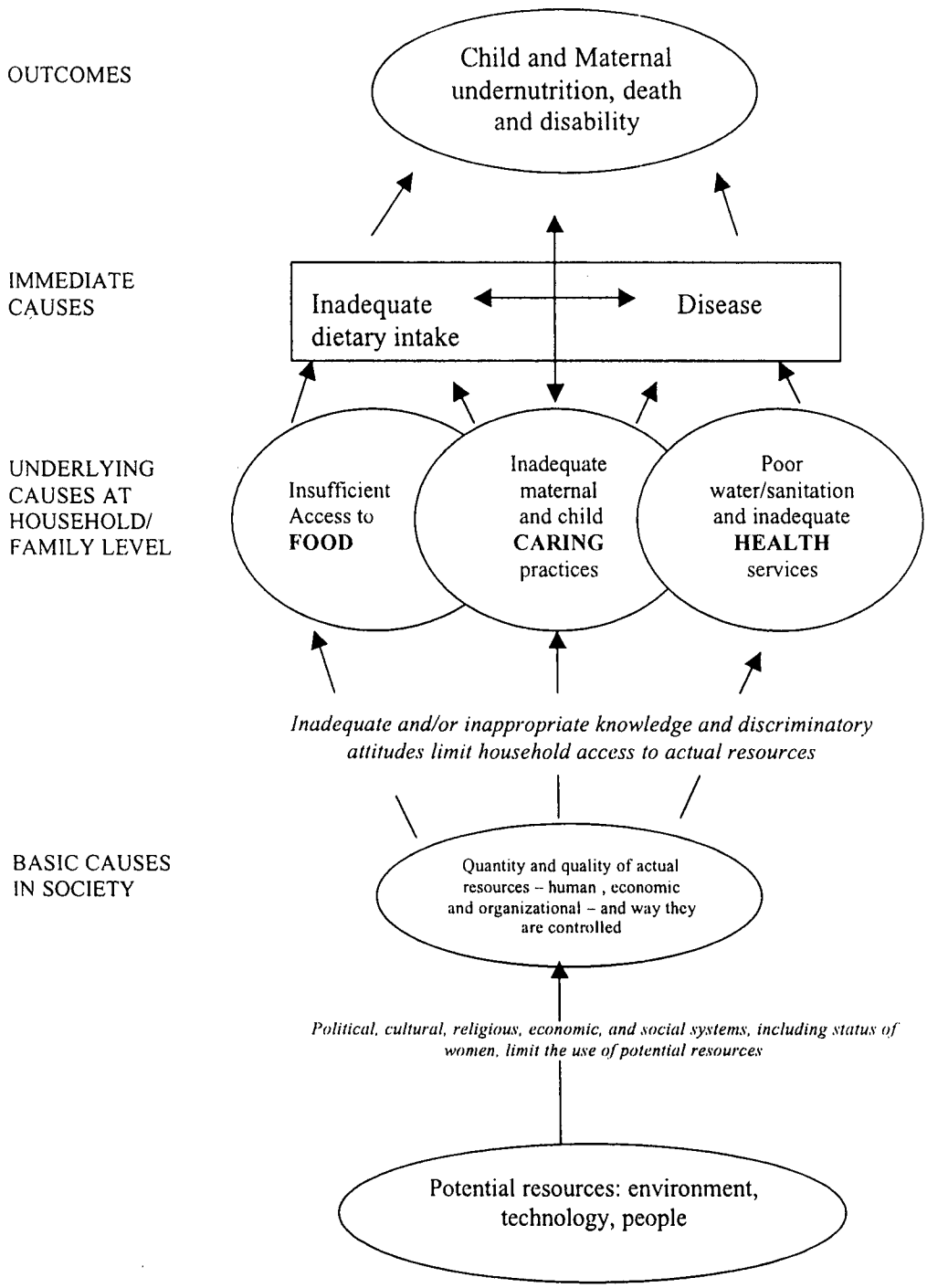
Set of Determinants	Determinants found in literature	Determinants found in NFHS-2	The Determined factors will be
Demographic Factors	1) Age group of the children 2) Birth order of the child 3) Mother's age at time of first child birth	1)Age group of the children 2) Available 3) –do-	1)Weight-for-age 2) Height-for-age 3) Weight-for-height
Child care determinants	1)Child's initial birth weight 2)Mother's BMI at pregnancy 3)Mother's initial care at time of pregnancy 4)Breast feeding of the child 5)Child food supplementation 6)Child Vaccination 7) Child's health status after birth	1)–do- 2)–do 3)(a) Types of care she received from the health worker at time of pregnancy. (b) Type of health service she opted for: whether professional (Doctor/nurse)or traditional (Dai) c) Weather she has gone for vaccination d) Whether she has given any supplement or not e) Post delivery care 4) Starting of the breast-feeding-, the duration of breast-feeding, 5)The starting of supplementation, Types of supplementation 6) Information is available on types of vaccination provided to the child and the number of times provided. 7) Information is available on weather child suffered from diseases after birth and the treatment he was provided.	

(Cont...)

Set of Determinants	Determinants found in literature	Determinants found in NFHS-2	The Determined factors will be
Household factors	1) Education Level of the parents 2) Mother's work status 3) Types of the Household (male or female headed) 4) Income of the House hold 5) Occupation of the household 6) Type of heath care the family has accessed. 7) Size of the household	1) Available 2) –do- 3) –do- 4) Standard of living index 5) –do- 6) –do- 7)) –do-	
Infrastructure available to the concerned household where the baby is living	1) Have latrine or not 2) Have water supply or not 3) Have sewerage system or not 4) Type of House 5) Power connection	1) Kind of toilet the household using 2) Source of drinking water 3) Not available 4) Pucca/semi-pucca/Kaccha 5) Available	
Community Factors	1) Region of the household 2)Caste of the house hold 3)Tribe to which the household belongs 4)Religion of the household	1) Available 2)–do- 3)–do- 4) –do-	

Figure 1.1

Food-health-care Framework for analysis of Maternal and Child Undernutrition



Source: UNICEF (1998), *The State of the Worlds Children 1998, Oxford: Oxford University Press*

CHAPTER II

MATERNAL UNDERNUTRITION: A REVIEW OF EVIDENCE:

2.1 Introduction

Maternal Nutrition is a relatively unexplored component in research on nutrition. But nonetheless this component is of greater relevance for women's health being a neglected dimension. Women's nutrition has its own implication on the nutritional status of children as well as other household members. So better nutritional status of women is indicative of better health of the concerned population as a whole. In the introduction chapter we already explained the role of nutrition in over all welfare and development of the society. So it is easy to derive the larger implication of women's nutrition towards welfare and development. Higgins and Alderman (1996) point out this limitation while explaining economic approaches to better nutrition which ignores the individual heterogeneity in calorie intake and energy expenditure. Instead they argue that the focus of the economic approach on nutrition is to be more concerned with child nutrition issues. According to them the adult work more, their calorie/nutritional requirement is also more. Among adults the women's nutrition is much more complicated because of the multiple roles they play in their life. These include role of reproduction, nurturing, caring apart from participating in ordinary economic and social activities. Sometimes existing socio-cultural behavior also complicate the matter. So Women are more vulnerable with regard to nutrition. Especially in their adolescence and post maternity many women suffer from under nutrition. Hence during the future years of life, they experience ill health arising out of nutritional deficiencies. In developing and underdeveloped societies the situation is really one of the worse. According to FAO, in Sub-Saharan Africa the maternal death is 30% of the total maternal deaths in whole world. Anemia during pregnancy is almost 50% in Africa. This is one of the major causes of maternal death in the continent. As far as India is concerned, NFHS-2; 1998-99 reports that, 35.8% of Indian women of reproductive age i.e. 15-49 taken in the sample, are found to have a body mass index less than 18.5 kg./m^2, reflecting chronic energy and micronutrient deficit. The prevalence of anaemia among all the women in the Indian sample is around 52%. Around 15% of the women in the total sample are found to be

moderately anaemic (Hemoglobin level 7.0-9.9 grams/deciliter) and another 2% are severely anaemic (hemoglobin level less than 7.0 grams/decilitre). Now we will discuss in detail the issues, methodologies, data bases used and the findings of these literatures.

We will start from the methodologies they adopted.

2.2 Issues in Maternal Undernutrition

There are various issues involved in the discussion on maternal malnutrition. However we will restrict ourselves primarily to maternal undernutrition. The causes and consequences of maternal malnutrition are different in developing and developed countries context. Maternal malnutrition consists of both maternal over nutrition and maternal under nutrition. In the former case the problem of obesity, vascular disease or blood pressure are the symptoms. It may happen due to over consumption of calorie or complexities of a modern developed, first moving society. While analysing this aspect a different set of methodologies need to be adopted. It is mostly an urban or developed country problem. But in case of developing and poor societies issue of concern is that of prevalence of maternal undernutrition. Though Overnutrition is also emerging as a health problem among urban and elderly women in developing as well as least developed countries as well. But their share in aggregate malnutrition is relatively low compared to maternal undernutrition. So for the time being we will restrict ourselves to the maternal undernutrition issues concerning the developing world.

The pertinent questions are; what is maternal under-nutrition? Why it needs to be addressed separately? What are it's implication towards the family or household welfare and for the society as a whole. How it contributes to the development? In developing societies undernutrition is widespread among all section of the society. Starting from child to adult a huge number in each age group suffer from undernutrition. According to Joanne Leslie (1991) around 500 million women were anemic, another 500 million were stunted due to childhood protein-energy malnutrition, 250 million suffer from iodine deficiency, and 2 million were blind due to vitamin-A energy deficiency. According to WHO (2003) around 800 million people suffer from malnutrition. Malnutrition affects one in every three people

worldwide, afflicting all age groups and populations, especially the poor and vulnerable. But women stand more vulnerable than men in all age groups. It is also responsible for 10.4 million annual child deaths in the developing world; it continues to be a cause and consequence of disease and disability in the children who survive. Anemia is a major factor in pregnancy and childbirth complications that take the lives of some 585,000 women each year. It accounts for one-quarter to one-half of deaths to women of childbearing age. In some places, pregnancy is the leading killer of women in this age. It also contributes to 20 percent or more of post-partum maternal deaths in Africa and Asia. In total, 0.8 million (1.5%) of deaths worldwide are attributable to iron deficiency, 1.3% of all male deaths and 1.8% of all female deaths. (WHO Report 2002, Fourth Report on the world nutrition situation 2000). There is a similar pattern for women affected by night blindness during pregnancy, with a global prevalence of approximately 5% and the highest prevalence among women living in Asia and Africa where maternal mortality rates are also high. In total, about 0.8 million (1.4%) of deaths worldwide result from vitamin A deficiency, 1.1% in males and 1.7% in females. In total, 1.4% (0.8 million) of deaths worldwide were attributable to zinc deficiency: 1.4% in males and 1.5% in females. Underweight is also common among women of reproductive age, especially in Africa and South Asia. It is estimated that prevalence of undernutrition among women is as high as 27--51% (WHO 2002).

In developing countries and poor nations the social setting too adversely affects women's well being especially in rural areas. Socially, economically, culturally, politically they have the least freedom. They suffer most from any socio-political disturbances. Their lack of freedom or limited access to household and social assets prevents them to decide about their own health, hygiene and calorie intake. That results in their undernourishment. Now we will discuss how women in these societies face a vicious cycle of poverty and undernutrition through out their life. We will call it Life cycle approach (The world Nutrition situation report 2000). In these societies a woman enters pregnancy undernourished, anaemic and she may have deficiency in other micronutrients too. Her child then takes birth as an underweight child. If she has a female child then she will have the nutritional deficiency from the beginning. If the household is a poor one again she will not get the adequate calorie and micronutrients which in turn will affect her growth in childhood, then adolescence. If the family has son preference then she will be discriminated further. Then after her marriage she will

enter to maternity as malnourished and give birth to another malnourished child. The early age at marriage only aggravates the problem further. This is known as the life cycle of women malnutrition. However there are various stages within this life cycle approach. We will discuss it one by one.

2.2.1 **Causes of undernutrition among female children in Infancy and childhood (up to 5 years):** Inadequate-feeding practices led to undernutrition among girl child in the early age of their life. The delayed initiation of breastfeeding and low rates of exclusive breast feeding in many underdeveloped societies led to the undernourishment. The WHO global Data Bank shows us an average of only 19% of infants in Africa between 0-4 months of age have exclusive breast feeding. The supplementary foods are also generally not energy or micronutrient rich and also their preparation is not free from contamination. Again diarrhoea, malaria and acute respiratory diseases also affect the nutritional status of the child. This trend hardly alters when they go to school where their mental development and learning ability is seriously affected.

2.2.2 **Causes of undernutrition among female children during five plus age to Adolescence (5 to 14 years)**: The impact of under-nutrition continues to be there in this stage only to make the thing worse. This stage is crucial for the growth of the children both physically and mentally. Moradi (2003) in his unpublished article focuses on the relationship between nutritional status of the women and protein consumption in adolescence. He measured the nutritional status of women through Height (antropometric indicator) because it reflects the intake of protein over the period. He has observed Demographic and Health Survey (DHS) data for Sub-Saharan and South Asian countries from 1950-80, consisting of 12000 mothers. He found that as a result of declining milk supply during 1971-75 in Sub-Saharan African countries, the mean height of women for the corresponding period declined. In addition, consumption of protein rich foods like meat, egg, milk, fish in childhood seems to have strong positive relationship with height of women. Contrary to the common notion, the relationship between GDP and protein consumption was not universal. This was evidenced in Chad and Mali in 1965, the two

poorest countries in Africa where protein consumption was very high because of high stocks of cattle and sheeps per household. On the other hand Countries like Ghana and Mozambique known to be relatively richer during the same period had low protein supply. But in subsequent decade the protein supply increases in richer countries and declines in poor countries. However Moradi's paper does not address the direct impact of basic rural/urban divide, sanitation, immunisation, and reproductive health indicators on women's height. Instead he choose Infant Mortality Rate (IMR) as a singular proxy for all of these factors. This may be too simplistic an approach. Also it ignores the declining or stagnant growth rate among countries in this region, which is due to lack of adequate supply of protein to girl children. However in Asian countries the mean height seems to be slowly increasing with economic development despite the gender bias in favour of male child between 1950-80. While in Africa the poverty actually hampers the growth of girl child during 1950-80. According to fourth world report on nutrition situation the girls are more likely to be stunted compared with boys. They argued on the basis of past evidence that better nourished girls have higher pre-menarcheal growth velocities and reach menarche earlier than their undernourished counterparts. Since undernourished girls take more time to grow, their early marriage definitely affect their height and weight. The study by Indian Council of Medical Research (ICMR) in 1995 has shown that in North Indian states mean age for first conception is 15.3 years. In general 25% of adolescent girls in the developing world are becoming mother by 19 years of age and they have a long reproductive span to follow. So they are likely to give birth to low weight babies. Maternal mortality ratio is high for the adolescent mothers. Quoting International Centre for Research on Women (ICRW), the fourth world nutrition report (2000) say that in 9 out of 11 case studies they found stunting process once started in pre-adolescence years, continues through out adolescence and there after. There is little evidence of making up for the loss in later years. Quoting INCAP follow up study in Guatemala they cited that 67% of severely stunted and 34% of moderately stunted three-year old girls later became stunted women. Their children are twice more likely to be low birth weight babies. Ramchandran's study (1993) on adolescent girls in India mentions early childhood stunting among adolescent girls to be significantly

related to the low birthweight and infant mortality risk of their babies. The second world nutrition report (1992) found a strong correlation between prevalence of underweight among pre-school children in the 1970s and prevalence of underweight in adult women in 1980s. They also found strong association between prevalence of underweight in adult women and low birthweight prevalence and again low birth weight and pre-school underweight. On the whole, one could conclude that impact of under-nutrition transmits from one generation to another.

2.2.3 **Causes of maternal undernutrition in Reproductive years (15-49 age):** The prominent factors determining nutritional status in this stage of life cycle are household food security, reproductive health, work status of the women, access to basic social services like health, education, clean water. The poor social status of the women along with cultural barriers negates the situation further. The lack of social and economic autonomy hampers their nutritional well being. According to nutrition life cycle this phase is also known as 'Adult Nutrition Phase", [World nutrition report (2000)]. The measures of adult nutrition status are Body Mass Index (BMI), Mid-upper-arm –circumference (MUAC), and Anaemia. BMI above 25 kg/m^2 refers to Overnutrition measured in terms of obesity, overweight etc. But BMI below 18.5kg/m^2 is considered as undernutrition. BMI below 16 kg/m^2 refers to chronically energy deficient (CED). According to this report underweight among women is widespread in South-central Asia. In Bangladesh around 51.3% of adult women are underweight. Half of them are below 16 kg/m^2. In African countries like Chad and Madagascar the prevalence of mild underweight stood at 15% where as in Kenya, Ghana, Benin, Burkina Faso, Central African Republic, Cameroon, Ivory coast, Egypt, Kenya and Ghana have around 10% mild underweight among adult women. But in Latin American countries overweight is the problem. About one third women suffer from mild to severe obesity. Now we will discuss in brief various factors affecting nutrition status of the women in adult age or reproductive age. They can be divided in to six broad categories. They are as follows:

i) Household food security: In one of the important study on women nutrition for Ghana Maxwell and Ruel et al (1999) have shown that working women in urban areas are more concerned about their food and nutrition security than male headed household despite their low income. Their study is based upon Ghana Living Standard Survey (GLSS: 1987-88). They take into account 559 household heads of which 363 are male headed and 196 are female-headed households. To measure the nutrition status they adopt calorie intake approach. They found that average income in female-headed household is less compared to male-headed household. Despite that female-headed households spend a considerable amount on food consumption. So they found that female-headed households have better mean calorie adequacy as well as availability. But that does not mean they have better nutritional opportunity compared to the male headed household because they did not talk about adequacy and availability of micro nutrients in their food intake. Better calorie availability therefore does not imply better nutrition status [Srinivasan: 1983, Osmani 1993]. Since female headed households have greater dependency ratio and lesser average income, it is found that around 40% of female headed households are food insecure, and therefore nutrition insecure.

(ii) Reproductive factors: Anaemia, early marriage, maternal depletion syndrome, prenatal and postnatal care is important determinants of nutrition status in this stage. The poorest women in developing regions start their childbearing at an early stage. Because of poverty they are forced to marry early. In many developing countries, poor women start bearing children between ages 15 and 19. This lead to their disability to avoid early pregnancy. Their ability to negotiate for safe sex, adopting family planning etc. is also minimal. Even countries with low fertility may not reflect the true picture. For example countries with low adolescent fertility have larger differences in fertility between poorer and richer sections of the society. But Latin America presents a contradiction to this .where overall level of adolescent fertility is very high along with the difference between wealthiest and poorest also being high. The poorest families have extremely high rates of childbearing among the young. Latin American countries

show a large gap between the poorest group (ranging from 105 to 234 births per thousand adolescent women) and the three middle quintiles, and another large gap between these intermediate groups and the wealthiest (ranging from 18 to 58). Only in Haiti, the poorest country in the region, does a single large gap occur between the richest quintile and the four poorest. In South Asia countries like Indonesia, the Philippines and Vietnam, the poorest adolescents are nearly seven times as likely to have children as their better-off counterparts. In the Philippines, poor young women are nearly 11 times as likely to have a child. In all three countries, reductions in youthful fertility are systematically related to increases in wealth. In Africa there is a clear-cut relationship between poverty and early marriage. In Egypt and Morocco we adolescence pregnancies are more predominant in poor households. Countries in Europe and Central Asia do not show a concrete pattern between wealth and adolescent fertility, indicating a complex interaction among service access, ethnic variation and regional differentials. However the wealthiest subgroups still have the lowest adolescent fertility, the findings from 22 countries reviewed in sub-Saharan Africa suggest adolescent fertility decreases with higher wealth. (UNFPA State of world population 2002).

In India, Surveys have indicated that more than one third of Indian girls between the ages of 15 and 19 years are married. Although as per Registrar General's data (1992) the mean age at marriage for girls is increasing steadily and stands at 19.5 years, there may be a reasonable proportion of marriages of girls below the age of 18 years. A study of rural girls in 6 states has shown that in case of girls the average age at marriage was 13.8 years and that of consummation of marriage 15.3 years. National Family Health Survey (NFHS II-1998-99) indicates that in India, a majority of the women aged 20 to 24 years had been married even before they reached age of 18 (legal minimum age for marriage stood at 18 years in India). Early marriage and early pregnancy can interrupt physiological growth of the mother and can result in birth complications / low birth weight babies. Since in the poverty groups, growth process of adolescent girls continues for a longer period. It is even more important that conception is delayed till

about eighteenth year of age. A collaborative nation wide study covering 13,200 girls in the age group of 7-18 years has revealed a strong gender bias in the entire process of socialisation (Passi and Malhotra 2002). This is mainly due to the fact that after experiencing maternity most women suffer from anaemia, weight loss etc. In backward societies or least developed countries there are lack of medical attention during pregnancy or post delivery period. Now the causes may be several. It may be due to poverty, which does not enable the household where she lives for better food, sanitation, pre medical check-ups etc. for her during the pregnancy. These causes might lead to an already detoriated health situation in her adolescence itself. It might not allow her for better information due to lack of education or attention she need.

ii) Infections: This is another major factor affecting women's nutrition status. Their already poor nutrition status makes them more susceptible to infections, which adds to further detoriation of their current status. The major contributor to infection may come from malaria, jaundice, tuberculosis, diarrhea etc. These arise mostly from the poor sanitation facilities. In Asia, Africa and Latin America the drinking water supply, use of latrine, safe cooking methods are very less. The hygiene practice is also not at satisfactory level. Now HIV/AIDS and STD diseases pose a great threat to the survival of the women and their nutrition status.

iii) Work status: Work status of the women is another determining factor of their nutritional status. There are quite a few literature, which focus on this aspect. In Asia and Africa women constitute major share of labour force in informal sector. Generally they engage themselves in agricultural sector (for sowing, reaping etc.). Some of them are engaged in plantation, fishery, quarry, hawker, street vendors' etc. These types of work consume a lot of energy and time. Besides, women are also responsible for household chores and childcare. These works are mainly in primary sector and informal in nature. So they are exploited in terms of lower wages and long period of work. Any insurance or social security net does not cover them. Hence, despite the participation in economic activity, it does not amount in

economic freedom for them. So now we will take the issues one by one and try to examine them as evidenced in the literature. The issue of women's labour and women's nutrition is highly debated one. As Higgins and Alderman (1996) argued, the women need more energy expenditure but hardly they get it. They perform the usual household activities, take care of their children and along side they also work for wage outside their home. Some times they work without wage if it is family owned business or they are bonded labour as witnessed in few instances in South Asia. So ultimately the nature of work determines the amount of energy intake. This is evidenced in Ghana, that the women who work in agriculture need more calories than other women who do not. Now this has significant impact on nutrition status of these women. If they don't have adequate intake then they are going to be malnourished. Beherman and Deolalikar; 1990, suggest a direct relationship between women's wage and food intake in the household. But it does not necessarily imply that women's calorie intake also increases with increased income. Higgins and Alderman (1996) have argued that labour has a direct impact on women's nutrition and fertility. Their study based on the women from Ghana, using Ghana Living Standard Survey (GLSS, 1987-88), shows that woman's time allocation pattern has a bearing on her nutritional status. This study was based on both household and individual information collected form 3200 household comprising 3,130 eligible women. The criteria of eligibility were that the female must be above 18, and not pregnant in time of survey. As far as the methodology is concerned, in this article they follow nutritional antropometric approach by taking BMI as the indicator of nutrition. The advantage of antropometric approach over calorie intake approach has been discussed in full in first chapter. They found the conclusion relevant for the total sample as well as for the educated and non-educated women separately. They found that as hours in agricultural work increase by 10 hours per week the nutritional indicator in terms of women's BMI decreases by 0.49. But for the non-agricultural worker they found work hours have no negative impact on BMI. Their analysis has also taken regional and rural/urban dis-aggregation into account. But this paper was not able to separate the effect of maternal depletion from effect of labour on nutritional status of the women. This

lacuna has been recognised by the authors in their article. As we see earlier from the study for Ghana by Daniel Maxwell, Marie T. Ruel et al (1999) that working women in urban areas are more concerned about their food and nutrition security than male headed household despite their low income. These women also earn income from primary sector and petty trade where the employers and urban officials exploit them. So despite having self-employment most of these women earn very less income. So nature and environment of work really matters for women nutrition whether she lives in a village or in an urban area. However working women have more probability of controlling fertility at their will.

Derose (2002) has discussed on this aspect in greater detail. Using Ghana Demographic and Health Survey-1988, she showed that working women generally have longer birth interval. Taking 2433 birth intervals from the survey she found paid work in any sector are associated with longer birth interval than unpaid work. But it is more pronounced in modern sector where it extends the interval by 14months on an average. For agricultural and traditional sector the birth interval increases on an average of five months. She also concludes the nature of work with in a particular sector influence the birth interval. If it is a paid regular job then the probability of having longer birth interval is also high. So she concludes that in those societies where modern fertility control policy is absent and women have less reproductive autonomy, the participation of women in any economic activity may lead to some kind of check on fertility. Because it becomes necessary for taking care of the child along with continuation of the paid job. Short et al (2002) found in China that the working women prefer to have low fertility to cope with their economic activity and childcare. Using "China Health and Nutrition Survey-1991" and conducting 37 focus group discussions in three provinces of China they found that mother-in-law, paid nurses and relatives support the mother to take care of her infant and also continuation of their economic activity. In urban areas they prefer average low fertility. In rural areas also women who work in agriculture spend more time with their children compared to their urban counterpart. But this study does not use any health or nutritional antropometric indicator to quantify

the exact effect of fertility and childcare on nutritional status of the Chinese women. But this study has it's own uniqueness in the sense that it focus on a country where around 90% of women between age group of 24-44 go to work or engage in some economic activity. According to WHO (2002) 84% of Chinese population use contraceptive.

iv) Access to health, education and information: Access to health, education and information is very important for women's maternal health therefore nutrition. Joshi (1994) has shown that maternal schooling does matter in both maternal and child health. His study on Nepal is a good piece of work reiterating this finding. He tries to establish the missing link between maternal schooling and it's impact on health status of the mother and her children in an economically and socially backward setting. The data was collected from 1,144 households from different socio-economic backgrounds. He has applied logistic regression to construct the model for children's height-for-age (stunting) and weight-for-height (waisting) with respect to maternal schooling, age of the mother, Husband's schooling, husband's employment, parent's literacy, and socio-economic status. The study emphasises the influence of women's education on the pattern of childcare. Education helps them to acquire skills necessary for improving their own hygiene behaviour. Their ability to read and write helps them to interact with health workers, doctors in their own language. They can acquire health-related information from media and newspapers. The identity acquisition hypothesis shows that women with better schooling are more likely to posses and use the objects that they have learned in the schools and they are closer to modern way of life. The study shows educated women take more care of their own hygiene, cleanliness of the household and the their children. They use more prenatal and postnatal health care compared to their illiterate counterpart. It has positive impact on contraception use and negative impact on breast feeding practices. These findings are consistent with practices in other modern and advanced societies. So maternal schooling has it's undoubted implication for both maternal and child nutrition. However if the author in this paper had explored the impact of maternal schooling on maternal nutrition status

(using some antropometric approach) it would have added to the strength of his argument. The study on Ghana by Levin, Ruel et al (1999) shows that most of the female-headed households have low educational status. So they are forced to work as non-skilled worker. Even in Ghanaian Sample most of them work as petty street food vendors, but their low education led them to exploit by Accra urban officials which led to their low economic status.

Lack of education also lead to little access to health, hygiene and nutrition information. From several studies it is found that maternal education do play an important role in maternal heath, hygiene and therefore nutrition. Women with better education and grater domestic autonomy ensure better nutritional outcome for their children. Better education ensures economic independence to some extent. Low education and low autonomy prohibit women from using better medical care, comply with instruction and follow up with health care provider if instructions do not work (WDR 2000/01). Studies in Brazil by Strraus and Thomas (1990) show, those mothers having more income or autonomy to spend family income, ensure better nutrition status for their children. Khandekar (1998) found that providing income-generating loans to female members/clients improve nutritional standard of their children, which is not true for their male counterpart. A study by Michelle Neiss et al (2002) found education does mediate partially between IQ of the child and age at first birth. It is found that higher educated couple opt for delay child birth which in turn result in better IQ among the new born. Moradi (2003) focuses on the relation between education and improvement in nutritional status of the women. He measured the nutritional status of women through Height (antropometric indicator) because it reflects the intake of protein over an elongated period. He has observed Demographic and Health Survey (DHS) data for Sub-Saharan and South Asian countries from 1950-80, consisting 12000 mothers. He found more educated mothers having more height on an average. His explanation is that there may not be a one to one relationship between height and education from birth itself. But when the girl enters into school she may get the benefit of school feeding programs which increase her protein intake and secondly in future she may be able to take better care

of herself and her children's nutrition. But the latter thing is a future thing. So Moradi argued that when parents spend on girl's education they might also spend on her food and health. So over all we can see better educated mother have better height on an average.

vi) Cultural and social barriers: Cultural and Social barriers also play an important role in determining women's nutritional status. Education and autonomy reinforce each other for women (World Development Report 2000/20001). Dominique Simon, Alayne M. Adams and Sangeetha Madhavan (2002) have analysed the relationship among women's social power, child nutrition and poverty in Mali. They addressed the issue, while micro level association between poverty and child malnutrition is well established, the concept of poverty and it's operationalisation in terms of measure of socio-economic status is least discussed along with the mechanism in which malnutrition is experienced or prevented. So there is an attempt towards answering whether women's social power is an answer? To examine this they conduct a micro level analysis. They collected data on 402 under five children and their 261 eligible mothers. BMI was the chosen measure of the nutrition status of the women. Here they treated BMI<16 as severe chronic energy deficiency among women. The determinants are increased morbidity, impaired work capacity and reduced social activity. Mali is predominantly Muslim. So quranic verses rule utmost. They found that husband's economic position is most important for women's social empowerment as Mali women see it and vise-versa. They measure the social empowerment of women via their education, their economic independence in terms of their access to cash for buying day to day articles and their participation in credit rotation scheme which allows them to own small assets in terms of reeds for mat making and purchase of small livestock, occupation, support from their husband, total network size, felt control in the household, and their ability to do specific work alone. No surprise, they found higher the social status of the women better is the BMI for women and their children. They also found that if the mother has multiple activity apart from household activity then they are likely to have waisted children. They conclude that women with malnourished children

tended to be socially isolated, bitter and passive where as mothers of better nourished children were socially integrated, well positioned to mobilise support for child care and more sensitive to the needs of their children. This study is unique in it's finding because it tries to quantify the direct impact of social power on women's nutrition status, measured in terms of long run indicator like Body Mass Index (BMI). But a lot has to be done to make the hypothesis universal by looking at more countries across the continent.

A study by Bentley and Griffiths, 2003 found that poor urban women are more likely to be anaemic and also have low BMI. Their study was based on Andhra Pradesh, one of the provinces in southern part of India. The data is drawn from National Family Health Survey (NFHS-2, 1998-99). Using ordered logit techniques they found household economic status, social background, place of residence, maternal education and dietary practices are detrimental to the anaemia and BMI outcome for the reproductive women of age 15-49 age group. But the exception in their finding is that those poor women who come from urban areas are more likely to be anaemic. This feature they attribute to the fact that, despite living in urban areas these women might not have access to available health care facilities because of higher financial and administrative cost need to access them. The same argument they provide for dietary practices of urban poor women. Though in urban areas Varity of nutrition rich foods are available, the urban poor women might not have access to them because of high prices. But in case of BMI they found that urban poor women perform little better, compared to rural women. The uniqueness of the study is that it focuses on the one emerging aspect of maternal undernutrition i.e. effect of urban poverty on the nutrition status of the urban women from poor economic background. The limitation of this article is, it gave importance to discussion on prevalence of anaemia among the women but not on the Body Mass Index (BMI), though an analysis has been done in the study.

3.2.4. **Nutritional status of older women:** The nutritional status of the old people now attracting attention of the researchers. "The London school of Hygiene

and Tropical Medicine" and Helpage International" sponsored studies reflect on the problem. Three case studies, in slums of Mumbai (India), Refuge camp in Rwanda and rural Lilongwe of Malawi found there is little gender gap in elderly nutrition status. In case of India 35% of both old men and women suffer from undernutrition measured in terms of Middle-upper-arm-circumference (MUAC). They suggested that BMI might not be a good indicator for nutrition of older persons because of change in their body composition. So MUAC could be better option because it is (MUAC cut-off point of 21.7) found more sensitive (86%) than BMI cut-off point of 16 kg/m^2. Actually MUAC reflect functional ability of the body among old persons while BMI only shows the body composition which detoriate with age. They found that in Indian case 60% of women above age 70 are malnourished. In Rwanda however old males (19.5%) are more malnourished than females (13.1%). In Malawi however 36.1% of males and 27.0% of percent of females are found to be malnourished. Since in India a large part of total population is of old age. So they need more attention because many of them are poor, less educated and less protected by any social security. Especially old women in urban slums and rural areas are vulnerable to nutritional deficiency to a greater extent.

CHAPTER III

ANALYSIS OF MATERNAL NUTRITION IN ORISSA

Introduction

This chapter focuses on examining patterns and determinants of maternal nutrition outcomes in Orissa. The pattern of maternal nutrition outcomes could be revealed in terms of the variation observed in this outcome across different age and other relevant socio-economic categories. The outcome variable considered here are namely,'Anaemia'[i] and 'Body Mass Index' (BMI)[ii] among women of reproductive ages. These two outcome variables will be analysed separately for their bearing with a list of socio-economic indicators available at the individual as well as household level towards understanding the variation in nutritional outcomes. The groups of characteristic variables considered in this analysis are the following:

1. Demographic characteristics like age, sex, marital status, childbirth, family size, marital duration etc.

2. Social characteristics like education level of the respondent and her partner, rural-urban residence, religious and ethnical affiliation of the respondent

3. Economic characteristics will include household standard of living index, occupational status of the respondent and her partner

4. Environmental characteristics/ availability of basic infrastructures like sanitation, water supply and electricity.

5. Dietary practices in terms of food intake including milk/curd, vegetables, pulses, fruits, eggs and other animal proteins.

The above set of indicators is available in NFHS-2 to facilitate such an analysis. However it needs to be clarified here that our sample taken from NFHS-2 contain only reproductive women of age group 15-49 which account for a total of 4425 women of which 4282 women have information on anaemia and 4059 have information on their Body Mass Index. This disparity in cases is because of non-reporting of related information. The whole analysis chapter will be divided in to two

parts. The first part (Part-I) will be devoted to maternal anaemia analysis. The second part will be devoted to maternal BMI analysis.

Part-I

This part will contain the sections 3.1 to 3.1.10. The whole part is devoted to analysis of maternal anaemia among women in Orissa.

3.1 Analysis of prevalence of anaemia among reproductive women in Orissa.

The nutritional outcome in terms of anaemia is examined with anaemic vis-à-vis non-anaemic as well as by the degree of anaemia in terms of severe, mild and moderate within those who are stated to be anaemic. Prevalence of anaemia has been universally accepted as an indicator for women's health and nutrition status [Hamilton; 1984, Mohan; 2002, Horton and Ross; 2003, Bentley and Griffths; 2003]. It is basically a clinical measure of hemoglobin level describing the health status of the women. One of the prime contributing factor for anaemia is iron deficiency, which has a direct bearing with the food intake that depends upon over all economic condition of the household. It is measured in terms of deficiency of hemoglobin in the blood. The hemoglobin deficiency occurs mainly due to iron deficiency, which help to produce blood cells in the body. The loss of blood due to any medical emergency, pregnancy, disease can also make some one anaemic but for a short time period. But anaemia due to iron-deficiency is a long run outcome of continuos inadequate supply of iron in the diet.

3.1.1 Demographic factors affecting anaemia outcome

With a sample of reproductive age women for our analysis, we describe the demographic factors influencing nutritional outcome in terms of anaemia. The table 3.1.1 shows us that around 63% of women are anaemic in Orissa. The age pattern of proportion of anaemic women shows a higher vulnerability towards anaemia in the two ends of reproductive ages i.e. 15-19 and 45-49 where the prevalence of anaemia is more (i.e. 66.32 and 72.63 respectively). Given the overall anaemic proportion of women well above 60 per cent, a larger share of it is mild anaemia (45 per cent), 16 percent of moderate anaemia and about 2 per cent is severe anaemia. But in every age

group we found above 60% of women are anaemic. Mild anaemia is wide spread in each group, well above 40% in each group. In case of moderate anaemia 15.88 % of women in the reproductive age group are moderately anaemic. Again, the prevalence is higher among 15-19 age group followed by 20-24 age group of women. This may be due to the fact that women in ages15-24 in Orissa are most exposed to maternity because of early marriages. The case of severe anaemia though low at about 2 per cent, it is more likely among older women 45-49 age category. Thus one may argue that vulnerability to anaemia is more during early years of reproductive life as well as during the closing years. The reasons could be different for both as anaemia during younger ages may be explained in terms of repeated exposures to maternity and it could be cumulative effect of life long negligence and bad health during old age.

While relating to marital status, the married women are relatively less anaemic compared with the formerly married. The formerly married women include divorce, widows and those who live separately from their spouse. These groups of women are said to be vulnerable because of their low position in the society and household itself. They have little control over resources and their health itself. The higher degree of anaemia like moderate and severe anaemic levels are found among formerly married group of women. However, this significant relationship between marital status and being anaemic need more comprehensive analysis before any affirmative conclusion could be drawn.

Exposure to maternity at an early age is said to be detrimental to women's health in general. Marriage signaling such exposure, the early age at marriage is considered to be influencing nutrition status of women with maternity experience at an early age as well as lack of fertility regulation adding to deteriorating health condition. The early age at marriage also associated with low living status, lack of resources, lack of education and high fertility rate contributes adversely on the nutrition outcome of the women. From our analysis we found prevalence of anaemia is high for those who are married before age of 18[1]. The degree of severity is also high for this group compared to those who married on or after 18 years. On aggregate 67% of women who married

[1] In India marriage before 18 years for a girl child is regarded as criminal activity and punishable under law. Despite that a large number of girls forced to marry before reaching this stage. Child marriage is still practiced in backward regions of the country of which Orissa is also a part.

before 18 years of age suffer from some kind of anaemia while among the other group it is 57%.

Like age at first marriage, age at first birth is also one of the important determinant of women health outcome. We found those who give birth below 18 years of age are found to have some kind of anaemia (68%) than their counter part who give birth after 18 years of age (61%). A similar pattern persists in mild and moderate categories of anaemia while in case of severity there is least disparity between the groups. Though it is believed that early age at marriage may ensure experiencing maternity at early age, we do not find any suggestive indication between age at first marriage and age at first birth in relation to the risk of being anaemic. We check it through a three way cross tabulation.

As women grow older we find the risk of being anaemic also increasing but to a very little extent. Our break up for the sample of ever-married women into less than 30 and more than 30 age groups tells us that in both the category 63% of women have some or other kind of anaemia. As regards the degree of anaemia prevalence we found as women in greater than 30 age group are more likely to be anaemic. But in case of severity, we found that women in less than 30 years of age group are more likely to suffer. But earlier our four-year break up of age group has confirmed women at bottom 15-19 and women at top 45-49 of the reproductive age are vulnerable to severe anaemia.

It is clinically accepted that women suffer from hemoglobin loss during pregnancy and it's aftermath. So this data do not include those women who have given birth during last two months, prior to the interview. We have grouped women in two categories like those who gave birth during last one year and those who gave birth during last five years. It is found that prevalence of anaemia is more among those women who have experienced at least one birth in last five-year and it is more pronounced if they have given birth in last one year. Around 64% of the total women who gave at least one birth in last five year were found to be anaemic. This rose to 69% if we consider the birth recorded in one year. It is true for the mild and moderate degree of anaemia too. But severe anaemia does not exhibit a similar linkage with occurrence of birth, rather it is found to be more among those who did not give birth. And therefore one could conclude severe anaemia to be a cumulative manifestation of

sustained anaemic condition. Nonetheless, recent exposure to maternity holds a significant association with the outcome of being anaemic/non-anaemic and also degree of anaemia.

Family size could be related to maternal health due to reasons that higher family size is indicative of more number of children as well as less of per-capita household resource. And in both occasions mothers have the due disadvantage. Considering a family size grouping of 1-4, 5-7 and eight and above, it is found that more anaemic women are found in household with 5-7 members in comparison with women from smaller household as well as larger households. This may be indicative of the fact that in Orissa case family size may not explain the anaemic outcome comprehensively. The family assets and income may have some role to play. This fact is confirmed through a three way cross tabulation where household size is controlled for household standard of living index. It is also statistically significant for anaemic/non-anaemic as well as degree of anaemia.

Likewise number of children under five years of age or below have also no significant impact on women's anaemia outcome. But interestingly we found women having no child or not more than two children are more anaemic (61% and 67% respectively) compared to those who have more than two children (58%). This pattern holds good for both anaemic/non-anaemic and degree of anaemia outcomes. Such an observation could be reasoned by saying that women with lesser or no children are younger and have recent exposures to maternity, which makes them more vulnerable to anaemia. The woman having more than two children may be little older and not going through any pregnancy or related events. However in this category also the over all anaemia prevalence is around 58%, a quite high figure.

But total number of children ever born has definite and positive significant relationship with anaemia outcomes. It is evidenced by several medical and demographic studies. It is clearly shown from the table that women having more than two children are more anaemic (66.24%) compared to other two groups; women with no child (55.08%) and women with not more than two children (59.42%). The pattern shows an upward trend of being anaemic with growing number of total children ever born. This pattern holds good for degree of anaemia as well except in case of severe anaemia where women having not more than two children shows a higher percentage compared to other two groups.

Table-3.1.1. Pattern of anaemia among women by demographic characteristics

Characteristics (1)	*Anaemic* (2)	*Degree of anaemia*[1,2] *(3)*			*Non-Anaemic* (4)	*Total* (5)
		Mild (3a)	*Moderate(3b)*	Severe *(3c)*		
Age group*						
15-19	193 (66.32)	123 (42.26)	63 (21.64)	7 (2.4)	98 (33.67)	291
20-24	494 (63.01)	341 (43.5)	145 (18.5)	8 (1.02)	290 (36.98)	784
25-30	547 (60.64)	390 (43.23)	144 (15.96)	13 (1.44)	355 (39.35)	902
30-34	488 (61.38)	363 (45.66)	118 (14.84)	7 (.88)	307 (38.61)	795
35-39	357 (61.02)	276 (47.17)	74 (12.64)	7 (1.19)	227 (38.8)	584
40-45	329 (61.61)	235 (44.00)	80 (14.98)	14 (2.62)	204 (38.2)	533
45-49	284 (72.63)	216 (55.24)	56 (14.32)	12 (3.06)	108 (27.62)	392
Total	2692 (62.86)	1944 (45.39)	680 (15.88)	68 (1.58)	1589 (37.01)	4281
***Marital status**[iii]*						
Currently married	2505 (62.56)	1818 (45.40)	632 (15.78)	55 (1.37)	1498 (37.41)	4004
Formerly married	185 (66.78)	125 (45.12)	48 (17.32)	12 (4.33)	92 (33.09)	277
Age at first marriage*						
<18	1693 (66.73)	1194 (47.06)	455 (17.93)	44 (1.73)	844 (33.26)	2537
>=18	999 (57.24)	751 (43.03)	225 (12.89)	23 (1.31)	746 (42.75)	1745
Age at first Birth* (Data available for 3810)						
<18	949 (67.78)	684 (48.85)	242 (17.28)	23 (1.64)	451 (33.21)	1400
>=18	1483 (61.53)	1098 (45.56)	348 (14.43)	37 (1.53)	927 (38.46)	2410
Age of Respondent*						
<30	1233 (62.36)	854 (43.19)	352 (17.8)	27 (1.36)	744 (37.61)	1977
>=30	1457 (63.23)	1089 (47.26)	328 (14.23)	40 (1.73)	846 (37.61)	2304
Birth in last five year*						
0	1513 (61.95)	1120 (45.86)	348 (14.25)	45 (1.84)	927(37.96)	2442
1+	1177 (64.0)	823 (44.75)	332 (18.05)	22 (1.19)	662 (36.0)	1839
Births in past one year*						
0	2329 (61.94)	1692 (45.0)	577 (15.34)	60 (1.59)	1430 (38.03)	3760
1+	363 (69.4)	252 (48.18)	104 (19.88)	7 (1.33)	160 (30.65)	523
***Family Size**[iv]*						
1-4	827 (63.37)	596 (45.67)	203 (15.55)	28 (2.14)	478 (36.62)	1305
5-7	1232 (64.68)	869 (45.64)	335 (17.59)	28 (1.47)	672 (35.31)	1904
8+	633 (58.88)	478 (44.46)	143 (13.3)	12 (1.11)	440 (40.96)	1075
No. children under age 5 or else						
Zero	1256 (61.78)	931 (45.79)	291 (14.31)	34 (1.67)	777 (38.2)	2033
One or two	1282 (66.25)	903 (46.66)	349 (18.03)	30 (1.55)	703 (35.41)	1935
More than two	153 (58.17)	110 (41.82)	41 (15.58)	2 (.76)	110 (41.82)	263
Total number of children ever born*						
No children	259 (54.98)	162 (34.39)	90 (19.1)	7 (1.48)	212 (44.91)	471
One or Two children	924 (59.42)	674 (43.34)	228 (14.66)	22 (1.41)	631 (40.57)	1555
More than2	1507 (66.79)	1107 (49.06)	362 (16.04)	38 (1.68)	747 (33.11)	2256
Total number of living children*						
Zero	304 (56.29)	193 (35.74)	103 (19.07)	8 (1.48)	236 (43.7)	540
One or two	1123 (61.39)	815 (44.55)	270 (14.76)	38 (2.07)	706 (38.62)	1829
More than two	1266 (66.14)	937 (48.95)	308 (16.09)	21(1.09)	648 (33.85)	1914
Sex of the Household head**						
Male	2500 (62.89)	1822 (45.83)	620 (15.59)	58 (1.45)	116 (37.9)	3975
Female	191 (62.21)	122 (39.73)	60 (19.54)	9 (2.93)	1474 (37.07)	307
Marital duration grouped (in years)*						
0-9	978 (60.25)	674 (41.52)	282 (17.37)	22 (1.35)	645 (39.74)	1623
10-19	916 (62.99)	681 (46.83)	219 (15.06)	16 (1.1)	538 (37.0)	1454
20-29	622 (65.19)	458 (48.0)	143 (14.98)	21 (2.2)	332 (34.76)	954
30+	176 (70.11)	132 (52.58)	36 (14.34)	8 (3.18)	75 (29.88)	251

Here * denotes statistical association at 5% level of significance. ** denotes statistical association at 10% level of significance.
Note: Here birth in last five year is significant for degree of anaemia analysis but not for anaemic/non-anaemic analysis.
Source NFHS-2; 1998-99

[2] Column 3 in each table is the break up for column two. While column 2 express the percentage of over all prevalence of anaemia in each category, column 3 presents the degree of prevalence in each category.

Total numbers of living children also have an impact on women's nutrition status. This relationship is also found to be significant at 1-% level in our case. The same pattern, which holds good for total number of children ever born also, holds well in this case. As the number of living children increases the probability of being anaemic also increases. It is also reflected within the degree of anaemia. In our case around 66% of women who have more than two child, have some kind of anaemia followed by those women who have not more than two child (61.37%) and those who have no children at all (56.29%). However severe anaemia is found to be more incase of women (2.07%) who do not have more than two children. This may need further investigation. One of the causes may be, as we said earlier, women who do not have more than two children are at early stage of their reproductive life.

Sex of the household head has no significant impact on anaemia outcome. However, in our anaemia sample 92% of the household head are male. The pattern of anaemia among two types of households is very close to each other. But in female headed households prevalence of moderate (19.54%) and severe anaemia (2.93%) are more compared to male headed household (15.59% and 1.45%). This could be partially reasoned with economic status of the female-headed households, which needs further investigation.

The marital duration comes out to be an important determinant of women's nutrition outcome. We found a negative relationship between the two, which is also statistically significant. As marital duration increases the risk of getting anaemic decreases. Our result indicates that in the marital duration category of above 30 years, the prevalence is 70% with a sample of 251 women, followed by 20-29 duration group (65.23% out of total 955 women), 10-19 years duration group (62.99% out of total 1454 women), and 0-9 years of age group (60.25% out of total 1623 women). This trend persists in case of mild and severe categories but not in case of moderate anaemia.

3.1.2 Social characteristics of anaemia outcome

In this section we will focus on social determinants which affect nutrition outcome of women measured in terms of anaemia [Mohan; 2002, Benteley and Griffith; 2003.]. First we will consider education level of the respondent. There is sufficient literature on the relationship between health outcome of the women and their education level. In

case of Orissa too, we found a suggestive association between the two. The percentage of anaemic is more among women who have no education in their life. With increase in the level of education, the prevalence of all degrees of anaemia declines. Among educated women who have higher education reported no severe anaemia in contrast with the uneducated women accounting for 20% suffering from severe anaemia. Only 9% of women having higher education suffer from moderate anaemia while it is almost 20% for women with out any education. This pattern also holds when education is counted in number of years of schooling. We found prevalence of anaemia is more among those women who have less than five years of education (67.69%) compared to the other women who have more than five years of education (52.3%). Similar differences are observed with degree of anaemia too. There may be an implicit relation between low or no education and poverty measured in terms of household standard of living index and it's combined impact on anaemia outcome. Our three-way analysis too asserts the inverse association between educational level of women and status of anaemia while controlled for standard of living in three categories low, medium and high.

Partner's education level is also found to be significant at 1-% level with prevalence of anaemia and degree of prevalence. Among less educated partners the prevalence of anaemia is more among their spouse (69.4%) and among more the educated partners it is least (47.08%). In case of degree of anaemia also the same pattern persists. Uneducated partners are also likely to have more severe anaemic spouse (2.34%) compared with highly educated ones (1.5%). Here also the partner's educational level may confound with standard of living index of the household. The three way cross tabulation considering standard of living index as a control; education level of the respondent's partner also shows significant association with anaemia and degree of anaemia.

The rural/urban difference is also found to be a major determining factor. Among rural women the prevalence of anaemia is (63.87%) compared to 54.66% among urban women. The pattern holds good for all the degree of anaemia. This shows that poverty which is more among rural population of Orissa has it's impact on women's nutrition status. Our cross tabulation between type of place of residence (rural/urban) and economic status (household standard of living index) is found to be statistically

significant. Taken together these two have also significant relationship (at 1-% level) with prevalence of anaemia and degree of anaemia among women of Orissa.

However religion and anaemia are not found to be significantly associated, so also religion and degree of anaemia. Nonetheless, the prevalence of anaemia is more among Christian women (73.13) followed by Hindu women (62.94), Muslim women (50%) and women of other religion (33.33%). The pattern holds good for all the degree of anaemia as well.

Taking ethnicity into account we can say that tribal women are more vulnerable to anaemia (74.7%), followed by Scheduled caste women (66.29%), other backward caste (61.01) and general category (51%). However mild anaemia is more widespread among tribal women (51.31%) followed by Scheduled caste women (45.7%), Other backward caste women (44.52%) and general caste women (42.07%). The degree of severe anaemia is wide spread among SC women (2.42%) followed by tribal women (1.91%). The moderate degree of anaemia is also wide spread among tribal women followed by SC women. The pattern holds well by taking SC/STs as one group and Non SC/STs as another group. We can see in every category, prevalence of anaemia is more among SC/ST women. The cause of this difference may be related with differential economic condition between these groups. The cross tabulation between poverty in terms of household standard of living index and ethnicity (being SC/STs, Other Backward Caste and General) found to be significant at 1-% level. The three way cross tabulation between ethnicity, household standard of living index and status of anaemia establishes ethnicity to be a determinant of anaemia status despite the control for standard of living.

Table-3.1.2. Pattern of Anaemia among women by Social Characteristics

CHARACTERISTICS	*Anaemic*	*Degree of Anaemia*			*Non-Anaemic*	*Total*
		Mild	*Moderate*	*Severe*		
Education level of the respondent*						
No education*	1637 (68.69)	1130 (47.41)	459 (19.26)	48 (20.14)	747 (31.34)	2383
Primary	551 (61.35)	421 (46.88)	120 (13.36)	10 (1.11)	347 (38.64)	898
Secondary	444 (52.23)	342 (40.23)	93 (10.94)	9 (1.05)	406 (47.76)	850
Higher	60 (40.0)	51 (34.0)	9 (6.0)	-	90 (60.0)	150
Partner's education level*						
No education	946 (69.4)	637 (46.73)	277 (20.32)	32 (2.34)	417 (30.61)	1363
Primary	730 (66.0)	535 (48.37)	181 (16.36)	14 (1.26)	376 (34.0)	1106
Secondary	820 (58.61)	610 (43.6)	189 (13.5)	21 (1.5)	579 (41.35)	1399
Higher	194 (47.08)	162 (39.32)	32 (7.76)	-	218 (53.04)	412
Type of place of residence*						
Urban	258 (54.66)	195 (41.31)	56 (11.86)	7 (1.48)	1376 (36.12)	472
Rural	2433 (63.87)	1749 (45.91)	624 (16.38)	60 (1.57)	214 (45.24)	3809
Religion						
Hindu	2606 (62.94)	1887 (45.57)	655 (15.82)	64 (1.54)	1534 (37.05)	4140
Muslim	36 (50.0)	26 (36.11)	9 (12.5)	1 (1.38)	36 (50.0)	72
Christian	49 (73.13)	32 (47.76)	15 (22.38)	2 (2.98)	18 (26.85)	67
Others	1 (33.33)	-	1 (33.33)	-	2 (66.66)	3

(Cont...)

CHARACTERISTICS	Anaemic	Degree of Anaemia			Non-Anaemic	Total
		Mild	Moderate	Severe		
Hindu Vs others						
Hindu	2606 (62.94)	1887 (45.57)	655 (15.82)	64 (1.54)	1534 (37.05)	4140
Others	86 (60.56)	58 (40.84)	25 (17.6)	3 (2.11)	56 (39.43)	142
Ethnicity*						
Scheduled caste	602 (66.29)	415 (45.7)	165 (18.17)	22 (2.42)	306 (33.7)	908
Scheduled tribe	623 (74.7)	428 (51.31)	179 (21.46)	16 (1.91)	211 (25.29)	834
Other backward caste	814 (61.01)	594 (44.52)	197 (14.76)	23 (1.72)	521 (39.05)	1334
Others[3]	654 (54.27)	507 (42.07)	140 (11.61)	7 (0.58)	552 (45.8)	1205
SC/ST Vs Others*						
SC/ST	1223 (70.28)	841 (48.33)	344 (19.77)	38 (2.18)	517 (29.69)	1740
OBC and Others	1469 (57.78)	1103 (43.39)	336 (13.21)	30 (1.18)	1073 (42.24)	2542
Region*						
Northern Orissa	448 (67.87)	321 (48.63)	117 (17.72)	10 (1.5)	212 (32.12)	660
Southern Orissa	412 (57.7)	300 (42.01)	107 (14.98)	5 (log 7^{-03})	302 (42.29)	714
Western Orissa	606 (63.32)	446 (46.6)	146 (15.25)	14 (1.46)	349 (36.46)	957
Eastern Orissa	1220 (62.59)	874 (44.84)	310 (15.9)	36 1.84)	727 (37.3)	1949

Source NFHS-2; 1998-99

Here * denotes statistical association at 5% level of significance.

Here ** denotes statistical association at 10% level of significance

[3] Others include socially forward casts. We refer it as general category in some places.

3.1.3 Economic characteristics of anaemia:

Summary economic status of households indicated by standard of living index has a bearing with the status and degree of anaemia [[Krishna Mohan; 2002, Benteley and Griffith; 2003]. The household standard of living index reflects the household's economic capacity to provide basic needs for a healthy living that determine the nutrition status of the women in that household. We found in households with lower economic status, prevalence of anaemia is more (67.84%) compared to (60.91%) in medium ranked households and only (44.25%) in high status households. The pattern holds good for all the degree of anaemia as well. The household standard of living index also bears a significant association with occupation status of the women and their partners. Apart from that it is also significantly associated with sex of the household head (female headed household are of low economic status) and ethnicity of the household. SC/ST households are found to be more of lower economic status, which in turn affect the nutrition outcome of the women in these households.

The working status of the women could also determine the nutrition outcome of the women. In our case we found there are significant relationship between women's nutrition status in terms of anaemia and working status of the women and their partners. Our findings suggest that prevalence of anaemia is more among women working in agriculture (69.85%) followed by women working in non-agricultural sectors (65.56%) and women not indulging in any economic activity (60.71%). The pattern holds good for all the degree of anaemia as well and statistically significant at 1-% level (see table 3.1.3). The partner's occupation status also has impact on women's nutrition level because it is related to over all economic status of the household. In our case however the relationship is not statistically significant. We find spouses of the partners working in agriculture are found to be more anaemic (65.89%), followed by partners not working (62.9%), and partners working in non-agricultural sector (60.12%). Here we can say that women, whose husband are not working, may face greater burden on their health because it may affect the income capacity of the household. However partners who are working in non-agriculture sector may have better economic status compared to their agriculture counterpart, which reflects in better nutrition status of their wives. The prevalence of mild, moderate and severe anaemia are more among women whose spouse work in agriculture (see table 3.1.3).

Table-3.1.3. Analysis of Anaemia According to economic indicators among Ever Married Women in Orissa.

Characteristics	*Anaemic*	*Degree of Anaemia*			*Non-Anaemic*	*Total*
		Mild	*Moderate*	*Severe*		
***Household Standard of Living Index**[4][vi]*						
Low	1557 (67.84.)	1101 (47.97)	416 (18.12)	40 (1.74)	738 (32.15)	2295
Medium	921 (60.91)	668 (44.17)	227 (15.01)	26 (1.71)	591 (39.08)	1512
High	204 (44.25)	167 (36.22)	36 (7.8)	1 (.21)	257 (55.74)	461
***Respondent's occupation**[vii]*						
Not working	1807 (60.71)	1317 (44.25)	448 (15.05)	42 (1.41)	1169 (39.61)	2976
Agriculture	468 (69.85)	325 (48.5)	125 (18.65)	18 (2.68)	202 (30.14)	670
Non-agriculture	417 (65.56)	303 (47.64)	107 (16.82)	7 (1.1)	219 (34.43)	636
***Partner's occupation**[viii]*						
Not working	78 (62.9)	63 (50.8)	15 (12.09)	-	46 (36.8)	124
Agriculture	1310 (65.89)	922 (70.38)	350 (17.6)	38 (1.91)	678 (34.08)	1988
Non-agriculture	1303 (60.12)	959 (73.59)	315 (24.17)	29 (2.25)	864 (39.87)	2167

Source NFHS-2; 1998-99
Here * denotes statistical association at 5% level of significance.
Here ** denotes statistical association at 10% level of significance

[4] Household Standard of Living Index holds information for only 4268 cases.

3.1.4 Availability of Basic Infrastructure:

The availability and quality of sanitation facility and drinking water have definite impact on health outcome of the members of the household [Mohan; 2002, Benteley and Griffith; 2003.] Especially the role of pure drinking water is very much related to the bacterial diseases like diarrhea, jaundice, dysentery etc. These diseases reduce the body's capability to prevent other diseases. It also results in loss of hemoglobin in the blood, resulting in anaemia. Especially in poor households the lack of pure drinking water is widespread. Our result shows that those women from those households using surface water (river, pond, lake, dam, stream etc.) have high prevalence of anaemia (71.69%) compared to those who use water from well (62.99%). Here the well water includes water from private open and covered well and public open and covered well as well as public and private hand pumps. But women from those households using public water supply (through public tap, tanker or private connection to public water supply system) reported less prevalence (54.03%) compared to other groups. However the prevalence of severe anaemia is very less among those women who use public water supply (0.8%), followed by the group using well water (1.53%) and surface water (2.83%). The prevalence of mild and moderate anaemia are also very high among women using surface water (47.48% and 21.38%) and lowest among women using public water (40.86% and 12.36%). These results are found to be significant at 1-% level (see table 3.1.4.). However sources of drinking water is found to be significantly associated with household standard of living index also.

The toilet facility represents sanitation condition available in the household. We found it to be having a significant relationship (at 1-% level) with anaemia outcome. Those women who have any type of toilet facility (private or public or flush or pit), experience less anaemia (46%) compared to those women who have no such facilities (65.6%). The severity of anaemia is also found to be less than 1% among women having any toilet facility (0.99) while it is 1.65% among the other group. The pattern also confirms this trend of having low prevalence of mild and moderate anaemia among women having toilets (see table 3.1.4).

Table-3.1.4 Pattern of Anaemia among women by basic infrastructures

Characteristics	*Anaemia*	*Degree of Anaemia*			*Non-Anaemic*	*Total*
		Mild	*Moderate*	*Severe*		
Sources of drinking water*						
Public Water	201 (54.03)	152 (40.86)	46 (12.36)	3 (0.8)	171 (45.96)	372
Well	2262 (62.99)	1641 (45.69)	566 (15.76)	55 (1.53)	1329 (37.0)	3591
Surface water	228 (71.69)	151 (47.48)	68 (21.38)	9 (2.83)	90 (28.21)	318
Toilet*						
Have toilet	277 (46.08)	219 (36.43)	52 (8.65)	6 (0.99)	1266 (34.39)	601
No toilet	2415 (65.6)	1725 (46.86)	629 (17.08)	61 (1.65)	324 (53.91)	3681
Has Electricity*						
No	1813 (67.42)	1268 (47.15)	500 (18.59))	45 (1.67)	876 (32.57)	2689
Yes	880 (55.2)	677 (42.47)	181 (11.35)	22 (1.38)	714 (44.82)	1594

Source NFHS-2; 1998-99

Here * denotes statistical association at 5% level of significance.

Here ** denotes statistical association at 10% level of significance

As regards electricity, which is another indicator of better household status we find a significant association between availability of electricity in households and prevalence of anaemia. Women from those households without electricity reports higher percentage of anaemia prevalence (67.42%) compared to women from households having electricity (55.2%). The observed pattern holds good for mild, moderate and severe categories as well (see Table 3.1.4).

3.1.5. Anaemia outcome and dietary practice of women

Dietary constituents of the meal have very important bearing on women's anaemic outcome [Hamilton; 1984, Mohan; 2002, Benteley and Griffith; 2003.]. Especially, women of reproductive ages need a well balanced diet containing recommended amount of calorie, fat, protein, vitamin, minerals etc. The influence of food intake on anaemic outcome is clinically proved and beyond any controversy. So we analyze the dietary practices of women in Orissa on their nutrition outcome. We take major food items recommended by clinicians for women. NFHS-2 have data on some of major food item essential for woman's better health; like intake of milk/curd, pulses, vegetables, fruits, animal proteins like egg, meat, chicken etc.

The results shows that those who do not consume milk/or curd have grater prevalence of anaemia (68.39%) compared to those women who take it daily (51.39%). Those who take occasionally (not on daily basis) also suffer more from anaemia (64.26%) compared to those who take it at least once in a week (56.26%). Hence we can conclude that frequency of taking milk/curd reduces the risk of getting anaemic. The pattern persists in case of moderate and severe category as well. Women never taking milk/curd are found to have higher prevalence of moderate and severe anaemia. The table provides evidence towards intake of milk/curd having significant impact on anaemia outcome of the women.

In case of pulses and beans, we found significant association with anaemia outcome. We found that those who take pulses or beans daily, experience less prevalence (58.9%) compared to women having weekly or occasional intake of pulses (64.57% and 68.08% respectively) and those who never take (59.57%). But one interesting outcome is that women taking pulses occasionally are worst sufferers of anaemia compared to those who do not take at all. The percentage of prevalence of mild

anaemia also very high among women who take pulses weekly (45.67%) and who take it occasionally (45.34%). It is higher for the women who do not take pulses at all (48.93%). In case of prevalence of severe anaemia also we found women taking pulses occasionally are worst sufferer (2.58%) compared to other three groups; 2.12% among women who never take it, 1.44% in case of those who consume occasionally and 1.21% who take it daily (see table 3.1.5.)The result is quite contrary to the widely accepted notion but this fact can not be falsified in the given data. However this fact can be further examined by taking the various types of pulses and their quantity consumed by the women of the household. Unfortunately the NFHS data do not provide such details.

The consumption of green leafy vegetables does not show any statistically significant relationship with anaemia outcome. These are rich source of iron and vitamin-A. So the important question here is the frequency of intake. Quite interestingly those women who reported no intake of green leafy vegetables reported lowest percentage of anaemia prevalence (37.5%) compared to those who take it daily (63.45%), weekly (62.38%) and occasionally (61.76%). Only 8 women do not take any kind of green leafy vegetables. The result shows that as frequency of intake of these green leafy vegetable increases the anaemia prevalence also rises. This pattern holds good for mild anaemia as well. In case of moderate anaemia also those who consume these vegetables at least once in a week are more anaemic (17.04%) compared to the daily and occasionally consuming women. (15.36% and 15.24% respectively. However in case of severity of anaemia the frequency of consumption, to some extent positively relates to the outcome. Those who take green leafy vegetables weekly report lowest prevalence (1.44%), compared to women consuming daily (1.35%) and occasionally (3.2%). Still women consuming daily are worst compared to others. So here the type and quantity of the green leafy vegetables consumed matter more rather than frequency of intake. Also exclusive consumption of green leafy vegetables may be more common in poor households as it is obtained from one's own garden and may not have its suggestive positive impact.

Consumption of other vegetables (other than green vegetables) is significantly related with both anaemia outcome and degree of anaemia. Here also picture is not clear as in case of consumption of green vegetables. Despite that daily consumption shows better

results. We found prevalence of any kind of anaemia is less among women who consume vegetables on daily basis (59.2%) compared to those who consume weekly (66.94%) and occasionally (65.36%). This trend holds good for all the degree of anaemia except mild category where women consuming weekly are little better off (44.02%) than their daily counter part (45.55). In case of moderate category however the weekly consumers show greater prevalence (20.41%) compared to daily consumers (14.95%) and occasional takers (15.64%). However the gap between the daily takers and occasional takers is very low in this category. In case of severity of anaemia the weekly takers again perform very badly (2.5%) compared to daily (1.35%) and occasional takers (1.67%). [See table 3.1.5. below].

In case of fruit intake also we found women having daily fruit intake reports lowest prevalence of anaemia (50.98%) compared to other women who take it weekly (58.18%), occasionally (63.62%) and never (67.47%). In fact those who do not take fruit at all reports highest percentage of anaemia compared to other groups. The daily takers of fruits also report lowest prevalence of mild anaemia (38.23%) compared to those women who do not take at all reported highest (48.54%). Coming to moderate degree of anaemia, we find those women who consume fruit regularly reported very low prevalence (1.07%) compared to other groups. But as far as severity of anaemia is concerned those who consume weekly (1.15%) and occasionally (1.56%) perform better than those who take regularly (1.96%) do. But who do not take any fruit item record highest percentage of severe anaemia (3%). [see table 3.1.5.].

Consumption of eggs is also significantly related to the anaemia outcomes. We find those who take egg on a daily basis have lower percentage of prevalence of anaemia (54.83%) compared to other groups; for weekly consumers prevalence is 57.12%, for occasional consumers 65.24% and for those who do not take eggs show highest prevalence (60.26%). The same pattern persists in case of both mild and moderate types of anaemia. But in case of severe anaemia we find a higher percentage among daily consumers compared to weekly and occasional consumers, for both of which prevalence is below 1.5%. But the prevalence of severe anaemia definitely is the highest among women not consuming egg (20.35%). [See table 3.1.5.].

Consumption of chicken/meat/fish are also found to be significantly related to anaemia at 10% level, but it is not significant with degree of anaemia even at 10% level.

However the pattern show that those who consume these items on a daily basis are less anaemic (53.22%) compared to the other groups. But we found those who consume weekly or occasionally are more anaemic (61.51% and 64.09%) compared to those who never take (58.71%). Though in the last category anaemia is more compared to those who take it regularly. Surprisingly in case of mild anaemia we found prevalence is lowest among those who do not eat these items (41.28%), against other groups. On the other hand those who consume these items daily found to be more anaemic (46.77%) compared to any other group in this category of anaemia. However in case of moderate prevalence daily consumers have shown lowest percentage (4.83%) compared to 16.57% among women who consume occasionally followed by those who consume weekly (14.94%). But those women who do not take these items are found to be in more or less same category of women who consume these items weekly or occasionally. There is not much variation in case of severe anaemia and intake of these items. All the categories register the percentage of women around 1.5% to 1.7%, being severe anaemic. So one can say that severity of anaemia may not be directly resulting from eating or not eating of these items but due to other factors. [See table 3.1.5]

However we found there are significant two-way relationship between household standard of living index and intake of all these items (at 1-% level). The three way cross tabulation of household standard of living index, prevalence of anaemia and different food items found statistically significant relationship with respect to milk/curd, pulses or beans, green leafy vegetables, other vegetables, fruits, eggs, chicken/meat/fish. For degree of anaemia the same exercise found significant three way relationship for milk/curd, pulses or beans, green leafy vegetables, other vegetables, fruits, eggs. This proves that households economic status plays a crucial role for diet intake of women in Orissa which in turn determine their over all nutrition status.

Table-3.1.5. Pattern of Anaemia among women by food habits

Characteristics	*Anaemia*	*Degree of Anaemia*			*Non-Anaemic*	*Total*
		Mild	*Moderate*	*Severe*		
Milk/curd*						
Daily	221 (51.39)	171 (39.76)	47 (10.93)	3 (.69)	209 (48.6)	430
weekly	256 (56.26)	193 (42.41)	56 (12.3)	7 (1.53)	199 (43.73)	455
occasionally	1676 (64.26)	1224 (46.93)	411 (15.75)	41 (1.57)	932 (35.73)	2608
Never	541 (68.39)	356 (45.0)	168 (21.23)	17 (2.14)	250 (31.6)	791
Pulses*						
Daily	1015 (58.9)	777 (45.09)	217 (12.59)	21 (1.21)	708 (41.09)	1723
weekly	1121 (64.57)	793 (45.67)	303 (17.45)	25 (1.44)	615 (35.42)	1736
occasionally	527 (68.08)	351 (45.34)	156 (20.15)	20 (2.58)	247	774
Never	28 (59.57)	23 (48.93)	4 (8.51)	1 (2.12)	19 (40.42)	47
Green leafy vegetables						
Daily	1540 (63.45)	1132 (46.64)	373 (15.36)	35 (1.44)	887 (36.54)	2427
weekly	919 (62.38)	648 (43.99)	251 (17.04)	20 (1.35)	554 (37.61)	1473
occasionally	231 (61.76)	162 (43.31)	57 (15.24)	12 (3.2)	143 (38.23)	374
Never	3 (37.5)	3 (37.5)	-	-	5 (62.5)	8
Other Vegetables*						
Daily	2003 (59.2)	1541 (45.55)	506 (14.95)	46 (1.35)	1290 (38.13)	3383
weekly	482 (66.94)	317 (44.02)	147 (20.41)	18 (2.5)	238	720
occasionally	117 (65.36)	86 (48.04)	28 (15.64)	3 (1.67)	62 (34.63)	179
Never	-	-	-	-	-	-

(Cont...)

Characteristics	*Anaemia*	*Degree of Anaemia*			*Non-Anaemic*	*Total*
		Mild	*Moderate*	*Severe*		
Fruits*						
Daily	52 (50.98)	39 (38.23)	11 (1.07)	2 (1.96)	50 (49.01)	102
weekly	302 (58.18)	225 (43.35)	71 (13.68)	6 (1.15)	217 (41.81)	519
occasionally	2199 (63.62)	1580 (45.71)	565 (16.34)	54 (1.56)	1257 (36.37)	3456
Never	139 (67.47)	100 (48.54)	33 (16.01)	6 (2.91)	67 (32.52)	206
Eggs*						
Daily	17 (54.83)	12 (38.7)	3 (9.67)	2 (6.45)	14 (45.16)	31
weekly	365 (57.12)	269 (42.09)	88 (13.77)	8 (1.25)	274 (42.87)	639
occasionally	1620 (65.24)	1177 (47.4)	408 (16.43)	35 (1.4)	853	2483
Never	681 (60.26)	487 (43.09)	171 (15.13)	23 (20.35)	449 (39.73)	1130
Chicken/Meat/Fish**[5]						
Daily	33 (53.22)	29 (46.77)	3 (4.83)	1 (1.61)	29 (46.77)	62
weekly	708 (61.51)	517 (44.91)	172 (14.94)	19 (1.65)	443 (38.48)	1151
occasionally	1787 (64.09)	1283 (46.01)	462 (16.57)	42 (1.5)	1001 (35.9)	2788
Never	165 (58.71)	116 (41.28)	44 (15.65)	5 (1.77)	116 (41.28)	281

Source NFHS-2; 1998-99

Here * denotes statistical association at 5% level of significance.

Here ** denotes statistical association at 10% level of significance

[5] Here consumption of chicken/meat/fish found to be statistically significant at 10% level for anaemic/non-anaemic, however the result is not significantly associated with degree of anaemia.

3.1.6 A discussion on association of prominent characteristics with maternal anaemia controlling for households standard of living index (Household SLI)

Given that all characteristic variables associate with anaemia outcome and their significance, it is also found that they are strongly associated with economic status of the household conceived in terms of the standard of living index (SLI). The table given in Annex-3 strengthens our analysis given in tables 3.1.1 to 3.1.5 further by bringing in the economic status as controlling factor. Table in 3.1.6 shows household size only matters for households with lower economic status, for both anaemia and degree of anaemia outcome. We find that total childbirth is significantly associated with anaemia outcome with respect to all types of households. Age at first marriage is significant for low and medium level household SLI with regard to anaemia and degree of anaemia outcome. Sex of the household head is significant for both anaemia and degree of anaemia in lower SLI household (10% level). However it is also significant for women of high SLI category household at 10 % level. Types of place of residence are significantly associated with anaemia only for rural household (at 10% level). But it is not significant for degree of anaemia in any category of the household. Similarly educational status is only significant for low and medium level SLI households in case of anaemia as well as degree of anaemia. Education level of the partner only turns out to be significant for rural household at 10% level. But it is significant for all level of household economic status (SLI) with respect to degree of anaemia. Ethnicity is found to be significantly associated with low and medium level SLI of household for being anaemic. Source of drinking water is significant for both anaemia and degree of anaemia for low economic status households (low SLI) households for 10% level. The toilet facility does not matter for anaemia or degree of anaemia for women of low SLI households. But it is significant for medium SLI households at 10% level. For high SLI households it only matters for anaemia outcome for 10% level. Electricity comes out to be significant for all kinds of anaemia across all SLI households. Consumption frequency of Milk/curd is only important for medium SLI households at 10% level for both anaemia and degree of anaemia. Consumption of pulses or beans does not matter for anaemia, for any type of household except for low SLI households for degree of anaemia.

Table 3.1.6

_Degree of association of selected characteristics with Stunting, Underweight and Waisting controlled for household standard of living index

Characteristics	*groupings*	*Controlled for Standard of living index*	Anaemic/Non-Anaemic	*Degree of Anaemia*
Household size	1-4	Low	-[6]	**[7]
	4-7	Medium	-	-
	8"	High	-	-
Total child birth	No child	Low	*[8]	*
	One or two	Medium	*	*
	children	High	**[9]	*
	More than two			
Age at first marriage	Less than 18	Low	*	*
	≥ 18	Medium	*	*
		High	-[10]	-
Sex of the households	Female	Low	**	**
	male	Medium	-	-
		High	-	*
Age at first birth	Less than 18	Low	-	-
	≥ 18	Medium	**	-
		High	-	-
Types of place of residence	Rural	Low	**	-
	urban	Medium	-	-
		High	-	-
Education level of the respondent	No education	Low	**	**
	Primary	Medium	*	*
	Secondary	High	-	-
	Higher			
Region	North Orissa	Low	-	*
	Southern Orissa	Medium	-	-
	Western Orissa	High	-	-
	Eastern Orissa			
Education level of the partner	No education	Low	*	*
	Primary	Medium	-	**
	Secondary	High	-	*
	Higher			
Ethnicity	SC	Low	*	*
	ST	Medium	*	*
	OBC	High	-	*
	Others			

(Cont..)

Work status of women	No work	Low	-	-
	Agriculture	Medium	**	**
	Non-Agriculture	High	-	-

(Cont..)

[6] refers to no significance at all.

[7] Significant at 10% level.

[8] Significant at 1-% level.

Characteristics	*groupings*	*Controlled for Standard of living index*	Anaemic/Non-Anaemic	*Degree of Anaemia*
Partner's occupation	No work	Low	-	-
	Agriculture	Medium	-	-
	Non-Agriculture	High	*	**
Source of drinking water	Source of drinking water	Low	**	**
		Medium	-	-
		High	-	*
Toilet	Have toilet	Low	-	-
	No Toilet	Medium	*	*
		High	**	-
Electricity	No	Low	**	**
	Yes	Medium	**	*
		High	**	-
Intake of Milk or curd	Daily	Low	-	-
	Weekly	Medium	**	*
	Occasionally	High	-	-
	never			
Intake of Pulses or beans	Daily	Low	-	**
	Weekly	Medium	-	-
	Occasionally	High	-	-
	never			
Intake of Green leafy Vegetables	Daily	Low	-	*
	Weekly	Medium	-	**
	Occasionally	High	-	-
	never			
Intake of Other Vegetables	Daily	Low	-	-
	Weekly	Medium	-	-
	Occasionally	High	-	-
	never			
Intake of Fruits	Daily	Low	-	-
	Weekly	Medium	-	-
	Occasionally	High	-	-
	never			
Intake of Consumption of Eggs	Daily	Low	-	**
	Weekly	Medium	-	-
	Occasionally	High	-	-
	never			
Intake of Chicken/meat/fish	Daily	Low	-	-
	Weekly	Medium	-	-
	Occasionally	High	-	-
	never			

Source NFHS-2; 1998-99
Here * denotes statistical association at 5% level of significance.
Here ** denotes statistical association at 10% level of significance

Green leafy vegetables only matters for low and medium level of the households at 10% level. Consumption of other vegetables (other than green leafy vegetables) and fruits have no bearings on anaemia and degree of anaemia for any economic status. Likewise egg and other animal proteins do not matter for anaemia or degree of

anaemia for all types of household (when controlled for economic status). [For all these see Table 3.1.6].

3.1.7 Regional variation: Role of regional variation in nutrition outcome for given economic and social status of the household with in the region

In this section we only discuss the significance level of the association between maternal anaemia and household economic and social status across different regions of Orissa. We found that both economic and social status have statistically significant association with both anaemia/non-anaemia and degree of anaemia outcomes, across all the regions. We did not mention the exact pattern in terms of numbers because we have some discussion in earlier sections.

Table 3.1.7
Regional variation in Maternal Anaemia-non anaemia and degree of maternal anaemia controlling for social and economic status of the household

Region	Economic status		Social status	
	Anaemia/Non-Anaemia	Degree of anaemia	Anaemia/Non-Anaemia	Degree of anaemia
North Orissa	*	*	*	*
South Orissa	*	*	*	*
Western Orissa	*	*	*	*
Eastern Orissa	*	*	*	*

Source NFHS-2; 1998-99

Here * denotes statistical association at 5% level of significance.

3.1.8a Role of economic status of the households in determining maternal undernutrition outcome in terms of anaemia with in different social groups

There is vast literature on economic status of the household and their health and nutrition outcome. Some of the well known theoretical and empirical works are done by Deolalikar; 1988, 1989, 1990, Gopalan; 1990, 1992, 1997, Sen;1989, 2000, Ray; 2000, Vaidyanathan 1993, Pal; 2002, Svedburg; 2002, Mohan; 2003 Griffth 2003; Dreaze and Deaton; 2003, and many others, for India. In India scheduled caste and scheduled tribe population are deprived of many economic and social rights. They live on the margins. In case of Orissa tribal population account for 48% of the population. They are still living on the margin and are considered a socio-economically deprived group. As a result they have less access to economic opportunities, education and health etc. The hierarchical structures within these deprived communities makes women more deprived and vulnerable. Women in these

households face the burden of economic and social deprivation at an alarming proportion. They also supplement household earning by doing job in agriculture and other informal sectors. In addition, they are at the receiving end of many social stigmas like alcoholism, domestic violence, lack of control on economic assets, low access to health care services and many other deprivations. These economic and social deprivations have a definite bearing on their nutrition outcome. We have attempted here to know the pattern of under nutrition measured in terms of anaemia and degree of anaemia among different caste groups controlling for SLI level of the household. We find that prevalence of anaemia is higher among lower strata of the scheduled caste (68.16%) and scheduled tribe (74.33%) where as compared to the lower strata of the OBCs (61.33%) and general category (58.99%). But in OBC and general category the percentage of anaemia and degree of anaemia comes down as economic status increases. But in case of scheduled caste households it only holds good for anaemia and mild and moderate type of anaemia. But in case of tribal households the pattern is little unclear for anaemia with mild and moderate degree. But the households with higher status have fewer shares compared to other two types of households. While anaemia and degree of anaemia have significance relationship (at 1-% level) with households status in OBCs and general categories, it is not so for scheduled caste and scheduled tribe households. This is a puzzle. The women from scheduled caste household only have significant association with anaemia (10% level) and tribal women for degree of anaemia (at 10% level). Here the cultural and social practices and beliefs may have some role to play.

Table 3.1.8a

A description of the nutritional outcome of the women by household economic status controlling for the social back ground of the households

Characteristics	*Anaemia*	*Degree of Anaemia*			*Non-Anaemic*	*Total*
		Mild	*Moderate*	*Severe*		
Scheduled caste						
Low	456 (68.16)	315 (47.08)	124 (18.35)	17 (2.54)	213 (31.83)	669
Medium	134 (62.32)	93 (43.25)	38 (17.64)	3 (1.39)	81 (37.67)	215
High	9 (45.0)	5 (25.0)	3 (15.0)	1 (5.0)	11 (55.0)	20
Scheduled Tribe						
Low	475 (74.33)	331 (51.79)	136 (21.28)	8 (1.25)	164 (25.66)	639
Medium	141 (77.04)	92 (50.27)	41 (22.4)	8 (4.37)	42 922.95)	183
High	5 (50.0)	3 (30.0)	2 (20.0)	-	5 (50.0)	10
Other backward caste*						
Low	324 (61.13)	286 (43.92)	105 (19.81)	13 (2.45)	206 (38.86)	530
Medium	337 (58.5)	253 (43.92)	75 (13.02)	9 (1.56)	239 (41.49)	576
High	67 (48.20)	51 (36.69)	16 (11.51)	-	72 (51.79)	139
General*						
Low	223 (58.99)	169 (44.7)	52 (13.75)	2 (0.52)	155 (41.0)	378
Medium	304 (57.03)	227 (42.58)	72 (13.5)	5 (0.93)	229 (42.96)	533
High	122 (42.06)	108 (37.24)	14 (4.8)	-	168 (57.93)	290

Source NFHS-2; 1998-99

Here * denotes statistical association at 5% level of significance.

Here ** denotes statistical association at 10% level of significance

3.1.8b Role of Social status of the households in determining maternal undernutrition outcome with in different economic status

In this section we will try to find out how women from each social groups suffer from anaemia and degree of anaemia within the given economic status. We found that in all the three economic groups tribal women have higher percentage of anaemia compared to women from other social groups. In case of low status households it is 74.33% while in case of medium economic status it is further high to 77.04%. Among higher status households also this groups has 50% of it's women anaemic. Women from scheduled caste also found to be more vulnerable to anaemia followed by tribal women. Women from OBC background for low and medium economic status households are found to be better than SC / STs. However in low and medium category the women from general category show lowest percentage of anaemia. But in cases of high status households, OBC women are better than general category.

Taking degree of prevalence into account, we found for mild anaemia, women with tribal background are reporting higher percentages in low and medium economic status, followed by scheduled caste women and women from OBC. Women from general social category report lowest percentage of mild anaemia for low and medium category. But in high economic status group women from general category are more anaemic to mild anaemia, after tribal women, followed by scheduled caste women and women from other backward caste. However the high economic status is not significant for anaemia/no anaemia, but found to be significant at 1-% level for degree of anaemia. In case of moderate anaemia category, we found that tribal women are most vulnerable groups to any kind of anaemia compared to other social groups within a given economic status. [See column 2b of the table 3.1.7b]. In case of severe anaemia the pattern is little doubtful. However one interesting fact is that there is no severe anaemia cases found, except 1 out of 526 women from higher economic status. There is no case of severity among women from tribal, other backward caste and general categories for high economic status households. She is found to be from SC category. Women from general category are found to be below 1% for severe anaemia in low and medium economic status households. Discussion in this table reveals a definite pattern to the economic and social status of the women vis-à-vis their nutritional status measured in terms of anaemia. Tribal women and women from scheduled castes are found to be more vulnerable to anaemia and it's various degrees

compared to other two social groups. So a concrete and targeted policy is required for women in these two most backward social groups in Orissa to improve their anaemia status vis-à-vis other groups. This may require an integrated approach of various economic, social, health measures with gender sensitivity, to tackle the menace. The vicious cycle of low economic status and poor nutrition status can be resolved through a vigorous interventionist approach targeting these groups. So the measures must ensure creation of economic assets in these households with provision for access to it, by the female members of the household, accompanied with comprehensive education and health programmes. The programmes should be formulated and implemented at a more decentralised manner to cope with local and region specific needs.

Table 3.1.8.b
A description of the nutritional outcome of the women by ethnicity controlling for the economic status of the household

Charact-eristics (1)	*Anaemia (2)*	*Degree of Anaemia*			*Non-Anaemic (3)*	*Total (4)*
		Mild (2a)	*Moderate (2b)*	*Severe (2c)*		
Low*						
SC	456 (68.16)	315 (47.08)	124 (18.532)	17 (2.54)	213 (31.83)	669
ST	475 (74.33)	331 (51.79)	136 (21.28)	8 (1.25)	164 (25.66)	639
OBC	404 (66.22)	286 (46.88)	105 (17.21)	13 (2.13)	206 (33.77)	530
General	223 (58.99)	169 (44.7)	52 (13.75)	2 (0.52)	155 (41.0)	378
Medium*						
SC	134 (62.32)	93 (43.25)	38 (17.67)	3 (1.39)	81 (37.67)	215
ST	141 (77.04)	92(50.27)	41 (22.04)	8(4.37)	42 (22.95)	183
OBC	337(58.5)	253 (43.93)	75(13.02)	9 (1.56)	239 (41.49)	576
General	304 (57.03)	227 (42.58)	72(13.5)	5(0.93)	229 (42.96)	533
High						
SC	9 (45.0)	5 (25.0)	3 (15.0)	1 (5.0)	11 (55.0)	20
ST	5 (50.0)	3 (30.0)	2 (20.0)	-	5 (50.0)	10
OBC	67 (32.52)	51 (24.75)	16 (7.76)	-	72 (34.91)	139
General	122 (42.06)	108 (37.24)	14 (4.82)	-	168 (57.93)	290

Source NFHS-2; 1998-99
Here * denotes statistical association at 5% level of significance.
Here ** denotes statistical association at 10% level of significance

3.1.9 Rural-Urban pattern in maternal anaemia across various social groups[11]

The rural-urban divide with in the different social groups for maternal anaemia outcome also found to be statistically significant for rural areas. We found that 67.2% of scheduled caste women from rural households are anaemic where as in case of their counterparts in urban households, it is 56.41%. This pattern holds good for moderate

[11] For rural area we found social background is important for both anaemia and degree of anaemia prevalence among the women of age (15-49 years).

and severe degrees of anaemia as well. For tribal women we found that 74.9% of the children from rural areas have anaemia prevalence compared to 67.5% among urban women. The pattern holds good for all the degree of anaemia as well. So women from tribal households living in urban areas are comparatively better off than their counterparts from urban set-up.

For OBC category we found that women from rural households are relatively at higher risk compared to their urban counterparts. In case of women from other category (which include socially forward castes and economically well to do groups) there is a clear-cut rural-urban divide for all the degrees of anaemia. [For detail see table 3.1.9].

But if we look with in rural set up we can see that tribal women are at highest risk for anaemia compared to any other social groups. 74.9% of women from tribal households and rural background are found to have some degree of anaemia. Among scheduled caste women within rural background, 67.2% are found to have some degree of anaemia. The corresponding figures for OBC and others stands at 61.4% and 55.4% respectively.

Table 3.1.9 Pattern of Anaemia among women by rural-urban residence within different social groups

Charact-eristics	*Anaemia*	*Degree of Anaemia*			*Non-Anaemic*	*Total*
		Mild	*Moderate*	*Severe*		
Scheduled caste						
Rural*	558 (67.22)	383 (46.14)	155 (18.67)	20 (2.4)	272 (32.77)	830
Urban	44 (56.41)	32 (41.02)	10 (12.82)	2 (2.56)	34 (43.58)	78
Scheduled Tribe						
Rural*	594 (74.9)	407 (51.32)	172 (21.68)	15 (1.89)	199 (25.09)	793
Urban	27 (67.5)	19 (47.5)	7 (17.5)	1 (2.5)	13 (32.5)	40
Other backward caste						
Rural*	727 (61.45)	530 (44.8)	177 (14.96)	20 (1.69)	456 (38.54)	1183
Urban	87 (57.23)	64 (42.1)	20 (13.15)	3 (1.97)	65 42.76)	152
Others						
Rural*	551 (55.04)	427 (42.65)	120 (11.98)	4 (3.99)	450 (44.95)	1001
Urban	102 (50.0)	80 (39.21)	20 (9.8)	2 (log 9^{-03})	102 (50.0)	204

Here * denotes statistical association at 5% level of significance only for rural households.
Source NFHS-2; 1998-99

In urban areas we found that tribal women are the most vulnerable social group as far as maternal anaemia is concerned. 67.5% of scheduled tribal women are found to have some kind of anaemia followed by women from OBC category (57.23%), women from SC (56.4%) and others (50.0%) categories. But as far as prevalence of

severe anaemia is concerned scheduled caste women show the highest prevalence (2.56%) compared to 2.5% for tribal women in the urban set-up. Thus tribal and scheduled caste women are found to be the most vulnerable social groups to undernourishment in rural as well as urban set-ups.

3.1.10 Regression analysis for anaemia/non-anaemia and degree of anaemia for women in Orissa

Following the understanding of the characteristic association of anaemia outcome with control for various determining indicators, we examine the impact of selected determinants on the probable nutritional outcome for the women in Orissa. We have used both binomial and multinomial logit models in this regard. In section 3.1.8a we will discuss on findings of binomial logit model. In the next section i.e. 3.1.8b we will discuss the findings of multinomial logit model, where the focus is on degree of anaemia. Both the models are presented in table 3.1.10

3.1.10 Analysis of Binomial logit regression for degree of anaemia

This particular section is divided in to two parts. First part (3.1.10a) discuss about findings from binomial logit model. Second part (3.1.10b) contains findings from multinomial logit model.

3.1.10a Analysis of Binomial logit regression for degree of anaemia.

The binomial regression is used to assess the influence of different indicators on anaemia/non-anaemia outcome. This suggests the direction of the relationship between anaemia and other independent variables as well as it help us to quantify the relationship. In our analysis we take the non-anaemia as reference category and we use two dummies for household standard of living index. One is Low Vs medium and high another one is medium Vs low and high. This will help us to determine the degree of relationship between likelihood of being anaemic and economic status of the household.

The age factor also plays a crucial role in the anaemia outcome. However the relationship is not significant but has a positive sign, suggesting that women below 30 years of age are more vulnerable to anaemia. Household size also shows positive but insignificant association with anaemia outcome. Nonetheless it shows as family size

increases above 8 members per household, women are more likely to be anaemic. This is expected because size of the house may not affect the nutrition outcome of the women directly unless it is associated by low economic status of the household itself. If the over all economic condition is very poor then the size will matter.

More than three births in less than five years also have no significant impact on nutrition outcome but it has a negative sign. It may be implying that those who have given less than three births in less than five years may be of lower age. From earlier analysis we have found that women at lower ages are more anaemic. So number of births may not matter.

Our result from table 3.1.10 shows us that total number of children born to the respondent has significant negative relationship with anaemia outcome. Those mothers who have more than three children have less probability of being anaemic. The relationship found to have negative sign for anaemia (significant at 5% level) because it has a small odd ratio of less than one. This is quite contrary to the available findings. So it needs further cross examination which is not attempted here.

Similarly age at first marriage also has significant bearing on anaemic outcome. Women married at lower than 18 years of age are more likely to be anaemic compared to their counterparts who marry after 18. The odd ratio shows greater than one value for the age at first marriage. This also has positive sign, indicating as marriage age goes down, the likelihood of being anaemic increases.

The level of education is also found to be positively and significantly related to anaemia outcome. Women with no education are 1.42 times more likely to be anaemic compared with those, who have some kind of education. This may be due to better education ensuring better knowledge about hygiene, food habits and also help to participate in economic activity, all of which may ensure better nutrition outcome. Earlier we have shown that SLI of household has significant association with educational achievement of the respondent. [For detail see table 3.1.10].

How ever the religion is not significantly associated with the anaemia outcome.

As we said earlier ethnicity and standard of living index, which reflects economic status of the household, found to have significant and positive relationship with

anaemia outcome. Women from scheduled caste and Tribal households and low economic status are found to be more vulnerable to any kind of anaemia. Women from tribal and scheduled caste household are more likely (1.7 and 1.2 respectively) to be anaemic compared with women from other social groups. Similarly women from low SLI households are 1.3 times more likely to be anaemic compared to other categories. For medium status households it is 1.68 times. We use two dummies for the economic status. One poor versus medium and high economic status of the household and other one is for medium versus others. In both the cases we found women from poor and medium status households are more vulnerable to anaemia. Types of place of residence has also positive but insignificant association with anaemia outcome. However women in rural areas are relatively at higher risk to be anaemic compared to their urban counter parts. [For detail see table 3.1.10].

However working status of the women is also positively associated with anaemia outcome but the association lacks significance even at 10% level.

3.1.10b Analysis of Multinomial logit regression for degree of anaemia

In this model we use four-category dependent variable called degree of anaemia. It comprises information for Non-anaemia, Mild anaemia, and Moderate Anaemia and Severe anaemia. We have taken Non-Anaemia as reference category against which we compare other degrees of anaemia with some selected independent variables. We found that age group has positive sign but insignificant association with all the degree of anaemia except the moderate anaemia. The likelihood of moderately anaemic is 1.33 times more for women below age 30, compared to the women of 30 or above age group. This is significant at 1-% level.

Types of place of residence also have positive but insignificant association with different degree of anaemia. But positive relation shows that women in rural areas have greater likelihood of more than one for mild and moderate degree of anaemia against urban women (1.01 times for mild and 1.12 times for moderate).

Level of education though has positive sign, it is not significant while relating with anaemic status. But education is significant for moderate anaemia especially for non-educated and primary educated women (at 1-% level) against higher educated women. Though mild anaemia has positive sign, but it is not significantly associated with

degree of anaemia against higher educated women. Also in case of severe anaemia, the odds ratio for uneducated and low educated women (having primary and secondary education) is positive but insignificant against higher educated women. It is 24 times more likely to be severely anaemic for uneducated women against higher educated women. The women with primary and secondary education also show a very high odd ratio (16 and 21 respectively) against women with higher education.

However for ethnicity, it is significant as well as positively associated with Scheduled caste and scheduled tribe women at 1-% level of significance. This holds good for moderate as well as severe anaemia. For scheduled tribes, mild anaemia also shows positive sign with 1-% level of significance. Women from scheduled caste and tribe are more likely to be anaemic compare to other social groups. The likelihood of a scheduled caste women to be mild anaemic is 1.14 times more compared to women from general category. For tribal women this stands at 1.64 (significant at 1-% level), and other backward caste women it is 1.08 times. For moderate category the likelihood for SC women is 1.42 times (significant at 1-% level) and for tribal women it is 1.9 times (significant at 1-% level) compared to general category women. It means that tribal women are most vulnerable groups to anaemia as well as various types of anaemia compared to women from general category. OBC women are 1.17 times more likely to be moderately anaemic compared to general category. For degree of severity SC and tribal women are four times more likely to be anaemic (odds ratios is 4.61 and 4.55 respectively), followed by women from other backward caste (odds ratio is 3) in contrast to women from general category. All the odds ratio for SC, tribal and OBC women are found to be significant at 1-% level.

Family size does not seem to have influenced the anaemia outcome for any degree of anaemia. Total children ever born and birth in last five years show that they are weakly associated with prevalence of mild anaemia. But the table shows that women who gave 3 or more than 3 births are more likely (1.24 times) to have moderate anaemia compared to women who have gave less than 3 births. The odds ratio is also significant at 1-% level. The odds ratio for severe degree of anaemia for the women having 3 or more than 3 births, is 1.12. However it is not statistically significant.

Age at first marriage seems to have impact on degree of anaemia outcome, though it has positive odds ratio for all the degree, it is not statistically significant, except

moderate anaemia. But earlier in binomial model we see it strongly associated with anaemia/non-anaemia at 1-% level. However greater than one odds ratio for all degree show that women who marry before 18 years of age are more likely to be anaemic compared to those who marry at 18 or after 18 years of age.

Work status of the does not show any significant association with degree of anaemia outcome. This holds good for women working in agriculture as well as women who reported not working. The same holds good for husband's occupation as well.

Like binomial regression, standard of living index shows strong positive association (significant at 1-% level) for all kinds of anaemia. Women from low status households are 1.32 [significant at 1-% level] times more likely to be anaemic compared to women in high category. For medium level household it is 1.23 times [significant at 1-% level]. In case of moderate category the likelihood is 1.34 and 1.43 times for low and medium households compared to high economic status. [Significant at 1-% level]. For severity the likelihood stands at 4.1 and 5.6 times. It shows that women from poor households are at least four times more likely to be severely anaemic compared to high status household. However this association is not statistically significant. For tribal women it is four times more likely to be severely anaemic compared to their counter part in high status household [significant at 10% level]. This proves that women in poor households and medium status households to be more vulnerable to different degree of anaemia compared to their counterpart from high economic status.

Households with no toilet facility show that woman in those households have greater likelihood to all the degree of anaemia except severe anaemia. The odds ratios are found to be significant at 1-% level for mild and moderate anaemia. Similarly women from households using open source for drinking water have greater likelihood of being anaemic compare to the women who use safe drinking water. [For detail see table 3.1.10].

The whole discussion suggests that prevalence of anaemia among women in Orissa is a reflection of widespread poverty, income inequality, lack of basic infrastructure, education, and health service. This also brings the message that the benefits of economic development in Orissa are not reaching the poorer section. Our analysis shows that women from SC/STs households are more vulnerable to different kind of anaemia and over all anaemia prevalence is more among these social groups.

Table 3.1.10 Results of logistic regression analysis on the determinants of Maternal undernutrition in Orissa by Anemia-Nonanaemia and degree of anaemia indicators

Variable	Value levels	Anemia-Non-Anemia [12]		Degree of anemia[13]					
				Mild		Moderate		Severe[14]	
		Exp.	S.E.[15]	Exp. [16]	S.E.	Exp.	S.E.	Exp.	S.E.
Age Group	< 30	1.066	.076	.994	.081	1.35*	.109	.752	.292
	> 30	1	1	1	1	1	1	1	1
Religion	Hindu	1.02	1.03	1.01	.203	.845	.263	.497	.653
	Non-Hindu	1	1	1	1	1	1	1	1
Mother's education	uneducated	1.42*	.208	1.21	.219	2.38*	.400	24.3*	.430
	Primary	1.80	.206	1.21	.216	1.74	.399	16.3*	.480
	Secondary	1.14	.193	1.06	.203	1.47	.367	21.22*	.000
	Higher	1	1	1	1	1	1	1	
Place of residence	Rural	1.02	.125	1.01	.133	1.12	.194	.645	.481
	Urban	1	1	1	1	1	1	1	1
Ethnicity	SC	1.24*	.102	1.14	.109	1.42*	.150	4.61*	.478
	Tribal	1.74*	.117	1.64*	.124	1.94*	.164	4.55*	.517
	OBC	1.12	.087	1.08	.093	1.17	.135	3.01*	.460
	Others[17]	1	1	1	1	1	1	1	1

(Cont....)

[12] This represents binomial logit regression for anemia and non-anemia. Here the reference category is women with non-anaemia, against which odds ratio and standard error are calculated for women with anaemia

[13] This represents multinomial logit regression. Here dependent variable is degree of anaemia. The reference category is non-anaemia against which odds ratio and standard error are calculated for women with mild, moderate and severe degree of anaemia.

[14] For severe degree of anaemia, most of the odds ratio and standard error have extreme low or high values. Because of the fewer cases of severe anaemia among the mother, which is only 68, the corresponding figure might not be reliable for describing likelihood of severity in anaemia.

[15] S.E. refers to standard error.

[16] Exp. implies likelihood ratio for the respected group.

[17] Other include all the non-SC, non-tribal, non-OBC groups including forward casts

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Variable Names Or determinants	Value levels	Anemia/Non-anemia		Degree of anemia					
				Mild		Moderate		Severe	
		Exp.	S.E.[18]	Exp. [19]	S.E.	Exp.	S.E.	Exp.	S.E.
Family Size	Above 8 members	.948	.079	.990	.084	.848	.119	.730	343
	Less than 8 members	1	1	1	1	1	1	1	1
Total birth in last five years	>= 3	.697	.274	1.35	.082	.953	.381	.819	.994
	< 2	1	1	1	1	1	1	1	1
Total number of child birth	>= 3	1.319*	.077	.629*	.283	1.24*	.110	1.12	.290
	< 2	1	1	1	1	1	1	1	1
Age at first marriage for the respondent	< 18	1.16*	.072	1.12	.077	1.28*	.106	1.05	.288
	>= 18	1	1	1	1	1	1	1	1
Respondent's occupation	No work	.973	.102	.948	.108	1.10	.008	1.5	.437
	Agriculture	.970	.128	.956	.136	.945	.103	1.94	.476
	Non-Agriculture	1	1	1	1	1	1	1	1
Husband's Occupation	No work	1.05	.198	1.17	.206	.829	.310	.0018	*5304.959*
	Agriculture	.923	.073	.944	.076	.882	.105	.772	1
	Non-Agriculture	1	1	1	1	1	1	1	

(Cont....)

[18] S.E. refers to standard error.

[19] Exp. implies likelihood ratio for the respected group.

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Variable names	Value levels	Anemia/Non-anemia		Degree of Anemia					
				Mild		Moderate		Severe	
		Exp.	S.E.[20]	Exp. [21]	S.E.	Exp.	S.E.	Exp.	S.E.
Region[22]	N.O.	1.21*	.104	1.21*	.111	1.27**	.146	.726	.392
	S.O.	.811*	.084	.824*	.101	.839	.139	.301	.481
	W.O.	1.19*	.088	1.21*	.093	1.19	.129	.936	.345
	E.O.	1	1	1	1	1	1	1	1
Household economic status	Low	1.33*	.152	1.32*	.161	1.34*	.253	4.17	1.05
	Medium	1.29*	.133	1.23*	.141	1.43*	.231	5.66	1.00
	High	1	1	1	1	1	1	1	1
Any types of Toilet[23]	No	1.38*	.128	1.37*	.137	1.50*	.211	.789	.539
	Yes	1	1	1	1	1	1	1	1

(Cont..)

[20] S.E. refers to standard error.

[21] Exp. implies likelihood ratio for the respected group.

[22] N.O. refers to North Orissa comprising undivided Keonjher, Mayurbhanja and Sundargarh districts.
S.O. refers to South Orissa comprising undivided Phulbani and Koraput district
W.O. refers to Western Orissa comprising undivided Sambalpur, Bolangir and Kalahandi district.
E.O. refers to Eastern Orissa comprising undivided Puri, Cuttack, Balasore, Dhenkanal, Ganjam

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Variable	Economic status	Anemia		Degree of anemia					
				Mild		Moderate		Severe	
		Exp.	S.E.[24]	Exp. [25]	S.E.	Exp.	S.E.	Exp.	S.E.
Drinking water source[26]	Open Source	1.11	.186	1.09	.197	1.07	.264	2.44	.727
	Well								
	Public water	.925	.133	.940	.142	.831	.205	1.58	.626
	Supply	1	1	1	1	1	1	1	1
Total no. of Observation	N = 4262 cases for all types of anemia indicators								
Model fitting Information	Log likelihood for binomial logit model (for anemia including the intercept) = 4211.825, chi-square=214.032*, degree of freedom = 25. Log likelihood for multinomial logit model (for degree of anemia including the intercept) = 2229.618, chi-square = 175.15, degree of freedom = 99.								

[24] S.E. refers to standard error.
[25] Exp. implies likelihood ratio for the respected group.
[26] Open Source comprises river, ponds, streams, open well and other open sources.
Well includes public, private, covered well public and private hand pumps. Public water supply includes public and private tap inside or outside the households and tanker supply.

The prevalence is also high among poor households. Our bi-variate cross tabulation for ethnicity (social backgrounds) and economic status of the household has already shown significant relationship. This implies that low economic status households come from these marginalised social groups of scheduled caste and scheduled tribe population. The multivariate cross tabulation between economic status and anaemia and degree of anaemia controlling for ethnicity shows a significant relationship indeed and proves our point. [see Table 3.1.6].

Part-II

This part will contain sections 3.2 to 3.2.11. The whole part contains analysis of patterns and determinants of BMI among women in Orissa

3.2 Analysis of maternal undernutrition of women in Orissa (Body mass Index approach)

The anthropometric approaches are of late regarded as more suitable indicators of assessing nutritional status. For women of reproductive ages 15-49, BMI is considered to be the best possible indicator. This is calculated as Kg/m^2 (weight of the women/square of her height). This indicator is widely used by the social scientists for measuring women's nutrition status. (Moradi: 2003, Higgins and Alderman; 1996, Thomas; 1996, Beherman; 2002, Barros and Fox; 1997, Ruel and Morris et al; 1999, 2001).

Their work highlights the role of economic status of the households, social status, age factor, total fertility, household size, working status, rural/urban divide in determining the women's nutritional outcome measured in terms of Body Mass Index. Since weight is prone to short-term variation and height is the result of past nutrition status, the weight-height combination provide a robust assessment of prevailing nutrition status. [For detail see Osmani; 1987, Svedberg; 2000, 2002, World nutrition report; 1993, 2000, Moradi; 2003, Kandla; 2002].

While Ruel et al; (1999) found women's work status, male/ female headed households, family size, income as determining factor for women's BMI outcome in Ghana, Higinns and Alderman (1996) found occupation status and economic condition with age group and family size contributing largely towards the women's

nutrition status in Ghana. Duncan Thomas did a comprehensive study on nutritional outcome of children and women in female-headed households in Brazil, where he found economic position of the household, occupation, maternal schooling as important factors influencing nutrition outcome of the women.

With all these premised evidence on women nutrition, we attempt here to analyse the nutrition outcome of women in Orissa in terms of demographic characteristics, social and economic grounds, basic infrastructure available in their households and dietary practices (like in case of anaemia analysis). We illustrate the pattern of under nutrition across different demographic, social and economic groups. We will use various types of cross tabulations for this purpose. Logit regression model will be applied to determine the determinants and their direction of association with nutritional outcome.

3.2.1 Demographic Factors

Now we will discuss the association between different demographic factors and nutrition outcome for women in Orissa. We found in Orissa a total 48.32% of women are under nourished in terms of low BMI. 3.79% suffer from moderate obesity and only 0.61% suffer from severe obesity. So the discussion will be mainly focused on under nutrition among women in Orissa as other types of malnutrition measured in terms of degree of obesity are rare and is not the focus of our discussion. While examining the age pattern of under-nutrition in terms of BMI, we find women below age 30 are more undernourished (defined with BMI less than 18.5 kg/m^2) compared to the older ones. In these groups more than 50.0% women have BMI lower than 18.5 kg/m^2. As maternity exposures as well as reproductive complications are more in younger ages, the loss of body weight could be more probable resulting in lower BMI. But with increase in age this trend slows down. Still we find that over 40.0 percent of women are undernourished in subsequent age groups. So this could be imagined as a recovery from low nutrition status during the reproductive years. Moderate obesity shows a mixed pattern across ages, but very high for age groups 35-39 and 40-44 compared to other groups. Similar is the case for severe obesity. But severe obesity declines beyond 45 years of age. This is a usual age pattern of BMI among women according to the available clinical literature on BMI. Essentially, it conveys that

vulnerability to undernourishment in women is more during effective reproductive years of life compared with during later ages.

With regard to marital status of women, the formerly married are more undernourished (52.29%) compared with the currently married (48.06%). This disadvantage could be reasoned with common social and economic deprivation of these women relative to their currently married counterparts.

Age at first marriage signaling the onset of exposure to reproduction bears a significant association with nutritional outcome of women. We find proportion of women undernourished are more among those women who marry before age 18 (50.96%), in contrast with women who marry after age 18 (44.4%). Similarly age at first birth also influences the nutrition outcome. Women who marry before age 18 are proportionately more undernourished (51.17%) compared to those who marry after 18 years of age. This suggests that marriage and maternity below the potential age add to the risk of undernourishment in women.

Women with most recent exposure to maternity (i.e. who gave birth in last five-year or one year), are relatively more undernourished (51.31% in each case) compared to those who have not given any birth in the said period (46.29% in each case). This shows birth and its aftermath have definite impact on women's nutrition status.

But interestingly family size does not present a consistent pattern with undernourishment in women. In fact, smaller size households (supposedly nuclear) have a higher risk of undernourishment and large size households have the least risk in this regard. This might be confounding with the standard of living more than the household size.

We also found that women having more than two children under age five are proportionately more undernourished (49.22%) compared to women having more children under age five (49.82%) and no child (47.96%). This suggests that closely spaced birth interval may have negative implication on nutrition outcome of the women. In this context, women distributed by their children ever born indicates nutritional outcome to be negatively associated with children ever born.

Table 3.2.1 Pattern of BMI among women by demographic characteristics

Characteristics	*Low BMI*	*BMI Normal*	*Moderate Obesity*	*Severe Obesity*	*Total*
Age group*					
15-19	124 (50.81)	117 (47.95)	3 (1.22)	-	244
20-24	355 (51.52)	298 (43.25)	5 (.72)	1 (.14)	659
25-29	422 (50.78)	383 (46.08)	26 (3.18)	-	831
30-34	374 (47.64)	375 (47.77)	29 (3.69)	7 (.89)	785
35-39	285 (48.46)	271 (46.08)	27 (4.59)	5 (.85)	588
40-44	231 (42.15)	271 (49.45)	41 (7.48)	5 (.91)	548
45-49	171(42.22)	204 (50.37)	23 (5.67)	7 (1.72)	405
Total	1962(48.32)	1919 (47.26)	154 (3.79	25 (.61)	4060
Age of the Respondent*					
<30	902 (51.95)	799 (46.02)	34 (1.95)	1 (.08)	1736
>=30	1061 (45.63)	1120 (48.17)	120 (5.16)	24 (1.03)	2325
Marital Status*					
Currently married	1815 (48.06)	1790 (47.40)	146 (3.86)	25 (.66)	3776
Formerly married	148 (52.29)	128 (45.22)	7 (2.38)	-	283
Age at first marriage*					
<18	1245 (50.96)	1102 (45.1)	85 (3.47)	11 (0.45)	2443
>=18	718 (44.4)	817 (50.52)	69 (4.26)	13 (0.8)	1617
Age at first birth* (Total cases 3672)					
<18	694 (51.17)	614 (45.28)	44 (3.24)	4 (0.29)	1356
>=18	1090 (47.06)	1108 (47.84)	100 (4.31)	18 (0.77)	2316
Birth in last five year*					
0	1106 (46.29)	1136 (47.55)	125 (5.23)	22 (0.92)	2389
1+	857 (51.31)	782 (46.82)	28 (1.67)	3 (0.17)	1670
Birth in last one year*					
0	1106 (46.29)	1136 (47.55)	125 (5.23)	22 (0.92)	2389
1+	857 (51.31)	782 (46.82)	28 (1.67)	3 (0.17)	1670
Family Size*					
1-4	636 (52.21)	532 (43.67)	40 (3.28)	10 (0.82)	1218
5-7	876 (47.97)	873 (47.8)	71 (3.88)	6 (0.32)	1826
8+	451 (44.43)	513 (50.54)	43 (4.23)	8 (0.78)	1015
No children under age 5 or else*					
Zero	951 (47.9)	918 (46.24)	98 (4.93)	18 (0.9)	1985
One or Two	884 (48.7)	872 (48.04)	54 (2.97)	5 (0.27)	1815
More than two	127 (49.22)	129 (50.0)	1 (0.38)	1 (0.38)	258
Total number of children ever born**					
Zero	208 (46.95)	223 (50.33)	10 (2.25)	2 (0.45)	443
One or Two	848 (49.82)	780 (45.82)	61 (3.58)	13 (0.76)	1702
More than two	907 (47.36)	915 (47.78)	83 (4.33)	10 (0.52)	1915
Sex of the household head					
Male	149 (49.33)	143 (47.35)	7 (2.31)	3 (0.99)	302
Female	1814 (48.27)	1776 (47.25)	147 (3.91)	21 (0.55)	3758
Marital duration grouped*					
0-9	708 (50.93)	654 (47.05)	25 (1.79)	3 (0.21)	1390
10-19	697 (48.6)	672 (46.86)	56 (3.9)	9 (0.62)	1434
20-29	448 (45.9)	457 (46.82)	60 (6.14)	11 (1.12)	976
30+	109 (41.92)	136 (52.3)	13 (5.0)	2 (0.7)	260

Here * denotes statistical association at 5% level of significance.
Here ** denotes statistical association at 10% level of significance.
Source NFHS-2; 1998-99

Sex of the household head does not have any significant association for nutrition outcome of the women in Orissa. Though it shows proportion of undernourished are

little more in male headed households (49.33%) compared to female headed households (48.27%).

Marital duration also has significant impact upon undernutrition status of women in Orissa. We found lowest martial duration group i.e. 0-9 years comprises of the highest proportion of under nourished women (50.93%). The proportion declined with increase in marital duration. It is lowest for 30 or more years of martial duration. This also implies that women at early stage of their reproductive life are more vulnerable to under nutrition.

3.2.2 Social Characteristics

Education is found to be significantly associated with BMI out come of the women in Orissa. We found women with lower education having largest proportion of under nourished (54.9%) followed by women having primary (43.04%) and secondary education (33.1%) and women with higher education (20.88%). Women belonging to highest education category have lowest proportion of under nutrition. But another interesting observation here is that almost reverse pattern is found for all degree of obesity across different education level. The proportion women having moderate and severe obesity are highest among most educated category, while it is lowest among uneducated women. This may be due to the educated women choosing sedentary life styles compared to the uneducated engaged largely in the household chores.

Educational achievement of the partner (husbands) is also found to be significantly associated with nutrition outcome of the women in Orissa. The women having uneducated partners are found to be more undernourished (57.85%), followed by those with husbands having primary education (47.7%), secondary education (44.02%), and lowest among women having highest educated husbands (22.91%). The pattern is almost the same as incase of respondent's education level, we saw earlier. The proportion of women having moderate and sever obesity is also highest among women having most educated husbands. The pattern of association between undernutrition and education level of respondent as well as her partner is found to be similar. [For detail see table 3.2.2 below]. Thus the education level may reflect the economic status of the households itself. This possibility has been explored in section 3.2.6. Controlling for standard of living index which reflect the economic status of the

household, the association between education level of the respondent as well as her partner with respect to nutrition outcome of the respondent has been examined further. [See table 3.2.6].

Table 3.2.2. Pattern of Body Mass Index among women by household Characteristics

Characteristics	*Low BMI*	*BMI Normal*	*Moderate obesity*	*Severe Obesity*	*Total*
Education level of the respondent*					
No education	1187 (54.9)	929 (42.96)	41 (1.89)	5 (0.23)	2162
Primary	362 (43.04)	433 (51.48)	42 (4.99)	4 (0.47)	841
Secondary	291(35.1)	450 (54.28)	70 (8.44)	18 (2.17)	829
Higher	33 (20.88)	97 (61.39)	24 (15.18)	4 (2.53)	158
Partner's education level*					
No education	711 (57.85)	496 (40.35)	20 (1.62)	2 (0.16)	1229
Primary	479 (47.7)	491 (48.9)	31 (3.08)	3 (0.29)	1004
Secondary	582 (44.02)	672 (50.83)	55 (4.16)	13 (0.98)	1322
Higher	99 (22.91)	249 (57.63)	71 (16.43)	13 (3.09)	432
Less than five years	1259 (54.97)	987 (43.1)	40 (1.74)	4 (0.17)	2290
More than five years	704 (39.79)	931 (52.62)	113 (6.38)	21 (1.18)	1769
Type of place of residence*					
Rural	1813 (50.23)	1677 (46.46)	105 (2.9)	14 (0.38)	3609
Urban	150 (33.18)	242 (53.53)	49 (10.84)	11 (2.43)	452
Religion					
Hindu	1909 (48.63)	1848 (47.08)	144 (3.66)	24 (0.61)	3925
Muslim	28 (40.0)	35 (50.0)	7 (10.0)	-	70
Christian	26 (41.26)	35 (55.55)	1 (1.58)	1 (1.58)	63
Others	-	1 (33.33)	2 (66.66)	-	3
Hindu Vs others* (.054)					
Hindu	1909 (48.63)	1848 (47.08)	144 (3.66)	24 (0.61)	3925
Others	54 (39.7)	71 (52.2)	10 (7.35)	1 (0.73)	136
Ethnicity*					
Scheduled Caste	464 (54.71)	366 (43.16)	15 (1.76)	3(0.35)	848
Scheduled Tribe	440 (55.41)	340 (42.82)	13 (1.63)	1 (0.12)	794
Other backward caste	616 (48.81)	595 (47.14)	43 (3.4)	8 (0.63)	1262
None of them	441 (38.18)	618 (53.5)	83 (7.18)	13 (1.12)	1155
SC/ST Vs others*					
SC/Tribals	905 (55.08)	706 (49.27)	28 (1.7)	4 (0.24)	1643
Others	1057 (43.75)	1212 (50.16)	126 (5.21)	21 (0.86)	2416
Region					
Northern Orissa	303 (49.02)	289 (46.76)	22 (3.55)	4 ($6.47e^{-03}$)	618
Southern Orissa	380 (56.54)	283 (42.11)	9 (1.33)	- .	672
Western Orissa	432 (47.21)	440 (48.08)	37 (4.04)	6 ($6.55e^{-03}$)	915
Eastern Orissa	847 (45.73)	906 (48.92)	85 (4.58)	14 ($7.55e^{-03}$)	1852

Here * denotes statistical association at 5% level of significance.
Here ** denotes statistical association at 10% level of significance.
Source NFHS-2; 1998-99

Place of residence has significant association with BMI outcome with rural women proportionately more undernourished (50.23%) compared to women from urban category. The gap is very large (17.04%) in this context. The wide spread poverty in rural areas and lack of basic health and education contribute largely to such disparities.

Hindu women are found to be more undernourished compared to other categories. [For detail see table 3.3.2. below]. Ethnicity plays a significant role in determining nutrition status of women in Orissa. Women from scheduled caste (54.71%), scheduled tribe (55.41%) and other backward caste (48.81%) are relatively more under nourished compared to women from general category (38.18). Similarly the moderate and severe obesity are also high among women from general category. This may suggest that the corresponding economic status associated with different social background plays a crucial role in nutrition outcome for the women in Orissa. This hypothesis will be detailed further in the following sections of this chapter.

3.2.3 Economic Characteristics

Economic characteristics are found to be associated with nutrition outcome of the women in the households. Association of household standard of living index with nutrition status of women is found to be statistically significant. The pattern suggests that women from high economic status have lowest proportion of under nutrition (21.08%) against women from medium (46.2%) and low households (55.34). This shows vulnerability of women from poor households to under nutrition. The reverse pattern can be seen for moderate and severe obesity where women from high economic status households have highest proportion for these two types of obesity. One can easily conclude that under nutrition is associated with poverty and obesity with economic affluence. [For more see table 3.2.3].

Respondent's occupation also show association (but not statistically significant) with BMI outcome. Women working in agriculture are found to be more under nourished (55.45%) compared to women who work in non-agricultural sector (49.5%) and women who do not work outside (46.43%).

Partner's occupation also exhibits a similar pattern. Women whose partner work in agriculture are proportionately more under nourished (52.92%) compared to other women whose partner work in non-agriculture (44.47%) or does not work (45.08%). Women whose partner works in non-agriculture are better placed compared to women whose partner either work in agriculture or do not work. Thus it shows women under nutrition is more in poor households especially where occupation is associated with agriculture. [For more see table 3.2.3].

Table 3.2.3. Pattern of BMI among women by economic characteristics

Characteristics	*Low BMI*	*BMI Normal*	*Moderate obesity*	*Severe Obesity*	*Total*
Standard of Living Index*					
Low	1206 (55.34)	943 (43.27)	27 (1.23)	3 (0.13)	2179
Medium	658 (46.2)	699 (49.08)	57 (4.02)	10 (0.7)	1424
High	93 (21.08)	266 (60.31)	70 (15.87)	12 (2.72)	441
Respondent's occupation*					
Not working	1296 (46.43)	1338 (47.93)	135 (4.83)	22 (0.78)	2791
Agriculture	366 (55.45)	292 (44.24)	2 (0.3)	-	660
Non-agriculture	301 (49.5)	288 (47.36)	17 (2.79)	2 (0.3)	608
Partner's occupation*					
Not working	55 (45.08)	61 (50.0)	5 (4.09)	1 (0.8)	122
Agriculture	1003 (52.92)	866 (45.69)	23 (1.21)	3 (0.15)	1895
Non-agriculture	905 (44.27)	991 (48.48)	127 (6.21)	21 (1.02)	2044

Here * denotes statistical association at 5% level of significance.
Here ** denotes statistical association at 10% level of significance
Source NFHS-2; 1998-99

3.2.4 Basic Infrastructure

The basic infrastructures in the households like provisions of safe drinking water, toilet facility and electricity considerably influence the nutrition outcome of the women living in these households. These also to some extent reflect economic status of the households. We find that households using safe source of drinking water (which include public water supply through pipe, tanker, public tap, hand pumps) have less proportion of under nourished women compared to those who use well (including public and private covered well). Women from those households where water is obtained from open source (river, tanks, streams etc.) have highest proportion of under nutrition in terms of BMI. Interestingly we found obesity of any kind to be highest among women from households using water from public supply. These are definitely rich households capable of taking connection to their home. Those who use surface water are mainly from poor households.

Similarly those who have some kind of toilet facility report low proportion of undernutrition compared to those who have no facility to use. Also households having electricity have less proportion of under nourished. In case of obesity we can see households having toilet facility and electricity supply have greater proportion of both types of obesity compared to poor households. This simply implies that all these three basic facilities can be taken as proxy for the over all economic status of the households. [For greater detail see table 3.2.4].

Table 3.2.4. Pattern of BMI among women in Orissa by household infrastructure

Characteristics	*Low BMI*	*BMI Normal*	*Moderate obesity*	*Severe obesity*	*Total*
Sources of drinking water*					
Public pipe water	110 (30.38)	195 (53.86)	45 (12.43)	12 (3.31)	362
Well	1699 (49.92)	1585 (46.57)	108 (3.17)	11 (0.32)	3403
Surface water	154 (52.20)	139 (47.11)	1 (0.33)	1 (0.33)	295
Toilet*					
No toilet	1834 (52.67)	1580 (45.37)	60 (1.72)	8 (0.22)	3482
Have toilet	129 (22.31)	338 (58.47)	94 (16.26)	17 (2.94)	578
Has electricity*					
No	1388 (54.45)	1130 (44.36)	30 (1.17)	1 (.02)	2549
Yes	575 (38.07)	788 (52.18)	124 (8.21)	23 (1.52)	1510

Here * denotes statistical association at 5% level of significance.
Here ** denotes statistical association at 10% level of significance
Source NFHS-2; 1998-99

3.2.5 Dietary Practices

The frequency of intake of milk, pulses, other vegetables, fruits, eggs and chicken/meat/fish are found to be significantly associated with nutritional outcome. We found that those women who consume milk, pulses/beans, green leafy vegetables, other vegetables, fruits, eggs daily have proportionately less undernutrition in terms of BMI compared to those who take it weekly or occasionally. Those women who do not take these items at all are relatively more undernourished compared to those taking it regularly or in some interval. But in case of chicken/meat/fish the findings are little puzzling. Those women who take these items regularly are found to more under nourished (53.33%) compared to the other group who consume weekly/occasionally. Even those who do not consume at all are found to have far lesser proportion (47.01%) of low BMI compared to other groups. Such an association could perhaps be due to the consumption of chicken/meat/fish as a substitute to vegetables or pulses. Another interesting thing is, women who consume these non-vegetarian items regularly are proportionately more obese (of severe type). This proves that the dietary

practice has significant association for both maternal under nutrition (measured in terms of low BMI) and maternal over nutrition over nutrition (measured in terms of moderate and severe obesity). The daily consumers of other items (except egg) shows highest proportion of obesity like in case of chicken/meat/fish compared to other irregular takers. [For detail see table 3.2.5].

Table 3.2.5. Pattern of BMI among women by dietary practices

Characteristics	*Low BMI*	*BMI Normal*	*Moderate obesity*	*Severe obesity*	*Total*
Milk/curd*					
Daily	132 (34.02)	41 (10.56)	9 (2.31)	206 (53.09)	388
Weekly	202 (46.54)	24 (5.52)	2 (1.49)	206 (47.4)	434
Occasionally	1232 (49.53)	70 (2.81)	12 (0.48)	1173 (47.16)	2487
Never	398 (52.78)	20 (2.65)	2 (0.26)	334 (44.29)	754
Pulses*					
Daily	663 (40.47)	105 (6.41)	17 (1.03)	853 (52.07)	1638
Weekly	870 (53.01)	39 (2.37)	5 (0.30)	727 (44.3)	1641
Occasionally	412 (55.75)	8 (1.08)	2 (0.27)	317 (49.6)	739
Never	17 (40.47)	2 (4.76)	1 (2.38)	22 (52.38)	42
Green leafy vegetables					
Daily	1096 (47.71)	94 (4.09)	17 (0.74)	1090 (47.45)	2297
Weekly	690 (49.42)	45 (3.22)	7 (0.5)	654 (46.84)	1396
Occasionally	173 (47.92)	14 (3.87)	1 (0.27)	173 (47.92)	361
Never	4 (66.66)	-	-	2	6
Other vegetables*					
Daily	1474 (46.19)	1550 (48.57)	144 (4.51)	23 (0.7)	3191
Weekly	384 (55.34)	9 (1.3)	2 (0.23)	297 (42.91)	692
Occasionally	105 (59.32)	1 (0.56)	-	71 (40.11)	177
Never	-	-	-	-	-
Fruits*					
Daily	30 (30.92)	56 (57.73)	10 (10.3)	1 (0.51)	97
Weekly	213 (44.37)	218 (45.41)	41 (8.54)	8 (1.66)	480
Occasionally	1616 (49.17)	1554 (47.29)	101 (3.07)	15 (.45)	3286
Never	104 (53.06)	90 (45.91)	1(0.51)	1(0.51)	196
Eggs*					
Daily	9 (3.1)	1 (3.44)	-	19 (6.55)	29
Weekly	266 (44.48)	36 (6.02)	5 (0.83)	291 (48.66)	598
Occasionally	1186 (50.07)	67 (2.86)	8 (0.34)	1078 (46.08)	2339
Never	502 (45.84)	50 (4.56)	12 (1.09)	531 (48.49)	1095
Chicken/Meat/Fish*					
Daily	32 (53.33)	2 (33.33)	1 (1.66)	25 (41.66)	60
Weekly	457 (42.27)	71 (6.56)	9 (0.83)	544 (50.32)	1081
Occasionally	1347 (50.84)	62 (2.34)	12 (0.45)	1228 (46.35)	2649
Never	126 (47.01)	18 (6.71)	3 (1.11)	121 (45.14)	268

Here * denotes statistical association at 5% level of significance.
Here ** denotes statistical association at 10% level of significance.
Source NFHS-2; 1998-99

3.2.6 A discussion on association of prominent characteristics with body mass index (BMI) of women controlling for their household standard of living index (SLI)

This section deals with a discussion regarding the significant association of few of the selected characteristics with BMI of women controlled for the economic status of the household assessed in terms of the standard of living index (SLI). The purpose is to justify the independent bearing of all these characteristic variables on BMI of women given that economic status of the household is universally known to have a bearing on women's nutrition status. It is found that the household size least affects BMI while controlled for economic status of the household though it has significant one to one association, as we found in table 3.2.6. This implies that it is not family size alone that matters, but availability of adequate resources within a household may nullify the negative implication of large household size on women's BMI.

Similarly total childbirth still has no strong association to women's BMI outcome in all types of household. This proves their economic background does not influence association between total fertility and outcome of BMI. Still there is overwhelming literature available on negative impact of frequent child bearing and low BMI. Our two-way association between total child birth and economics status of the household shows a significant association. So from all these we can only conclude that the role of economic background of the women may not have strong direct implication on association between frequent child bearing and BMI outcome for women in Orissa but still total fertility holds significance to BMI outcome at 10% level. [See Annex-1].

Similarly age at first marriage for the respondent does not holds good with BMI outcome for any category of household. However age at first marriage found to be significantly associated with household's standard of living index but not with BMI outcome. [See Annex-1].

Female-headed households are found to be detrimental for BMI outcome of women from low SLI households. But in case of other two SLI groups of households, sex of the household head does not make a difference. This again proves that economic status has strong implication for BMI status of the women at least for poor women. The two way association between sex of the household head and households standard of living index being significant implies that female headed households might be poorer compared to male headed households. [See Annex-1].

It is also significantly associated with BMI outcome. [See table 3.2.1].

The other variable like age at first birth does not seem to have an association with the BMI outcome, while controlled for SLI levels of the household. This may be indicative of the fact that women with lower age at first birth will be mostly from lower socio-economic strata and few who are from the upper socio-economic strata will escape the negative consequence of lower age at maternity through better maternal care provision. So in this respect the outcome of this particular association needs more comprehensive analysis.

Type of place of residence (i.e. rural/urban) is associated with BMI outcome for the women in all categories of households at 1-% level of significance. So this shows that BMI outcome of the women have rural-urban distinction. Our cross tabulation in table 3.2.2 has shown this. Table in [See Annex-1] also shows significant association between types of place of residence and economic status of the household.

Education level of the respondent does not show significant association with BMI when controlled for economic status of the women. But table 3.2.2 shows that there is one-to-one association between BMI and level of education. The standard of living index also shows a strong association with BMI [See Annex-1]. So we can say that women's education may not influence BMI outcome irrespective of their economic status. So this premise is very significant for policy outcome. Similar pattern holds good for education level of the partner [table 3.2.6] except in case of low household SLI. In case of low economic status households the partner's education has significant association with BMI when controlled for household standard of living index, probably because of association of education and income in these households. Education of the partner and standard of living index also proves our point partially with significant association between the two. [See Annex-4]. The better education for partner may increase the over all economic status of the household which is favourable to BMI outcome of women in the household. Earlier in table 3.2.2., We have seen a significant association between BMI of women and the education of their partner.

Ethnicity does reflect a variation in the nutrition outcome of women as we have seen in table 3.2.2. When controlled for standard of living index it does show significant

association. For two-way association also, ethnicity does show significant association with standard of living index, which suggest scheduled caste and tribal women are more likely to be from poor category. [See Annex-1]. This may imply social background of the women and their economic background may affect their nutritional outcome. A more careful analysis is required here to come to any conclusion. I t will be done in next section of this chapter.

Occupation status of the respondent has no association with BMI when controlled for economic status for women in middle and high economic group. But for lower income group women this is significant at 1-% level. So nutritional status of women (measured in terms of BMI) from poor households depends upon their occupational status. Similar is the case for occupation of the partner. Occupation of the partner is only detrimental to women's nutrition in poor households not in other categories. But in both cases we found the occupation status of the respondent and her partner to be associated with their economic status of the household [See Annex-1]. Earlier from table 3.2.3 we have seen that both are significantly associated with BMI outcome in a two-way association model.

Sources of drinking water does matter for women from poor and middle class households but not for rich category. This implies that water drawn from any source may get purified for drinking in relatively richer households, which may be lacking in the poor households. The significant association between source of drinking water and economic status also prove this fact. [See Annex-1]. Earlier our table 3.2.4 has shown that water source has significant association with anaemia outcome.

Facility for toilet has no implication for women in poor households but for high and medium households. That shows even if women hail from rich households, their lifestyle factor (perhaps not using toilet) may make difference to their nutrition outcome measured in terms of BMI. But for women from poor households toilet facility does not matter when controlled for economic status, it may indicate that provision of toilet make little difference to their already degraded condition. Our result from [Annex-1] and table 3.4.2. proves that though source of drinking water has significant two-way association with standard of living and BMI outcome, it may not hold good in a three-way association.

Table 3.2.6

Degree of association of selected characteristics with maternal body mass index (BMI) controlling for household standard of living index (SLI)

Characteristics	*Groupings*	*Controlled for Standard of living index*	Body Mass Index
Household size	1-4	Low	-[27]
	4-7	Medium	-
	8	High	-
Total child birth	No child	Low	-
	One or two children	Medium	-
	More than two	High	-
Age at first marriage	Less than 18	Low	-
	<= 18	Medium	-
		High	-
Sex of the house hold	Female	Low	*
	Male	Medium	-
		High	-
Age at first birth	Less than 18	Low	-
	<= 18	Medium	*
		High	-
Types of place of residence	Rural	Low	*
	Urban	Medium	*
		High	*
Education level of the respondent	No education	Low	-
	Primary	Medium	-
	Secondary	High	-
	Higher		
Education level of the partner	No education	Low	*
	Primary	Medium	-
	Secondary	High	-
	Higher		
Region	Northern Orissa	Low	*
	Southern Orissa	Medium	*
	Western Orissa	High	-
	Eastern Orissa		
Ethnicity	Scheduled caste	Low	*
	Scheduled tribe	Medium	*
	Other backward caste	High	*
	General		
Work status of women	No work	Low	*
	Agriculture	Medium	-
	Non-Agriculture	High	-
Partner's occupation	No work	Low	*
	Agriculture	Medium	-
	Non-Agriculture	High	-
Source of drinking water	Public water supply	Low	*
	Well	Medium	*
	Surface water	High	-
Toilet	Have toilet	Low	-
	No Toilet	Medium	*
		High	-
Electricity	No	Low	**
	Yes	Medium	**
		High	-

(Cont...)

[27] refers to no significance at all.

Characteristics	*Groupings*	*Controlled for Standard of living index*	**Body Mass Index**
Region	Northern Orissa Southern Orissa	Low Medium High	
Milk or curd	Daily Weekly Occasionally never	Low Medium High	- ** -
Pulses or beans	Daily Weekly Occasionally never	Low Medium High	* - -
Green leafy vegetables	Daily Weekly Occasionally never	Low Medium High	- - *
Other vegetables	Daily Weekly Occasionally never	Low Medium High	- - -
Fruits	Daily Weekly Occasionally never	Low Medium High	- - -
Eggs	Daily Weekly Occasionally never	Low Medium High	- - -
Chicken/meat/fish	Daily Weekly Occasionally never	Low Medium High	- - -

Here * denotes statistical association at 5% level of significance.
Here ** denotes statistical association at 10% level of significance.
Source NFHS-2; 1998-99

The provision of electricity is associated with BMI for women in each category of households, at 10% level. This may be due to the fact that electricity connection in Orissa is directly associated with economic status of the household which in turn determine BMI outcome as shown in table [Annex-1].

However more interestingly the dietary practices of women do not show significant association with BMI, when controlled for economic status of the household. But earlier we have seen that they have significant two-way association with BMI outcome with intake of pulses, other vegetables, but not significant for milk and milk products, green leafy vegetables, fruits, eggs, and chicken/meat/fish. [See table 3.2.5]. The two-way association between economic status and Dietary practice also show, that association are significant for all types of diets. [See Annex-1].

So the three-way association here may indicate to the fact that it is not only diet as such but also their quantity and quality are most important for women's BMI status. This needs further investigation, which is not possible here due to limitation in the data.

3.2.7a Role of economic status of the households in determining maternal under nutrition outcome within different social groups

As in case of anaemia the economic and social status have definite impact on the nutritional outcome measured in terms of BMI. We have attempted here to know the pattern of under nutrition measured in terms Body Mass Index among different caste groups. We controlled this relationship with respect to their household status. We find that BMI pattern varies widely according to social background of the women. Women with low BMI are found to be higher among lower strata of the scheduled caste (58.05%) and scheduled tribe (56.55) followed by the women from the OBC communities (54.86%) and general category (49.31%). Households with higher economic status are found to be better off in each social category. In all the social groups we found percentage of women with low BMI comes down as economic status increases from low to medium and high. Similarly the percentage of women with normal BMI increases with increase in economic status with in all social groups. Here another interesting finding is that, obesity (both moderate and severe obesity) is associated with upward mobility of the household in terms of economic status with in each social group. The pattern is very similar for each social group in case of moderate obesity. In case of low status households in each social group, we found that moderate obesity is very low. But within these social groups, women from general category reports higher percentage of obesity among women in low status households compared to other social groups. But within each social group obesity is highest among women from high economic status households. The case of severe obesity is also higher among women from high economic status households (high SLI). This proves that obesity among women (it is also one form of malnutrition) is associated positively and significantly with economic status of the households they come from. Over all case we found that scheduled caste and tribal women are more likely to be with low BMI. The findings in case of anaemia and degree of anaemia also show these women are most vulnerable to low nutritional status. This fact is again ratified by findings from the table given below. So both short term nutrition status (measured

in terms of anaemia) and long run nutrition status (measured in terms of Body Mass Index) show that social background does play a role in determining nutrition outcome for women in Orissa, even if conditioned upon their economic status.

Table 3.2.7.a
Pattern of BMI among Women by economic groups (SLI) within different social groups

Ethnicity	Low BMI	Moderate Obesity	Severe Obesity	Normal BMI	Total
Scheduled Caste*					
Low	364 (58.05)	5 (0.79)	2 (0.31)	256 (40.82)	627
Medium	95 (47.5)	7 (3.5)	1 (0.5)	97 (48.5)	200
High	2 (10.52)	2 ()10.52)	1 (5.26)	14 (73.68)	19
Scheduled Tribe*					
Low	345 (56.55)	3 (0.49)	-	262 (42.95)	610
Medium	93 (53.75)	8 (4.62)	-	72 (41.61)	173
High	2 (25.0)	1 (12.5)	1 (12.5)	4 (50.0)	8
Other Backward Caste*					
Low	316 (54.86)	9 (1.56)	-	251 (43.57)	576
Medium	264 (48.26)	16 (2.92)	6 (1.09)	261 (47.71)	547
High	35 (26.31)	19 (14.28)	2 (1.5)	77 (57.89)	133
General*					
Low	181 (49.31)	10 (2.72)	1 (0.27)	175 (47.68)	367
Medium	205 (40.75)	26 (5.16)	3 (0.59)	269 (53.47)	503
High	54 (19.21)	47 (16.72)	9 (3.2)	171 (60.85)	281

Here * denotes statistical association at 5% level of significance.
Here ** denotes statistical association at 10% level of significance.
Source NFHS-2; 1998-99

3.2.7b Role of social status of the households in determining maternal under nutrition outcome within different economic groups (in terms of household SLI)

In this section we will try to find out how BMI outcome of women from each social groups differs within the given economic status. We found that given the economic status, women in Orissa from different social backgrounds show variation in their Body Mass Index. In case of low economic status households, women with low BMI are more in scheduled caste category (58.05), followed by tribal women (56.55%), OBC (54.86%) and general (49.31%). The declining pattern with upward social mobility, given the economic status, shows women from scheduled caste, scheduled tribe and other backward caste are more of low BMI status compared to women from general category. So the social background did matter given the economic status. This may imply that life style of the women for tribal, scheduled caste and other backward caste significantly varies from the women of higher economic status. This shows that in these communities' non-economic factors like education, use of safe water,

sanitation may have some role to play. Despite being poor household, women in these households may have better hygienic life style compared to other groups. That in turn helps them to maintain a good BMI status within poor economic condition. In case of moderate and severe obesity we found that those women from general category are vulnerable compared to other groups, given the low economic status. This is also somewhat pointing to the fact that nutrition outcome may not be entirely an outcome of economic status as such but many non-economic factors like food practices etc. Food practices directly determine the obesity as proved in many clinical studies.

For medium economic status households we found that percentage of women with low BMI are more (53.75%) followed by women from other backward caste (48.26%), women from scheduled caste (47.5%), and women from general caste (40.75%). Though the pattern is little different to the low-income households, still it shows women from general category are less prone to undernutrition compared to other social groups. The relationship is significant at 1-% level as in case of low economic status. But moderate obesity is highest for general category women followed by tribal, scheduled caste and other backward caste women. Here it is little different what we had mentioned earlier. Still women from general category are more likely to be moderately obese compared to women from other social groups, within same economic status. But severe obesity is found to be higher among otherbackward caste.

But within the high economic status, the BMI outcome of the women may not follow same pattern with respect to their social background as in case of low or medium economic status (SLI) households. As table 3.1.7b shows women from scheduled caste category have lesser percentage of low BMI (only 10.5%) compared to women from tribal background (25%), other back ward caste (26.31%) and general category (19.21%). This shows that undernutrition of women (measured in terms of BMI) in Orissa is strongly associated with social background in low and medium level economic status households. In case of high status household social background may not matter. In case of moderate obesity within the high economic status households, we found women from general category tops the list. In case of severe obesity tribal women tops the list followed by women from scheduled caste and general category. Thus we can conclude that in higher economic category or rich households, women's

nutritional status (measured in terms of BMI) may not be influenced by their social background. But in case of low and medium economic status households, the social background of women matters significantly, for their nutritional outcome.

Table 3.2.7.b
Pattern of BMI among Women by Social Groups within different economic (SLI) groups

Standard of living index	Low BMI	Moderate obesity	Severe obesity	Normal BMI	Total
*Low**					
SC	364(58.05)	5 (0.79)	2 (0.31)	256 (40.82)	627
Tribals	345 (56.55)	3 (0.49)	-	262 (42.95)	610
OBC	316 (54.86)	9 (1.56)	1 (0.17)	251 (43.57)	576
General	181 (49.31)	10(3.67)	3 (0.87)	175 (47.68)	367
*Medium**					
SC	95 (47.5)	7 (3.5)	1 (0.5)	97 (48.5)	200
Tribals	93 (53.75)	8 (4.62)	-	72 (41.61)	173
OBC	264 (48.26)	16(2.92)	6 (1.09)	261 (47.71)	547
General	205 (40.75)	26(5.16)	3 (0.59)	269 (53.47)	503
High					
SC	2 (10.52)	2 (10.52)	1 (5.26)	14 (73.68)	19
Tribals	2 (25.0)	1 (12.5)	1 (12.5)	4 (50.0)	8
OBC	35 (26.31)	19 (14.28)	2 (1.5)	77 (57.89)	133
General	54 (19.21)	47 (16.72)	9 (3.2)	171 (60.85)	281

Here * denotes statistical association at 5% level of significance.
Here ** denotes statistical association at 10% level of significance.
Source NFHS-2; 1998-99

3.2.8 Rural-Urban pattern in child undernutrition across various social groups

This section focuses on the prevalence of BMI among women from different social groups across rural-urban sector. The study shows that in rural set-up scheduled caste women and tribal women have the higher prevalence (55% app.) of low BMI. But for women from other backward caste the prevalence is 50.9% and for the women from socially forward casteess have lowest prevalence (41% app.).

As far as urban set-up is concerned scheduled caste women have the highest prevalence of low BMI (50.6%). Among tribal women the prevalence of low BMI is 48.6%. For women from OBC and other categories the prevalence is 32.4% and 23.9% respectively. As far as degree of obesity is concerned women from urban areas have higher prevalence compared to women from rural households, for any given degree of obesity. The moderate and severe obesity is highest among women from 'Others' categories, compared to any other social categories with in rural as well as urban set-up.

Table 3.2.8.
Pattern of BMI among Women by Social Groups within Rural-Urban Sector.

Standard of Living Index	Low BMI	Moderate obesity	Severe obesity	Normal BMI	Total
SC					
Rural*	426 (55.21)	11	2	334	773
	38	(1.42)	(.0025)	(43.2)	
Urban	(50.66)	4	1	32	75
		(5.33)	(1.33)	(42.66)	
TRIBAL					
Rural*	422	12	-	323	757
	(55.74)	(1.58)		(42.66)	
Urban	18	1	1	17	37
	(48.64)	(2.7)	(2.7)	(45.94)	
OBC					
Rural*	568	28	5	514	1115
	(50.94)	(2.51)	(4.48)	(46.09)	
Urban	47	15	3	80	145
	(32.41)	(10.34)	(2.06)	(55.17)	
OTHERS					
Rural*	394	53	7	505	959
	(41.08)	(5.52)	(7.29)	(52.65)	
Urban	47	30	6	113	196
	(23.97)	(15.3)	(3.06)	(57.65)	

Here * denotes statistical association at 5% level of significance, only for rural sector. It implies within rural sector social background is important but not for urban sector.
Source NFHS-2; 1998-99

3.2.9 Analysis of Binomial logit regression on BMI of women in Orissa.

The binomial logit regression shows that being young in age (below or above 30 years of age) and total number of births in last three years for the women are the most significant determinants for low BMI status of the women compared with women having normal BMI. The ethnicity or social background, economic background and regional background too have important bearing on nutritional outcome in terms of BMI. Our results shows that women from scheduled caste, scheduled tribe and other backward caste households are more likely to have low BMI compared to women from socially and economically forward households (consisting of upper castes and other better-off groups). This is reflected in the household economic status of the women in terms of low, medium and high economic status. The results indicate the likelihood of having low BMI is more for the women from low and medium economic status households in contrast with women from high economic status. Women of northern, southern and western Orissa are more likely to have low BMI compared to women from eastern Orissa. [For detail see table 3.2.9].

Table 3.2.9 Results of binomial logistic regression analysis of the determinants of undernutrition among women (in terms of BMI)

Independent Variables or determinants[28]	Low BMI	
	Odds Ratio	S. E.
Age group		
Less than 30	1.23*	.077
More than 30	1[29]	-
Types of place of residence		
Rural	1.07	.137
Urban	1	-
Education level of the mother		
No education	1.43	.259
Primary	1.14	.257
Secondary	1.04	.249
Higher	1	-
Religion		
Hindu	1.14	.198
Others	1	-
Ethnicity		
Scheduled Caste	1.18**	.105
Scheduled Tribes	1.16	.115
Other Backward Caste	1.18**	.092
General	1	-
Family size		
8+	.978	.082
1-7	1	-
Total number of births		
More than 3	1.05	.078
Less than 3	1	-
Birth in last three years		
More than 3	1.79*	.240
less than 3	1	-
Age at first marriage		
< 18	1.06	.074
>= 18	1	-
Work status of the women		
No Work	1.04	.102
Agriculture	.984	.123
Non-Agriculture	1	-
Work status of the husband		
No Work	.921	.199
Agriculture	.970	.074
Non-Agriculture	1	-

(Cont...)

[28] In this column we have taken determinants and their coding structure.

[29] 1 refers to reference category with in a particular variable

Which sets to be zero.

Independent Variables or determinants[30]	Low BMI	
	Odds Ratio	S. E.
Source of drinking water		
Open Source	.997	.190
Well	1.11	.146
Public Water Supply	1	-
Types of toilet facilities		
No	1.64*	.144
Yes	1	-
Household economic status		
Low	1.91*	.169
Medium	1.71*	.154
High	1	-
Region		
Northern Orissa	1.14	.104
Southern Orissa	1.43*	.097
Western Orissa	1.19*	.089
Eastern Orissa	1	-
N	3864 cases	
Log likelihood	3720.204 (including the intercept)	
Model chi-square	191.442* (with 24 degrees of freedom)	

Here * denotes statistical association at 5% level of significance.
Here ** denotes statistical association at 10% level of significance.
Source NFHS-2; 1998-99

3.2.10 Analysis of Multinomial logit regression on BMI of women in Orissa

We also use a multivariate model, like in case of anaemia, to determine the degree and direction of association of some selected indicators with BMI. The results are more or less same as far as low BMI concerned. The reference category in both the form of logits is women with normal BMI.

The result shows that women from less than 30 years of age are 1.2 times more likely to be of low BMI compared to women above 30years of age. But for obesity of any degree, the likelihood of women of age group below 30 to become obese is very low. Women from rural areas are 1.08 times more likely to have low BMI compared to the women from urban areas. But for obesity of all degree, likelihood is low among women from rural areas. Similarly women from low education categories are more likely to have low BMI compared to their higher educated counterparts. But for low educated women the likelihood of obesity is very low compared to higher educated women. This probably suggest women from higher educated women also come from

better-off households and consume higher amount of calories and fat, whereas women from lower educated categories are most likely to come from poor economic status households. In the poor households their might be lack of diet containing higher amount of calorie and fat, the prevalence of disease is more due to lack of basic sanitation and hygienic facilities. All these factors might not allow women to gain additional weight and become obese. Hindu women are also more likely to be anaemic compared to women from any other religious groups. That might be due to customs, practices or religious beliefs especially regarding diets, by the Hindu women. In contrast likelihood of becoming obese is also very low among Hindu women. As far as social background is concerned, women from scheduled caste, scheduled tribe and otherbackward caste households are more likely to have low BMI compared to women from general categories (or Others in this case which, consists of socially and economically forward castes). The odds ratio is found to be significant at 1-% level. Interestingly women from tribal categories are also 1.12 times more likely to be moderately obese, compared to women from other categories. For all other social groups, likelihood of obesity is very low. Women having more three children or more than three births in last five years are found to be susceptible to both low BMI and moderate degree of obesity. Work status of the husband is not likely to affect the BMI outcome of women for low BMI as well as obesity. But considering women's work status, we found that women working in agriculture are more likely (1.03 times) to have low BMI compared to women working in non-agriculture sector. The likelihood of obesity is also very high among the women not-working and women working in agriculture compared to women not working any agriculture. This is somewhat a contradictory finding. The result found that women using well water are more likely to have low BMI compared to women using public water supply. The women using open source of drinking water also are having less likelihood of experiencing low BMI. Women not using toilet facility of any kind, are likely to have low BMI compared to women who use some kind of toilet facility. The women using no toilet facility are also less likely to be obese of any degree. Women from low and medium economic status households are more likely to have low BMI compared to women from high economic status households.

[30] In this column we have taken determinants and their coding structure.

Table 3.2.10 Results of multinomial logistic regression analysis of the determinants of undernutrition among women (in terms of BMI)

Independent Variables Or determinants[31]	Low BMI		Moderate Obesity		Severe Obesity	
	Odds Ratio	S. E.	Odds Ratio	S. E.	Odds Ratio	S. E.
Age group						
Less than 30	1.23*	.076	.444*	.235	.0096	1.39
More than 30	1[32]	-	1	-	1	-
Types of place of residence						
Rural	1.08	.136	.997	.206	.843	.543
Urban	1	-	1	-	1	-
Level of Education for the respondent						
No education	1.43	.259	.683	.425	.558	1.08
Primary	1.14	.257	.866	.399	.924	.980
Secondary	1.04	.248	.864	.342	2.261	.810
Higher	1	-	1	-	1	-
Hindu Vs Others						
Hindu	1.148	.197	1.07	405	2.48	1.4
Others	1	-	1	-	1	-
Ethnicity						
SC	1.19*	.104	.971	.327	2.47	.720
ST	1.16*	.114	1.12	.362	.812	1.45
OBC	1.17*	.091	.907	.217	1.34	.495
General	1	-	1	-	1	-
Household Size						
8[1]	.966	.082	.875	.206	1.35	.472
1-7	1	-	1	-	1	-
Total children ever born						
3 or more than 3	1.048	.077	1.07	.213	.584	.460.
Less than 3	1	-	1	-	1	-
Birth in last five years						
3 or more than 3	1.77*	.240	1.36	.975	4136	.00
less than 3	1	-	1	-	1	-
Age at first marriage (in years)						
< 18	1.03	.073	1.74	.206	1.45	.474
>= 18	1	-	1	-	1	-
Work Status of Husband						
No Work	.923	.198	1.86	.206	1.54	1.5
Agriculture	.970	.073	.421	.729	2.89	.687
Non-Agriculture	1	-	1	-	1	-
Work status of the respondent						
No Work	1.03	.102	1.58	.559	2.62	.764
Agriculture	.98	.12	2.61	-	2.89	1309.904
Non-Agriculture	1	-	1		1	-

(Cont...)

[31] In this column we present the determinants taken and their coding structure.

[32] 1 refers to reference category with in a particular variable

Which sets to be zero.

Independent Variables Or determinants[33]	Low BMI		Moderate Obesity		Severe Obesity	
	Odds Ratio	S. E.	Odds Ratio	S. E.	Odds Ratio	S. E.
Sources of drinking water						
Open Source	.99	.189	.199	.240	1.49	1.11
Well	1.16	.147	.856		.383	.516
Public Water Supply	1	-	1	-	1	-
Toilet Facility						
No	1.64*	.144	.356	.262	.467	.648
Yes	1	.	1	-	1	-
Household Economic Status						
Low	1.86*	.171	.450	.360	.512	.043
Medium	1.67*	.155	.876	241	.827	.540
High	1	-	1	-	1	-
Region						
Northern Orissa	1.15	.103	.722	.283	.779	.615
Southern Orissa	1.44*	.097	.342	.374	1.64	103.46
Western Orissa	1.18*	.089	.726	.222	.590	.530
Eastern Orissa	1	-	1	-	1	-
N	4043					
Log likelihood	3496.941 (including intercept)					
Model chi-square	464.845					

Here * denotes statistical association at 5% level of significance.
Here ** denotes statistical association at 10% level of significance.
Source NFHS-2; 1998-99

It also shows women from low and medium economic status households are less likely to be obese compared to women from high economic status households. Women from northern, southern, and western Orissa are more likely to have low BMI compared to women from eastern Orissa. But in relation to obesity of any degree, we found women from northern, southern and western Orissa have less likelihood. Thus on the basis of findings of both binomial and multinomial logit we conclude that social background, economic status, and regional background are the most significant determinant for low body mass index (BMI) among women in Orissa.

3.2.11. Association between anaemia and BMI for women in Orissa

As we have said earlier in this chapter that anaemia measures short-term nutrition status in terms of haemoglobin level in the blood. But the long-term nutrition outcome is better reflected by anthropometric measurement. The Body Mass Index measured in terms of weight-for-height (Kg/m^2) reflects long term nutritional status of the body. Many development economists and nutrition analysts agree with this fact. [Sen; 1989,

[33] In this column we present the determinants taken and their coding structure.

2000, Osmani; 1987, Kakwani; 1993, Svedberg; 2000, 2002, Hadad; 1999, 2000, 2002, Ruel; 2002 and many others].

Now we want to know whether there is any association between these two short-term and long-term indicators of nutrition for the women in Orissa. This is illustrated with the help of a two- way association table. Results are given below.

Table 3.2.11 Pattern of association between maternal Anaemia and maternal BMI among women in Orissa

Degree of Anaemia	Degree of BMI				Total
	Low BMI	Moderate Obesity	Severe Obesity	Normal BMI	
Mild					1871
Moderate					588
Severe	43 (66.15)	-	-	22 (33.84)	65
Normal	683 (44.52)	93 (6.06)	11 (2.05)	747 (48.69)	1534
Total	1953	154	23	1918	4058

Here * denotes statistical association at 5% level of significance.
Here ** denotes statistical association at 10% level of significance.
Source NFHS-2; 1998-99

We found that degree of anaemia and BMI outcomes are significantly associated at 1-% level of statistical significance. From the table, one can see that out of 1871 women who are mildly anaemic, 49.43% are also found to have low Body Mass Index. Only 47.19 % women are found to have normal BMI though they are mildly anaemic. Only 2.72% suffer from moderate obesity and less than 1% suffers from severe obesity.

Out of 588 moderately anaemic women we found 53.06% have also low BMI while 45.23% have normal BMI, though having moderate anaemia.

Out of 65 women who suffer from severe anaemia, 66.15% are also found to have low BMI. There was no case of any type of obesity found among severely anaemic.

Among 1534 women without any form of anaemia, 44.52% have low BMI, 6.06% have moderate obesity and 2.05% are severely obese. The rest 48.69% are found to have normal BMI with no anaemia. Hence, 747 out of total 4058 (18.4%) women in Orissa are well nourished both in terms of anaemia and BMI. This two-way association holds good at 5% significance level. But when we control this association for standard of living index (economic status) and ethnicity (social background) of the

respondents, we find that there is no significant association within specific economic or social groups. This may indicate that this association is more clinical and not significantly influenced by social or economic background of the women.

But this association between degree of anaemia and Body Mass Index holds well, when we control for age at first marriage and age at first birth (significant at 1-% level). This suggests that women who marry before age 18 or give birth before 18 years of age are proportionately more anaemic and have low BMI compared to their counterparts who marry or give birth after 18 years of age. This is also true for total children ever born, suggesting that women with more births are proportionately more under nourished according to both indicators. Women from large households are also more likely to be anaemic and of low BMI. Total children born to the mothers also determine their nutrition and BMI outcome. Women having more than three births are ought to be more anaemic and of low BMI.

Anaemia and BMI are still significantly associated despite controlling for Rural/urban difference, social background and economic status. Women from rural areas and from scheduled caste and tribes are likely to be more anaemic and of low BMI. Similarly in no education category also the anaemia and BMI are found to be significantly associated. The occupation of women and their husband is significantly associated with anaemia and BMI outcome, for those working in agriculture.

Similarly controlling for the dietary practices, the anaemia and BMI are significantly associated with regular takers of milk, pulses and vegetables. But the association is not significant for those who do not take it regularly. But controlling for fruits, eggs and fish/meat, we found anaemia and BMI are still significantly associated for both regular and irregular takers. This means that regular takers are likely to have normal anaemia and BMI compared to those who don't take them regularly. [For detail see table given in appendix-2].

APPENDIX-1

A discussion on association of prominent characteristics with household standard of living index (SLI)

Characteristics	Association with household standard of living index
Household Size	*
Total child birth	*
Age at first marriage	*
Sex of the household head	*
Age at first birth	*
Type of place of residence	*
Education level of the respondent	*
Education level of the partner	*
Ethnicity	*
Work status of the women	*
Partner's occupation	*
Sources of drinking water	*
Toilet	*
Electricity	*
Milk/curd	*
Pulses/beans	*
Green leafy vegetables	*
Other vegetables	*
Fruits	*
Eggs	*
Chicken/Meat/Fish	*
Region	* (for all the four regions)

Here * denotes statistical association at 5% level of significance.
Here ** denotes statistical association at 10% level of significance.
Source NFHS-2; 1998-99

APPENDIX-2

A discussion on association of prominent characteristics with body mass index (BMI) of women and anaemia conditioned upon different demographic, social, economic, infrastructure, and dietary characteristics.

Characteristics controlled upon anaemia and BMI association in a three way table	Level of significance for different value level of different characteristics.
Household Size	*
Total child birth	*
Age at first marriage	*
Sex of the household head	* (for male headed household)
Age at first birth	*
Type of place of residence	*
Education level of the respondent (with no education or any education)	* for no education
Education level of the partner (with no education or any education)	* for no education
Ethnicity in terms of SC/Tribals Vs others	*
Work status of the women (agriculture Vs others)	*
Partner's occupation (agriculture Vs others)	*
Sources of drinking water (public water supply Vs other supply sources)	*
Toilet	*
Electricity	*
Milk/curd	* (Significant for those who take regularly but not for others)
Pulses/beans (regular Vs irregular)[34]	* (Significant for those who take regularly but not for others)
Green leafy vegetables (regular Vs irregular)	* (Significant for those who take regularly but not for others)
Other vegetables (regular Vs irregular)	* (Significant for those who take regularly but not for others)
Fruits (regular Vs irregular)	*
Eggs (regular Vs irregular)	*
Chicken/Meat/Fish (regular Vs irregular)	*
Region	* (for all the four regions)

Here * denotes statistical association at 5% level of significance.
Here ** denotes statistical association at 10% level of significance.
Source NFHS-2; 1998-99

[1]Here anaemia refers to low level of haemoglobin in the blood. Anaemia usually results from deficiency of micronutrients like iron, folate and vitamin B_{12}. This types of anaemia which results from deficiency of iron, folate and Vitamin B_{12} also called iron-deficiency anaemia. In NFHS-2 survey the 'Hemocue' instrument has been used for estimating the concentration of haemoglobin in capillary blood in field situation (i.e. on the spot). This method uses the third or fourth drop of blood to know the haemoglobin level (haemoglobin concentration) in the blood. A health investigator generally conducts the taste on the spot with consent of the respondent. For maternal anaemia, women only from 15-49 age group were elected. In NFHS-2; 1998-99 three levels of severity of anaemia are distinguished. They are mild anaemia (10.0-10.9 grams/decilitre for pregnant women and 10.0-11.9 g/dl for non-pregnant women), Moderate anaemia (7.0-9.9 g/dl for both

[34] Regular includes both daily and weekly takers and irregular included both occasional and non-takers.

pregnant and non-pregnant women) and Severe anaemia (less than 7.0 g/dl for both pregnant and non-pregnant women). Appropriate adjustments in these cut-off points are taken for women living in high altitudes (1000 meters or more than that), women having smoking habits, because these women need relatively more haemoglobin in their blood.

[ii] The body mass index has been defined as the weight in kilograms divided by the height in metres squared (Kg/m^2). It can be used to assess both thinness and obesity. For 4059 women the body mass index (BMI) has been calculated in NFHS-2; 1998-99 for state of Orissa. Chronic energy deficiency among the women is indicated by a BMI of less than 18.5, which indicated nutritional deficiency at a higher level. BMI score of 18.5 to less than 25 are regarded as normal body mass index indicating no nutritionally deficiency for the women. BMI score of 25 to less than 30 refers to moderate obesity among the women and BMI score of more than 30 represents obesity of severe degree among the women. While low BMI results from undernutrition (under consumption of nutrients), Obesity is resulted from overnutrition (over consumption of nutrients).

[iii] Here currently married includes those women who are married currently. Formerly married women include the divorcee and widows. This classification holds good for maternal anaemia and BMI analysis as well.

[iv] Here family size includes nuclear families (1-4 members), small families (5-7 members) and large families (more than 8 members). The classification follows the National Sample Survey Organisation (NSSO pattern). This classification holds good for maternal anaemia and BMI analysis as well.

[v] In NFHS-1 Orissa is divided in to four major geographical regions. They are northern, southern, western and eastern Orissa. Northern Orissa or 'region 1' constitute undivided Sundargarh, Kenojhar and Mayurbhanja districts. Southern Orissa or 'region 2' constitute undivided Phulbani and Koraput districts. Western Orissa or 'region 3' constitutes undivided Sambalpur, Bolangir and Kalahandi districts. Eastern Orissa or 'region ' constitutes undivided Balasore, Cuttack, Ganjam, Puri, Dhenkanal districs. We follow the same classification for NFHS-2, Orissa; 1998-99 as well. This classification holds good for maternal anaemia and BMI analysis as well.

[vi] Household standard of living index (SLI) used in NFHS-2; 1998-99, is a composite index reflecting household economic status. It is calculated on the basis of the assets, availability of basic sanitation and hygiene facilities owned by the household for a comfortable and disease free life. Different weights are awarded for holding these assets or having these facilities. These assets and facilities include separate room for cooking (1 for yes, 0 for no), Type of houses (2 for pucca, 1 for semi-pucca, 0 for kaccha), source of lighting (2 for electricity, 1 for kerosene or gas or oil, 0 for other sources), fuel for cooking (2 for electricity, gas or bio-gas, 1 for coal, char-coal or kerosine, 0 for other fuels), source of drinking water (2 for own pipe or well, 1 for public pipe or well, 0 for other source), types of toilet facility (3 for own flush toilet, 2 for shared flush or pit toilet, 1 for shared or public pit toilet and 0 for other), ownership of livestock (2 for bullock, cow, buffalo and camel, 1 for goat and sheep), ownership of goods (4 for car, 3 for refrigitor, TV, VCR and two-wheelers, 2 for sewing machine, sofa set, fan, radio and bicycle and 1 for clock/watch). The total score is ranged from 0-48. A score of 0-9 for a household on the aggregate will be rated as low economic status households. Households scoring 10-19 are terms as medium economic status households. For scoring 20 and above, the household will be rated as of high economic status. This classification holds good for maternal anaemia and BMI analysis as well.

[vii] Respondents occupation is broadly divided in to agriculture, non-agriculture and no work categories. It is referred to as occupation of the women in the NFHS-2 data. Agricultural category consists of women who work in agriculture as self-employed or work as employee. Non-agriculture category consists of women who work as Professors, Technocrats, Managers, Clerk, Salesman and women working in various service sectors, women working in households and engaged in domestic work, women working as skilled manual and unskilled manual workers. No work here constitutes women who do not participate in any economic activity other than the job of housewives. This classification holds good for maternal anaemia and BMI analysis as well.

[viii] Husband or partner's occupation also follows the same classification mentioned above and it holds good for maternal anaemia and BMI analysis as well. But here the now work category might imply the unemployed husband or partner.

[ix] Source of drinking water facility is broadly divided in to three categories. The first category constitutes households using water from public water supply scheme i.e. water collected through public supply pipe or public water tankers at home or outside. The second category includes water drawn from covered well (both public and private) and hand pump (both public and private). The open source includes water used from public or private open well, streams, rivers, ponds and other unsafe sources. This classification holds good for maternal anaemia and BMI analysis as well.

[x] Toilet facility includes any type of toilet use i.e. public or private toilets of any kind (flush or pit toilets). This classification holds good for maternal anaemia and BMI analysis as well.

CHAPTER IV

CHILD UNDERNUTRITION: REVIEW OF EVIDENCE

The child undernutrition is one of the most debated subjects in development literature. It has relevance in understanding development as well, both economic and human development. It is argued that the consequences of being undernourished in childhood extend into adult hood. [Fourth Nutrition Report; 2000]. The vast literature on epidemology suggest that foetal undernutrion have causal relationship with increased risk of various adult chronic diseases. So a child born under nourished has greater risk of undernourishment through out his/her life cycle. The situation further worsens during infancy and early childhood, if the child is exposed to frequent or prolonged infections and inadequate intakes of nutrients like protein, vitamins, minerals etc. It is clinically established that most growth faltering, resulting in underweight and stunting occurs with in a relatively short period from before birth to two years of age. [Fourth Nutrition Report; 2000, Osmani; 1987, 1993, 1997, Svedberg; 2000, Hadad; 1991]. Undernutrition in childhood has very serious implications in terms of the possible future achievements of the children. Underweight children tend to be susceptible to severe illness, including diarrhea, pneumonia, jaundice, various physical disabilities, blindness, memory loss etc. [Nutrition report; 1993, 1997, 2000, IFPRI Research Report 111, 112, 118, Ashworth et al; 1997]. According to WHO (1995), there exists a linear relationship between severity of being underweight and under five mortality. According to this report out of 11.6 million deaths among children under age five in the developing countries, 6.3 million (54%) were associated with low weight-for-age (underweight). If this trend continues in the future, then it is estimated that by 2020, 20% of all developing country children under age five numbering 140 million will be under nourished. In this projected aggregated number, it is estimated that South-Asia and Sub-Saharan Africa will have the largest share. It is predicted that the regional share may change little in favour of South-Asia (51% at present to 47% in 2020) and against sub-Saharan Africa (a rise in the share from 19% at present to 35% by 2020). With this background, we will present a brief review of some of the literature and their findings. We will also highlight on some key observations made on these issues.

There remains a large diversity of factors responsible for the child under nutrition and consequent policy suggestions. However a comprehensive study done by Smith and Hadad; [IFPRI Research Report 111, 2000], explains the determinants of child under nutrition in three major categories. They are immediate determinants, underlying determinants and basic determinants. This basic model is also used in UNICEF; 1990, Osmani; 1992, Cladwell; 1993, Young; 1994, Frongillo et al; 1997. We too follow a similar classification of determinants in our subsequent analysis.

The immediate determinants are identified as dietary intake and health. They are influenced by another set of three underlying determinants called food security, care for mothers and children, and quality of health environment. Four explanatory variables namely, per capita national food availability, women's education and status within the households and safe water access represent the above underlying determinants. Basic determinants are those, which influence child malnutrition through their effects on the underlying determinants. These are in terms of economic resources available to the society in general and to the household in particular including the political environment. Though we accept this classification of determinants on a broader basis, for our analysis, we will modify little bit to suit our data and objective. Nevertheless, the classification made by Smith and Hadad (2000) will entail a suitable framework for our present discussion. We will also discuss clinical, socio-economic and other multidisciplinary works for better understanding of the child under-nutrition; it's causes, consequences and remedies.

4.1 Clinical Studies

The dietary intake of mothers and that of children have a definite impact on the outcome of children's nutrition status. The poor intake of energy, protein, fat, and micronutrients for mothers at the time of pregnancy and their children have long term impact. The malnourished mothers give birth to low birth weight babies. This makes the child disadvantaged from the beginning. Even if the child born is of normal weight at birth, the subsequent non-availability or inadequate availability of the macronutrients like protein, energy, fat etc. and micronutrients like vitamins can make it susceptible to various diseases. This further makes them incapable of absorbing the nutrients in the food because disease depresses the appetite. The diseased children also need more energy and vitamins to coup with extra demand of the body to

maintain natural Basic Metabolic Rate (BMR) and to fight with disease. Rosado (1999) has shown that stunting results from deficiency of several micronutrients. In a study conducted by him in five Mexican villages, with total of 219 stunted children between 18 to 36 months of age are selected and iron and zinc supplementation are given to them. He found little improvement in their height growth after one year though they have improved content of iron and haemoglobin in their blood cells. Since 64% of the children taken in sample were suffering from multiple micro nutrient deficiencies, he concluded that only iron and zinc supplementation is not enough. But another study done by him shows a different result. Taking 337 children of age 8-14, he has done a case control study. Out of 337 randomly selected children, 168 children were given a drink containing multiple micro nutrients like Vitamin D, E, K, niacin, B-1, B-6, folic acid, pantothenic acid, iodine copper, manganese floride and selenium (of one RDA each), 1.2 RDA of Vitamin-A, 1.5 RDA of ascorbic acid, riboflavin, vitamin-B12, iron and zinc. This beverage is only 25 milligram in quantity and contains only 30-Kcal and no fat and protein. Other 169 children are given the same drink containing 25 mg. (it also provides 30-kcal) but without any micronutrients or fat or protein. After one year they find children in controlled group are 0.9 centimetre taller in average compared to the children in uncontrolled groups. When controlled for age, sex, initial length and socio-economic status, the mean height growth rate falls to 0.6 centimetre and significant at 1% level. The difference between the controlled groups and uncontrolled groups are higher when controlled for their socio-economic status. Children from low and medium socio-economic status of the micronutrient-supplemented groups grew 1 centimetre more than their counterparts (those who are not supplemented with micronutrients). But this significance does not hold good for catch-up growth for the observed children. This study brings out an important fact that growth retardation among under five children could not be assigned to deficiency of one or two micronutrients. The multi nutrient supplementation is definitely better than supplementation of a particular micronutrient and may have more positive effect on height growth of pre-school children. . This study is basically a clinical study to assess the effect of micronutrients on early growth of child. But nonetheless it is helpful, because it proves that controlling for all the given socio-economic parameters, the intake of essential micronutrients still make difference to nutrition outcome of the pre-school children in their early ages.

Stephensen (1999) has argued that the high prevalence of infections among children living in poor areas of developing countries impairs linear growth in these populations. His study was based on children of Guatemala, of age group 0-36 months. Quoting some studies (Campos et al; 1987, Rahaman et al; 1996, Sommer et al; 1987) he argues that acute and chronic infections may impair linear growth by causing micronutrient malnutrition, for example diarrhea, acute respiratory infections and chicken pox, all are associated with development of vitamin deficiency. Infections of acute and invasive in nature provoke systematic responses in terms of dysentery and pneumonia. Goitre infection is one of the long-term chronic infections due to prolonged under nutrition. Such infections reduce the rate of linear growth by affecting nutritional status of the children of age 0-3 years. Further he argued that infections may decrease food intake, impair nutrient absorption, cause direct nutrient losses, increase metabolic requirements and impair transport of nutrients to targeted tissues, which in turn make harder for these infants for catch-up growth. He cited examples from study of Martorell et al; 1980, how children suffering from acute infections and diarrhea consume 8 and 18% of fewer total calories per day, respectively, in contrast with children without infection. Similarly quoting from another study by Duggan et al; 1986, he says that children in Africa suffering from acute phase of measles, consume less than 75% of total calorie required per day in contrast with children without measles. Significantly another study cited by him, from Brown et al; 1990 shows breast-milk intake is not diminished by infection. Infact when total energy intake from non-breast-milk source decrease by 20-30%, in times of diarrhea or fever, no measurable decrease was found in case of breast milk intake by these children. This study was based upon 136 Peruvian child. Stephensen's work in 1987 also shows that nutrient absorption decline drastically for infected children, especially in case of Vitamin-A. His work in 1987 also informs the hookworm as a major cause of nutrition loss, because worm sucks blood from the child for it's own growth. Hookworm infected children are very vulnerable to iron-deficiency anaemia. Quoting Sarker's study; 1986 he also argues that measles virus infection may lead to loss of protein in the child. Quoting Melchior et al; 1993, he argued that infections like AIDS may increase the nutrition requirement of 57% for the infected children. All these infections mentioned above, thus led to loss of one or the other micronutrients. In the long run, it also reduces the weight of the infected child, as we see in the above discussion, that an infected child consumes less than required calorie.

But the impact on growth is less likely to be direct. But Stephensen (1999) argued that infected child is also likely to be stunted. Because the micro-organisms causing infection also damage the growth cells through microbial products or proinflammatory mediators (like prostaglandin), which in turn affect the growth and composition of bone remodelling, bearing direct impact on future growth of height of the child. He suggested that prevention of disease control through sanitation, promotions of breast feeding, vaccination of children are important to prevent infections in children during early ages.

Black and Krishnakumar (1999) attempted to asses the effect of ecological factors on height and weight of the pre-school children, with or without early growth deficiency. They conducted a follow-up survey for first six years on 225 randomly selected children. From these 225 total numbers of children, 127 have early growth deficiency and remaining 98 children without any growth deficiency. They find that in addition to genetic factor, growth also depends on a nurturing and sensitive care giving system. This study proves children of taller and heavier parents to have better growth. These outcomes are also sensitive to better health provision in the family, maternal sensitivity towards health (which depends upon maternal education), temperament of the child (especially at feeding time), nurturing mothers and other female genders, increase in weight of the children as they grow. On the otherhand children having history of growth faltering are found to have slower growth rate. These children were also found to have negative temperament towards feeding which affect their gaining of weight and height. This study is unique in the sense that almost all the families selected are from poor economic background, mostly female headed, black-African households from U.S.A. So there is not much difference in their socio-economic status, along with pertinent variables like female education or income. Still the genetic factors and ecological factors make difference to children' nutritional status. This study also shows that mothers who married at older age are likely to have children who were taller and heavier. Similarly the mothers who are more sensitive to the health and feeding of their children are likely to have heavier and taller children for the entire age cohort. This study, though a clinical one, it has taken into consideration the socio-economic status of the family. Still it shows a better result for the children of relatively better care taking mother irrespective of their economic status. So the

study reiterates maternal education and nurturing care should be important aspect of any nutrition intervention policy.

A study by ***Ramakrishnan et al (1999)*** explain how maternal height and pregnancy weight determines weight and height of children in pre school age. Citing evidence from Guatemala they argued that intrauterine growth retardation (IUGR) and growth in early childhood are important determinants of height and body composition in later stage. The study uses longitudinal data from four villages of Guatemala collected between 1969 and 1977. The data follow the women in their pregnancy to birth of the child and again the children were followed up to next seven years. Using a multi variate analysis, they found every 100-gram increase in maternal birth weight, the infant's birth weight increased by 29 gram after adjusting for the effects of maternal age, maternal height and weight, gestational age, sex of the infant and socio-economic status of the mother. The relationship is found to be significant at 1-% level. Both maternal birth length and birth weight was found to be significant predictors of her child's birth length. The child's birth length increases by 0.2 c.m. for a given 1 c.m. increases in maternal height. This relation ship is also significant at 1-% level, given the same parameters as in case of mothers' weight. This study is also very useful because it is one of the very limited studies, which examine the relationship between maternal height and weight at pregnancy to that of child height and weight, in relation to socio-economic status[1] of the mother.

4.2 Socio-economic Studies

In this section we will discuss some literature on socio-economic correlates of nutrition analysis. However in these studies the methods of measurement are either based on calorie intake or on antropometric standards. As we have stated in the beginning, underlying determinants are those influencing the dietary practices and health status of the mothers and in turn their children. Per capita food availability, women's education, status of women, environmental factors like sanitation and water supply are most important proxies to represent these determinants.

[1] Here socio-economic status is given as a composite index and the components are not mentioned. This may be the limitation of this study, but did not reduce it's importance in terms of it's findings and implications for further research.

In a study by ***Ashworth et al (1997)***, it was found that socio-economic status of the households can affect the postnatal growth patterns of full term low birth weight infants. The study was done in Northeast Brazil. A total of 133 selected infants were less than the prescribed weight at birth, all from poor families. They are monitored for 12 months without any nutrition intervention. They found wide differences in growth patterns of the children in first eight weeks of the life and the growth in this eight weeks are also found to be significantly associated with attained z-scores at 12 months (r=0.62 for height and 0.64 for height). They found socio-economic variables like sanitation (measured interms of toilet facility), living condition (measured interms of television ownership), quality of housing (measured in terms of bedrooms), economic condition (measured in terms of father's presence/literacy) are considered as determinants for catch up growth for low weight babies in this study. Mothers' characteristics like her height and smoking habit and children's own health condition measured in terms of duration of time suffering from illness like diarrhea, cough, vomiting and fever also considered as possible determinants. The study found even in poor category a little upward variation interms of better housing, articles parent's education, sanitation for the household can have significant positive impact on the growth of height and weight of low birth weight babies. The study found only socio-economic status (which comprise of type of toilet facility, television ownership, father's presence and literacy, number of bed rooms in the house) can explain 21% of variation in weight-for-age and 24% variation in height-for-age, among the observed children. It is also seen that controlling for socio-economic status, mother's height and life style matter in determining children's height and weight. Hence, the role of socio-economic status in determining growth in children during post-natal period is inconclusive. And they argued the socio-economic status to be having an influence in prenatal period also. The women in poor households are likely to have low weight and height for themselves. The dietary practices in prenatal and postnatal period (including supplementation), the quality of care and hygiene all are determined by the socio-economic status. It is therefore argued that socio-economic status of the households first determine the nutrition status of mother, which in turn is reflected in the nutritional outcome for children. However the poor economic conditions not only hamper growth of fetus, but also affect the catch up growth, there by ceasing the chance of recovery. The authors cited example from Gopalan; 1994, that how Indian orphans who are of low birth weight and born in poorest communities and adopted by

affluent Swedish families soon after their birth, could not achieve an adult height comparable to their Swiss adopted parents. Instead their height is identical to their Indian counterpart in same communities. This shows the growth in utero and prenatal cares to be significant determinants of child nutrition after birth. So they argued that to break the vicious cycle of intergenerational nutritional disadvantage in a household, it is necessary to adopt prenatal intervention programmes in the short term and poverty alleviation in the long term.

Shan and Haldorman (1997) did one antropometric study using socio-economic approach. The study is based on 1,816 randomly selected households from Maputo Integrated Household Survey (1991-92), which was conducted in Greater Maputo comprising of rural and semi-urban areas, the capital of Mozambique. The Maputo study by Shan and Haldoerman; 1997 shows positive significant impact of mother's height and children's birth weight on nutritional growth of children. This is in accordance with the evidence found in clinical literature cited above. It also shows mother's education to be having a positive and significant impact on the nutritional status of children below the age 36 months. But the maternal education does not bear the same significant association with the nutritional status of older children. On the contrary the effect of income is found to be significant for children greater than 24 months. The study finds that the nutrition status of the younger children is more sensitive to quantity and quality of the care, which in turn largely depends upon mother' awareness measured in terms of her education. But in case of older children it may be beyond maternal care, like amount and quality of food and other services, which are vital. This in turn may be influenced by the overall economic condition of the household. The study found that the effect of income transfer (increases in income for household) has no significant impact on nutrition status of the children at younger stage, but significant for children aged 24 months or more. The reason they cited is, since nutrition is a stock variable and income as a flow variable, the regression is measuring the cumulative impact of that flow (of income) over time on nutrition status of the children. The ecological factor measured in terms of availability of latrine is also found to be significant for child' s nutrition status. The Maputo studies show that the children born in rural area of Maputo are more likely to be undernourished. However the biggest drawback of the study is, it only considers

height- for-age as the indicator of nutrition status, which is only a long term indicator for past nutrition status in terms of growth retardation.

Engle et al (1999), in a comprehensive study of existing literature on care practice and it's implication on child nutrition, have identified several dimensions of care. The concept of care according to this study has broadly two dimensions i.e. resources needed by the caregiver for care and the child's own characteristics. Broadly they identified six types of resources of care of mother herself, breast feeding practice of the mother, food preparation, over all hygiene condition of the household and hygiene practice of the care giver/mother, home health practices, quality of supplementation and psychological care by the mother to the child (affection and attention paid by the mother to her child through physical, verbal and visual interaction). They conclude that education, knowledge, beliefs of parents can determine the condition of over all care practice in a household. Mental and physical health of the care giver/mother promote good interaction between mother and child and crucial for psychological care for the children by her mother. Female autonomy, control of household resources and gender equality in the intra-household food and other resource allocation favour the maternal and child health positively. The work load and time constraint may hamper both child and maternal nutritional outcome. They also conclude effect of care on nutrition status can be measured through antropometric outcomes of the child. Thus this paper is a valuable source for policy makers who try to improve the nutrition status of the children through better care practice.

Hotchkiss et al (2002) examine the effect of health accessibility in terms of the health infrastructure, personnel and services on the nutritional outcome of the children in a least developed country, Nepal. The study is based on 696 children taken from Nepal Standard of Living Survey (NSLS-1996). The criterion of selection is that the child must born before two years of survey. The analysis is done at individual, household and community level. The regional variation is also taken into account. Using multivariate technique the nutrition status is measured in terms of all the three-antropometric measures viz.: height-for-age (stunting), weight-for-age (underweight), and weight-for-height (waisting). The study found that maternity and child health utilisation (MCH) is positively associated with all the antropometric measures of nutrition and significant for weight-for-age. Increase in MCH service use index by

one point has found to increase the weight-for-age and height-for-age z-scores by 0.21 and 0.17, respectively. The children above 6 months are more likely to be undernourished in terms of height and weight compared to their counterparts below six months. This shows that growth faltering and waisting starts early in Nepal. But interestingly the effect of monthly per capita income is found to be statistically insignificant for all the three-antropometric approach. The access to quality water supply, sanitation, house condition, assets are found to be insignificant for nutritional outcome in terms of all the three indicators. The reason may be, since poverty is widespread in Nepal (especially in rural Nepal), these indicators may not have the visible positive impact on nutrition. Another problem may be due to small sample, which may not represent the country well. The limitations of this study are the following; it does not take into account dietary intake/food habit of the children and their mother, it does not talk about intra-household variation in child care practices, which may provide significant explanation of child nutrition. Some of these limitations are also recognised by the study.

This result supports the argument presented by Shan and Haldorman; 1997, that income matters less for nutrition status of children below age two years. But the mother's education has positive impact and large in magnitude on all the three indicators, but statistically significant. The study thus strengthens the argument present above, that maternal education does matter for child nutrition, especially for younger children below 2 years.

Kassouf and Senauer (1996) assess the impact of parental education on child under-nutrition outcome. The study uses data from National Health and Nutrition Survey-1989 of Brazil. The study only considers the children of age two to five years old. They use all the three-antropometric indicators of child growth; called height-for-age, weight-for-age and height-for-weight. They found that parental education had both direct and indirect impact effect via wages and full income on child health. The study also shows that 25% of the pre school children of the mothers who have schooling of less than 4 years are either severe or moderately stunted (height-for-age). The figure falls further to 11% for women who have at least primary education (5-8 years) and to 3% if women are have higher education (11 years or more). For other two indicators also they found maternal education has positive impact. Only 2.8% of the children of

mothers having 11 year or more education found to be waisted (weight-for-height), while this figure is only 0.4% for underweight (weight-for-age). Father's education also shows significant impact when controlled for wage and full income (wage+non-wage income) on z-scores of height and weight for the pre-school children. It is found that fathers having primary education have 17.8% stunted, 1.4% waisted, 5.8% under weight children. These figures become 11.3%, 1.0% and 3% for their counter part who have 11 years off education or more. The major finding of this study is that total household income has a positive impact on nutrition outcome of the children for all three indicators. And the levels of education of both father and mother have direct bearing on nutrition outcome of the children through health and care practices and also have indirect impact through income of the household. The major drawback of this paper is, it considers health behaviour in terms of health demand, which in turn is determined only by non-wage income. But nonetheless it assumes that the increase in income will ensure better care practice for children, which is crucial for growth of the children. But the paper does not mention the direct proxy for care in their analysis, which may be influenced by the parents' education directly. However the paper does talk about positive and significant impact of sanitation and basic infrastructure facilities like toilet pipe water supply, electricity and road facility on child growth indicators, which may partially represent the care variables. Another interesting finding is that children in urban areas are not bettering of compared to their rural counterpart if the urban variable is controlled for income and infrastructure. But an earlier study by Straus and Thomas found that children in urban area are more likely to be better nourished. This difference is attributed to the population density and pollution in Brazilian cities, which may have negative impact or at least neutralise the positive impact of income and infrastructure on child health. This finding has greater implication for health status of children in cities and slums in India.

The study from Vietnam by ***Haughton and Haughton (1997)*** found that the parental education is directly related to nutritional outcome of the children measured in terms of height-for-age and weight-for-height (both are long term indicators of nutrition status), even controlling for income, rural background and socio-economic status of the household. Here we have to remember that Vietnam is a least developed country (per capita income is 200$). But in terms of human development indicators like life expectancy (66 years of age), literacy (around 80%), it is considered one of the better

performer. So this finding supplements our earlier argument that parental education do influence the nutritional outcome of the children irrespective of their sexes, even if in Vietnam Son preference is very strong. In addition, the study found child under nutrition to be quite high among children from rural households, poor regions (North Vietnam, which is under developed compared to South Vietnam), and families belonging to ethnic minorities. Since, this study is based on Vietnam Living Standard Survey (VLSS; 1991-92) it has measured nutrition status of the children in terms of anthropometry and the age group of the children covered ranged between 0-15 years. Therefore this study is unable to capture direct impact of parental education on nutrition status of the children of younger age (0-3 years). As in case of Kassouf and Senauer (1996), this study supplements their study in another way, by saying that parental education can have significant impact on nutrition outcome of both younger and older children even controlling for income and economic status of parents.

Garret et al (1999) found that undernutrition among children of age 0-60 months are very high in rural areas of Mozambique while compared with their urban counterparts. Height-for-age (stunting) is taken as the nutrition indicator of the children of age 0-60 months. They are divided into two broad age groups; 0-23 months and 24-60 months. Around 46% of the rural pre-schoolers and 26% urban pre schoolers are found to be less than -2 standard deviation from reference height (stunted) for these age groups. They found child nutrition to be having the least rural/urban differential at the early stage of the infancy (0-23 months) but this differential is pronounced once children grow older (24-60 months). Maternal education is found to be a significant determinant for both rural and urban child nutrition status irrespective of their age groups. However, the economic indicator like income bears a sensitive influence on nutritional outcome of urban children. Household size is found as a significant determinant in case of both rural and urban children of age 24-60 but not for children of age 0-23 months. Thus it implies that practice of child rearing may be important for children of age 0-23 which is determined largely by education of the mother, both in rural and urban areas. But for older children of age 24-60 months, the income and household size matter more along with care because as they grow older, they need more calorie and have lot more exposure to environment and quality of household living. It is also seen that the pattern of land holding has positive implication on child nutrition in rural areas but

not in urban areas because in urban areas the agricultural households may fall into lowest income strata. This in turn justifies the role of income in determining, child nutrition in rural/urban areas for children below the age of five years. These stated evidence provide an understanding towards explaining differential nutritional outcome of children not only by place of residence or household economic status but also they need to be examined within control variables like the household environment of care in terms of sanitation, water supply, access to health facility etc. Better income levels and urban residence may not ensure a relatively better nutritional status of children if the quality of sanitation and basic infrastructure adds to a adverse household environment. So the paper argued that while mothers' education should be of priority for short-term nutrition programme, income generation and increase in agricultural productivity may be adopted as long term solution to tackle child under nutrition.

Ruel et al (1999) analyse the impact of good care practices on nutrition outcome of the children of age 0-36 months. The study shows that good care practices can mitigate the negative effects of poverty and income on children's nutrition status. The children in these households are selected randomly from households in Accra, the capital city of Ghana. This study has taken into consideration, the individual characteristics at the child level like, child's age, gender, stunting, waisting, and underweight less than -2 z-scores. The individual characteristics at the mother level are age, height, body mass index, schooling, ethnic groups, maternal work status, if the households is female headed or not and care practices. The index on care practices include child feeding practices (in terms of breast feeding, supplementation, initiation of supplementation, duration of breastfeeding, the methods used when child refuse to eat) and use of preventive health care services (in terms of growth checking, DPT immunisation, Measles immunisation). At the households level households size, percapita expenditure on food and non-food items (proxy for per capita income), calorie availability per adult equivalent unit for mother, and quality of housing measured in terms of condition of the house and assets in the household.

The analysis found strong associations between care practices and child nutrition status using a bivariate regression in terms of service used or not. The prevalence of stunting and underweight was significantly smaller among children whose mothers

scored in the highest tercile of care practices. The magnitude of the difference between the lowest and highest care practices tercile was more than three fold for stunting (24.1% compared to 7.3%) and 2.5 fold for underweight (22% compared to 8.7%). This association also was true despite controlling for income and household economic status. The multivariate analysis confirmed a statistically significant interaction between maternal schooling and good care practices. This relationship further holds good when this interaction of maternal schooling and good care practices are controlled for income of the household and the significance interaction between maternal schooling and good care practices still hold good at 1-% level. Thus the study proves that good care practices for the children of uneducated and poor mothers can improve their nutrition status both in terms of height and weight, vis-à-vis children of educated and wealthier women. The study thus re-confirms the positive influence of maternal education on nutrition outcome for the pre-school children. But the exact process was not found. The additional component revealed by this study is the process in which better maternal education and information could improve the nutrition status, irrespective of the household socio-economic status. But authors here cautioned that realisation of this crucial link is not in the absence of certain basic minimum economic status of the household. The little impact of higher maternal education and better income of the household on nutrition status are expected, as after a threshold level these factor cease to influence child nutrition outcome. But this finding nonetheless can be used as a policy measure (to improve maternal education for better nutrition outcome of the children) for poor households. But the major drawback of this study is that it is based on urban households, not rural households. It is well known fact that rural poverty is more complex and widespread compared to urban poverty and there is relative difference between absolute economic condition of the poor households on the basis of their rural/urban divide, especially in developing countries like Ghana. Whether maternal schooling (via good care practices) can mitigate the negative impacts of income and poverty on nutrition outcome of the rural children from poor household, still remains to be seen.

However a study by ***Joshi (1994)*** also confirms the impact of maternal education on health seeking behaviour of the women and their children in Nepal, especially those from poor households in rural areas. The data are collected from a poor rural region of Nepal and have information for 156 randomly selected women from 1,144

households, who have children of age 5-36 months. After controlling for economic status, ethnic background, plain/mountain divide, the study found that maternal schooling influence the health outcome for the mother and child. The child health indicators used are in terms of height-for-age (stunting) and weight-for-height (waisting). It is found that maternal schooling can explain 28% of variance in height-for-age and the positive association between maternal schooling and height-for-age is significant at 1-% level. The prevalence of diarrhea among children is also found to be less among more educated mother irrespective of their socio-economic status. Similarly they found husband's education is significant for weight-for-height of the children where as mother's education does not. Husband' occupation status and employment are also found to be significantly associated with height-for-age outcome but not for weight-for-height. Since weight-for-height represent both past and present nutrition status of the child (a cumulative outcome of a sustained condition), we find that husband's education may have some impact on over all social and economic status of the household through income, exposure to modern skills and better health information, which in turn determine the nutrition status of the child. This also proves at a smaller age maternal schooling may have positive impact on height-for-age, but may not have significant impact on weight-for-height, which is a cumulative effect of various other factors. Nonetheless the study proves that maternal schooling via good care practices can improve the nutrition status of their children, irrespective of their asset holding and economic status, like their urban counterparts in Ghana. [Shan and Haldorman; 1997, Ruel et al; 1999]. This also provides missing link in the study by Hotchkiss et al; 2002, which found better provision and accessibility of Maternal and Child Health Care (MCH) in Nepal, has improved the nutrition status of the children in Nepal. Actually the better maternal schooling can improve the practice of care in two ways; acquisition of skills and identity acquisition by the mother. The acquisition of skills can make a mother to communicate better with health personnel, to understand and benefit from new methods, policies, information and techniques. The identity acquisition actually tells that women from the poor households want their child to be as healthy and normal as their counterparts from better off households. Thus we can conclude that better maternal education has the capacity to improve the child nutrition with in constraint boundary of social and economic backwardness. Earlier we have seen in chapter-2 and chapter-3 that maternal education has a positive significant impact on their own nutrition and health status. So maternal education and

literacy should be an integral part of any policy strategy to counter child and maternal under nutrition.

Another study by ***Ravallion and Jalan (2001)*** finds the provision of pipe as a determinant of child health outcome, especially in terms of controlling diarrhea. This is reflected in the differential under five mortality rates among children of households with this facility as against those without it. But the association only holds good for those children whose mother have some minimum level of education. Thus this study agrees with earlier findings that maternal education does have impact on child health through better care practices (in this case use of pipe water for drinking). This study use the cross sectional data collected by National Council for Applied Economic Research, New Delhi from 33,000 rural households covering 16 states. This is basically a cross section data and uses a logit model to assess the determinants of health status of the children measured in terms of incidence of diarrhea among children under age five and it's duration. They found that among poor households, the education of women matters greatly to achieve child health benefits from piped water. But for richer households the maternal education's impact is not found to be significant. The illness duration is also 40% higher in case of households not using pipe water in contrast with identical households having piped water.

Frongillo Jr. et al (1997) studied the impact of socio-economic and demographic factors on nutrition status of the children (measured interms of stunting and waisting) in a cross-country analysis, consisting 70 developing and least developed countries of Africa, Asia and Latin America. They have used World Health Organisation Global Data Base on Child Growth for less than five years of children. They worked out a comprehensive conceptual model and a database of national factors with their variance components and used regression analysis to determine the determinants. Food security at the national level is the energy available from food; it was estimated as the daily calorie supply as a percentage of daily requirements. To measure the impact of maternal and child care they have taken into account the services and activities which could enable the women to have better nutrition and health care for them and their children. Enrolments of female children as a percentage of enrolled male children, female literacy and fertility rate are used as proxies for measuring these services and activities. For measuring the impact of health service and environment

on child nutrition outcome, the proxies were percentage of population with access to safe drinking water, natural logarithm of government health expenditure as percentage of gross national product of that country, percentage of immunised child in less than 1 year age group. They defined the socio-economic and demographic structure in the country in terms of it's formal and non-formal institutions. The proxies they used to measure the impact of socio-economic factors were military population as percentage of working age population, population density, and female participation in total labour force and also in industrial work force. The female political rights and religious practices are also included. Economic factors were measured by the proxies like distribution of productive assets, external economic dependency (measured in terms of debt and interest payment). The binomial regression, Multivariate regression and Analysis of Variance (ANOVA) methods were used to determine the major determinants. They found substantial variability in nutrition status among different nations and regions within a particular nation. They also found 76% national variability of stunting and 66% national variability of waisting could be explained by national factors and geographic region. It was found that for almost all the countries with higher energy availability, female literacy, and gross national product had lower prevalence of stunting. The amounts spend on health also affect nutrition status by regions. For Asian countries where half of the total undernourished children live, higher immunisation rate, per capita energy availability is significant explanatory factors for child undernutrition measured in terms of waisting. They found differences in the relationship between stunting and waisting were accounted for by national factors. The striking observation made in the study relates to child malnutrition with in a household being greatly influenced by issues at national and provincial levels, and intervention should be considered at national, provincial and household level. And its limitation is in terms of the inability to explain regional variations in child nutrition, which is mostly due to variation in dietary practices, acknowledged by the authors. Despite this limitation, it addresses many questions, which were not answered previously. The study found those immediate factors, underlying factors and national factors can only partially explain the differential in child nutrition outcome. The most interesting finding is about Asia. Quoting Ramalingaswamy et al; 1996, they mentioned three important factors to be responsible for widespread undernutrition among children in Asia compared to Africa and Latin America. These factors are poor care provision for girls and women by

husband and elders along with poor hygiene practices related to breast-feeding and timing of introduction of supplementation. These three factors may have been built on the concept of sex-discrimination and the vicious cycle of undernourished mother and children, as we find in case of maternal under nutrition. On the whole, food security at national level is found to be having a significant bearing on child nutrition. But at household level, it is more complex to assess the direct impact of energy availability comprising quality, quantity, certainty and acceptability. But food security at the individual level may not always hold good for nutritional status of the children. But nonetheless this study concludes that higher energy availability (food security at the national level), female literacy, immunisation, economic growth (in terms of GDP) are favourable to better height and weight of the children. It also emphasises the nutrition intervention at national, provincial and household level.

The work by ***Ruel et al (1999)*** also raise some important issues emerging in context of rapid development and urbanisation in developing societies. Because in urban areas there is greater dependence on cash income, lack of social nets, greater labour force participation of women and it's consequence for child care, lifestyle changes (particularly diet and leisure pattern), lack of accessibility for poor to basic health, water, electricity and sanitation services, emergence of new property right regimes where there is lack of accountability affect the nutrition security of the poor. Especially poor casual workers and landless population and weaker sections like women are more vulnerable to under nutrition. Especially the changing role of women at least in urban setting, has great significance for the pattern and nature of the care for the child and in turn nutrition status of the child. Using Demographic and Health Survey data, she found that urban women in Africa on an average, are less likely to initiate breast-feeding and more likely to wean earlier if they do breast-feed. This may have serious implication for future nutritional status of the children.

Maxwell (1999) also aired similar views presented by ***Ruel et al (1999).*** His study on Sub-Saharan African region found that by the year 2000, 40% of the population in this region would live in cities. But at the same time the on going economic recessions, political instability and domestic conflicts might affect the food security of the people. The over crowded cities in these countries have hardly enough resources to provide housing, sanitation and other basic facilities to the growing population. He

also noticed the falling real income both in formal and informal sectors, which would limit the purchasing power of the lowest quartile to a large extent. He also observed the increase in price of the essential commodities and curtailing of the food security programmes in the region. All these according to him might affect the over all food availability for the households in poor strata. At the same time it might affect nutrition intake and growth of the members of these households, All these developments will have a cumulative adverse impact on children's nutrition outcome. In case of India, it is also expected that around 40% of population might live in the cities and other small and urban areas. So a comprehensive study on status of food and nutrition security of poor in urban areas would tremendously help to meet the challenges in future.

A study done by ***Kundu (2000)*** found that calorie consumption has been declining for female workers in general and casual workers in particular (working in construction and other informal sector) in urban areas. His analysis was based on National Sample Survey Organisation Report on Nutrient Intake-2000. This data provides information at national, household, individual level consumption of calorie across different age, sex, and occupation category. However nothing was mentioned about the consequence for children in these vulnerable households. So one should explore further, the implication of reduction in calorie intake for nutrition status of the children.

However all these studies do not state explicitly about the major factors behind socio-economic status itself i.e. the agro economic condition and level of development of the region compared to neighbouring regions. In a country like India where poverty and underdevelopment is region specific, the analysis of nutrition needs a special approach. Especially in India the agriculture is still the backbone of rural economy, in terms of generation of employment and income and this in turn depends upon the seasonal variation itself due to lack of irrigation and poor agriculture infrastructure. The policy measures to tackle nutritional deprivations may not be feasible by overlooking these issues.

The study by ***Rao et al (2002)*** is a good attempt in this regard. His study is based on AndhraPradesh, a province of India. The state of AndhraPradesh illustrates itself with large diversity in development across regions. He and his team conducted a stratified sample survey through out the state. The state is divided into three agro-economic

regions called Coastal, Rayalaseema, and Telengana. Economically and agriculturally Telengana is the least developed region and Rayalaseema is the most developed region within that state. The study takes into account the pre-school children of 0-6 years of age. The three standard antropometric approaches are used for measuring nutrition status of the children; stunting, waisting and underweight. The study found that children from Telengana are the worst performers in all the indicators and children from Rayalaseema are the best performers in all the three indicators. The study found socio-economically and demographically Rayalaseema region was better developed with high per capita income, smaller family size, higher literacy rate, higher landholding size, and higher percentage of agriculturist because of better irrigation followed closely by Coastal Andhra. The Telengana is the worst performer on all these parameters. It is important to notice that though in Telengana agriculture is the prime occupation, it is a relatively dry region in the absence of widespread irrigation system. The study also found the role of social and cultural practices affecting the nutrition outcome. The children from households with better economic status, from higher caste, low family size, pucca houses, large land holdings, higher per capita income, and occupation such as cultivation, business and services have better nutrition status while compared with the children from poor, low caste, large families, share croppers within the same region. Thus in Indian context the seasonality in agriculture and regional variation in economic development might explain the causes and remedies of child nutrition better.

The study by ***Senauer and Garcia (1991)*** in Philippines shows that apart from parent's education, village wage rate, age of parents and age of the child, the price of the essential commodities (here price of rice) can make difference to nutrition outcome of children in a poor society. In a follow-up study done by them among pre-school children, they found that during the increase in price of main staple food rice, the calorie adequacy ratio and weight-for-age show a declining trend for the children. But the rises in price of the rice and further impact on intake do not affect height-for-age. This proves seasonal price rise has it's impact on short term indicators of nutrition; calorie adequacy ratio and weight-for-age. But it may not affect or at least be pronounced in case of long term indicator like height-for-age. This particular study is both a longitudinal (comprising both time series and cross section data) and case control study. Because the selected children of age two to six years are followed for

18 months and they are drawn from three different provinces from poor households. The children are also divided into two broad groups of household; in one group the households benefit from some food subsidy programme and the other group have no such subsidy. The study found even if the price of rice increases, the households with food subsidy do not report underweight or inadequate calorie intake ratio for their pre school children. Thus this study emphasises that poor households should have access to some food security or income transfer program by the government to meet the seasonal fluctuations in the nutrition status for their child. Otherwise in long run it may affect their over all nutrition achievements in terms of height-for-age and weight-for-height.

The role of gender and intrahousehold distribution of resources between boys and girl are also important for the outcome of child nutrition. It was found that better financial control for women in the household could increase the nutrition status of both male and female children.

Beherman (1988) has examined intra-household allocation of nutrients in rural India. His study was based on the sample of 240 households, collected from two villages from AndhraPradesh and six from Maharashtra. He found that there is pro-male bias in intra household allocation of calorie and other micronutrients, especially in lean seasons where food is in short supply for poor households. But this is not clearly visible from antropometric scores for male and female children taken in lean (September to November, before crop harvest) and surplus seasons (January to March, after crop harvest). Sons may be preferred over daughters because they are the one who will earn in future. He negates the explanation provided by Sen and Sengupta that this behaviour of parents could be attributed to land holding patterns in the rural area. Instead he opines the lower caste to be having strong son preference. But a closer look at the two arguments will tell that low caste people are also the poor landholders in rural areas, especially in Indian context. So one can conclude that the poverty of poor households might determine their preference for male children who are considered as future economic assets of the family.

Hazarika (2000) analyses gender differences in children's nutrition and their access to health care to determine weather there is any discrimination for girl child in Pakistani society on the basis of their sex. The study found that there is discrimination on the

basis of gender at least for provision of health care for the child (in terms of immunisation, frequency of visit to health professionals). But this discrimination may not surface through nutrition indicators measured in terms of anthropometry. The study is done on data collected by Pakistan Integrated Household Survey (PIHS-1991). Only children of age 0-5 years were considered. The total sample size is 3785 and it covers all provinces of Pakistan. Thus this study concludes that intra-household gender discrimination has primary origins not in parental preference for boys but in higher returns to parents from investment in sons, especially in poor households. The finding is quite similar to the findings by Beherman for Indian villages. In fact Hazarika quote DasGupta; 1987, Walker and Ryan; 1990, Basu 1989, 1993, National Family Health Survey; 1992-93, that in Indian context there is very little evidence of gender discrimination as far as nutritional allocation is concerned. Gopalan (1987) has concluded that nutritional imbalance is not as a major part of gender inequality in the region. But on the other hand study by Singh, Gordon; 1962, Aziz; 1977, NFHS-2; 1998-99 shows wide spread gender inequality for provision of health care for the girl child. So on the whole nutritional outcomes could hardly reflect gender discrimination against girl child.

Shan and Stifel (2002) find the reverse to be true for Africa. They have done a cross-country analysis for nutrition status of the children according to sex of the child for 14 African countries in the 1990s. They found that mothers are more sensitive to health and nutrition of the female children and fathers are more sensitive to male children. It is reflected in the respective z-scores for height-for-age, weight-for-age of the children. Even mother's education had a favourable influence on the nutrition status of girl child. This result holds true after controlling for income and economic status of the household, age of the parents, parental education, care practices, provision of basic infrastructure in the household. But nonetheless the authors pointed out that it could be due to some peculiar cultural behaviour of the African society. In many African societies female-headed households are very common. The girls also stay in mother's house after marriage in many cases. The migration to big urban and trading centers by male members is also very high. So all these factors might help girl's nutritional achievements. Secondly in African societies it is usual practice to over estimate boy's age so that he could get admission soon in the school. On the other hand girl's age is under reported, so that she will have more option in marriage

market. Another possible explanation might be that in Africa the reference height and weight for age for male child might be set at very high and for girl child at a lower level. But the gender bias in South Asia and Africa needs more robust analysis to conclude some thing affirmatively.

Marcoux (2002) has done a very comprehensive literature review on evidence of gender difference in child undernutrition. His study shows that girls are more affected than boys for waisting (acute growth disturbance measured in terms of height-for-weight) in 9 out of 35 surveys. These include four surveys from India in 1994, four surveys from Venezuela, one survey from Jamaica 1993. In the 26 remaining surveys, boys are found to be more affected. Out of 40 surveys for revealing significant sex differentials in the prevalence of stunting (long term growth faltering in terms of height-for age), only one survey from China found to have bias against girl child. Other 39 surveys have reported more prevalence among boys. Out of 30 surveys revealing sex differentials in the prevalence of under weight (weight-for-age measuring short-term variation in nutrition), only four studies found bias against girl children. Out of four studies two are from China; 1987, One from India; 1996-97 (Orissa) and one from Srilanka; 1993. In other 26 studies boys are found to be more affected than girls for underweight. In case of India it is found that national surveys like National Family Health Survey; 1992-93, 1997-98 can explain gender bias in all the three anthropometric indicators at national level. But in other cases like Bangladesh, Nepal, Egypt, Kiribati, Philippines, Hongkong, Cambodia, Kenya, Malawi, Myanmar and other countries no bias against female children was found even at national level survey. To conclude with Sommerfelt and Arnold; 1998 we can say, gender discrimination against girls in societies having strong son preference, are more visible in terms of feeding practices and medical treatment but might not be so widespread or not sufficiently severe to show up in data on nutritional status at the national level. Though we found girls are less likely to be undernourished than boys, it does not reduce the burden of undernutrition among children in developing countries. [See Marcoux; 2002]

Pitt et al (2003) in the context of Bangladesh found that the increase in economic resources for poor rural women have significant impact on nutrition outcome of their children measured in terms of armcircumference and Height-for-age. Both are long

term indicators of nutritional status. But the same is not true for the men. They found that 10% increase in credit provided to women is associated with 6.3% increase in armcircumference for their daughter and to a smaller degree for their sons. But for men, though the increased income has a positive impact on girls arm circumference, it is negative for boys arm circumference. The one unit increase in female credit is found to have large, positive, and statistically significant impact on height-for-age for both boys and girls (0.50 and 0.36 centimetres per annum on an average). But interestingly the same unit increase in credit for men participants result in decline of the height for age on an average for both sons and daughters (0.11 centimetre and 0.16 centimetre respectively). But for BMI of the children, the credit for men or women have no impact. However the study does not reveal how these rural poor women used the credits in contrast with their male counterparts which might explain the contradiction presented above. One possibility could be that the women better use the rural credit programme for generating economic assets for their family. The self assertion through command on economic resources, greater participation in economic decision making of the household and self help group, might have changed their life style and enable them to take better care of their children with their own resources. On the other hand the men might use this credit for short-term consumption, but nothing can be asserted firmly because authors have not mentioned about this. Another interesting thing is that positive impact is more for girl child. It may be due to the fact that nutrition status of the girl children in male dominated South-Asian societies are originally at very low level. So a little improvement in availability of care and diet might result in greater improvement in nutrition status. The BMI is not showing any improvement, because weight-for-height indicates nutrition status of long past, which solely might not be affected by economic factors but other non-economic factors like care, environment as well. Since this study includes all the children under age 15 years, it is very difficult to say how women's economic status affect the nutrition status of the children in their early stages of life (0-3 years). But nonetheless this study is unique in the sense that it proves that women centric poverty alleviation and income generation programmes may have better chance to improve economic, health and nutrition status of the targeted households.

We have mentioned at the beginning of this chapter that, the factors affecting nutrition outcome of children can be divided into three:

1) First the direct determinants; dietary intake and health status of the children

2) Second underlying determinants which influence direct determinants; care practices, parental education, availability of basic infrastructure in the household etc.

3) The third categories of determinants are those, which affect child nutrition outcome indirectly, through underlying determinants. These are over all economic status of the household, the region and the nation from which this household belongs, the social, political and cultural background of the household, region and nation themselves. These determinants are proxied by per capita income of the nation and household, over all economic growth, prevalence of poverty and poverty gap etc. The social background is reflected through caste (in case of South Asia), ethnicity, religion, cultural practices etc. We will discuss in brief some of the literatures, which analyse the impact of basic determinants on nutrition outcome. First take the impact of growth measured in terms of national income.

Hadad and Smith (2002) have examined the hypothesis of 'wealthier is healthier' i.e. countries with higher per capita national income levels also have better physical health at the individual level. But the authors argued that in the absence of an effective income distribution, lack of public health and nutrition security, there is every reason to believe that the fruits of economic growth in terms of better health and nutrition might not reach to the poor. Even if the income rises for the poor due to growth, lack of education and poor quality of care might not help to transform that growth into better nutritional outcome. Sen (1989) has raised this particular issue. His example of South Africa and Sri Lanka best suits this argument with South Africa's higher per capita income, does not increase the life expectancy and Sri Lanka's lower per capita income is accompanied with high life expectancy (comparable to developed countries). Similarly his comparison of Bhutan and Sri Lanka shows, while per capita calorie intake is higher for Bhutan, the life expectancy, under five mortality and availability of health care accessibility is very low compared to Sri Lanka. He attributed the achievements of Sri Lanka to better public infrastructure provided by the government for health and nutrition intervention. So having this argument in the background, we will analyse the findings of Hadad and Smith (2002). Their study is based on findings of nutrition status (z-scores in terms of weight-for-age; -2 standard

deviation) of children below five years for 63 countries from 1970-96, from various secondary sources like DHS/WHO/NCH/WB. The results from the analysis shows that increase in per capita income by 10% reduces the rate of child under nutrition by 6.3% in almost all developing countries under observation. The coefficients of per capita GDP and GDP^2 (to allow non linearity across the countries in rate of increase in per capita GDP) found to be significant in all the models they used; Ordinary least square, Random Effect Model, Fixed Effect Model, Instrumental Variable model. This study also found the pathway through which the growth of per capita income reduces the rate of child undernutrition. The time panel data shows that greatest GDP induced reduction in the child underweight come from national food availibilities (46% of the change in total effect can be explained by increase in food availability), followed by increases in female enrolment (31%), safe water access and female to male life expectancy ratio (11-21%). So increased per capita income might reduce the prevalence of undernutrition by facilitating private and public investment in four key sectors that influence the immediate determinants (dietary intake and health status of the child). They are food availability at national and per capita level, women's education, women's status and health environment quality. But the major drawback of the study entails that though income growth has positive impact on health of child and other household members, it does not show how the income distribution itself play a role in these countries. It is also not clear whether all the regions with in a country or a province within the country equally benefited from national per capita GDP growth i.e. undernutrition rate declines at same rate every where all over the country. The benefit of over all decline in child undernutrition might not be fully realised if some regions within the country still suffering from high rate of prevalence.

Beherman and Deolalikar (1987) also address the issues concerning the improvement in nutritional outcome in the developing countries. The advantage of the study being in a rural setting and its relevance for us is for it being in rural India. Two hundred forty households from six villages of Maharashtra and Andhra Pradesh were selected. Their study found that in the poor families the increase in income will increase in food expenditure-more or less proportionately to income-but the marginal increments might not be devoted to obtain more nutrients. The increased income might be devoted to more costly (tasty and regarded as prestigious foods) food items having low nutrient content. This tendency they attribute to lack of education and

information about role of micronutrients among the poor who consider more costly food as nutritious. So the argument of Hadad and Smith presented earlier have to be taken keeping this finding in the background.

Thus from all the literature and evidences on child undernutrition cited above we can conclude that child undernutrition has a complex dynamic of determinants. It needs account of all the determinants; immediate, underlying and basic. But one thing comes out clearly from these findings that socio-economic background of the households and parental education are the two most significant determinants of the child undernutrition. However the determinants are diverse according to rural/urban residence. In urban areas we find many unique issues which are not seen in rural areas. The income might be higher in urban centers but the over crowded cities might upset the benefit of income growth on nutrition status of children, if the basic living conditions are poor. In rural areas of developing countries all round intervention in public health, building infrastructure in agriculture and other village industries, asset generation through low cost programmes, improvement in maternal education, educating parents about better child care are important issues in the context of child undernutrition. The next chapter looks at a comprehensive analysis on pattern and determinants of child under nutrition in context of Orissa.

CHAPTER V

ANALYSIS OF CHILD UNDER NUTRITION IN ORISSA

This chapter will focus on the nutritional status of children in Orissa. The analysis will include both anaemia[i] and anthropometric[ii] methods to find out the patterns and determinants of undernutrition among children in Orissa. The chapter will be divided in to two broad sections. One section (Part-I) will contain anaemia analysis and the other section (Part-II) will contain anthropometric analysis. In case of anthropometry we will consider height-for-age (stunting), weight-for-age (underweight), and weight-for-height (waisting) as the indicators of children's nutritional status. [Osmani; 1987, Kassuf and Senaur; 1996, Black and Krishnakumar; 1999, Frongillo et al; 1999, Hadad and Smith; 2000, Mallikajurna et al; 2002]. Both the approaches will have six sets of characteristics i.e.

1) Demographic characteristics: Like age of the mother, mother's marital status, mother's age at first marriage and first birth, birth in last three years for the mother, total children born to mother, total number of children under age five, sex of the household from which the child comes and marital duration of the mother are considered as demographic characteristics here. Either one or the other demographic characteristics are taken in to account in any study of child under nutrition. Especially age of the mother, marital status, sex of the household head, family size are more frequently used characteristics to explain child under nutrition. We include some more to get a more comprehensive expression of the child under nutrition.

2) Social Characteristics: Social characteristics like education level of the mother and father of the child, their place of residence, religious, ethnic and regional background are considered in this set of characteristics to explain child undernutrition. Many studies on the nutritional status of children have considered some of the characteristics but not all in one study. Especially on Orissa we have not found any literature on this subject dealing with all these characteristics (educational, social, ethnic, religious and regional) at a time. This study takes all

the mentioned characteristics keeping in mind the social and ethnic structure of the population of Orissa.

3) Economic characteristics: These include the household economic status in terms of household standard of living index and occupational status of father and mother of the child. These characteristics are highlighted in almost all literature found on children's nutrition.

4) Basic infrastructure: These sets of characteristics imply the quality of life enjoyed by the household. Whether the household in which the child lived has the capability to access basic sanitation, hygiene and live life free of avoidable diseases due to air or water pollution. The recent empirical literatures on child nutrition focus on these issues with great importance. [Hadad and Smith; 2000, Ashworth et al; 1997, Kassouf and Senaur; 1996, Shan and Alderman; 1996].

5) Dietary practices: The dietary practices of the mother in terms of frequency of taking protein and vitamin rich foods like milk/curd, pulses, different vegetables, fruits and other animal proteins are not taken in to account in previous literature. We include these food items to know over all dietary pattern of the household, which might affect child's initial birth weight and his/her vulnerability to various diseases.

6) Child and mother's individual characteristics related to pre and post-natal period, prevalence of disease and health care practices. In this set of characteristics we try to capture the pre and post natal care practices of mother and her child, the care practice during disease like diarrhea and vaccination for the mother and child. In some literature one or two characteristics of all the characteristics cited here are taken in to account but not all of them.

The categorisations of the selected characteristics are same for both child anaemia and child anthropometry analysis. We follow the same categoristion procedure as we followed in case of maternal anaemia and maternal BMI analysis.[iii]

Part-I

This part will contain analysis on child anaemia. The sections 5.1 to 5.1.11 are included in this part.

5.1 Child Anaemia Analysis for Orissa

In the previous chapter we have justified anaemia as an important indicator for child nutrition status. It is a clinical measure. This indicator helps us to know the iron deficiency in the blood. The iron is a micronutrient (mineral) which is crucial for growth of body cells, which in turn determines the height and weight for body. If the body lacks the required amount of iron then the hemoglobin level declines (because hemoglobin is produced from red cells which in turn help to produce required blood for the body; this blood again regulates the growth and efficient function of other important organs). A child suffering from anaemia might also lack proper growth of brain. In latter stage of the life, the lack of anaemia also affects the productivity, especially for manual works. Anaemia among pre-school children can affect the cognitive performance, behavioral and motor development, coordination, language development, educational achievement and resistance to infection and other diseases in the future. [For detail see various issues of ICMR, Gopalan and Seshadri; 1989, Seshadri; 1993, 1998, Bhargava et al; 1995, Gomber et al; 1998].

Some of the research works mentioned above found that socio-economic and demographic characteristics are important in determining child anaemia. Here for child anaemia analysis of children in Orissa, we have taken data from NFHS-2; 1998-99. The total sample size for child anaemia analysis is 1129. Based on this sample we have done the following analysis.

5.2.1. Demographic characteristics and anaemia among the children

The set of demographic characteristics shows that 70 per cent of children are anaemic irrespective of the age of mothers. The formerly married mothers (i.e. widow, divorce) have relatively higher prevalence of anaemia among their children (76.9%) compared to children of currently married mothers (72.1%). That is because in Indian society women without husband are economically and socially less resourceful in general, which might get reflected in poor nutrition status of their children (Table 5.2.2)

Table-5.1.1.Pattern of Anaemia among children by Demographic Characteristics

Characteristics (1)	*Anaemic* (2)	Degree of anaemia[1] (3)			*Non-Anaemic* (4)	*Total* (5)
		Mild (3a)	*Moderate (3b)*	Severe *(3c)*		
Age group						
15-19	70 (70.0)	19 (19.0)	48 (48.0)	3 (3.0)	30 (30.0)	100
20-24	310 (75.79)	108 (26.4)	193 (47.18)	9 (2.2)	99 (24.2)	409
25-30	266 (70.18)	101 (26.64)	151 (39.84)	14 (3.69)	113 (29.81)	379
30-34	126 (67.14)	49 (26.34)	74 (39.78)	3 (1.61)	60 (32.25)	186
35-39	29 (74.35)	14 (35.89	14 (35.89)	1 (2.56)	10 (25.64)	39
40-45	14 (93.33)	6 (40.0)	8 (53.33)	-	1 (6.6)	15
45-49	1 (50.0)	-	1 (50.0)	-	1 (50.0)	2
Total	816 (72.21)	297 (26.28)	489 (43.27)	30 (2.65)	314 (27.78)	1130
Marital status						
Currently married	804 (72.1)	294 (26.36)	481 (43.13)	29 (2.6)	311 (27.89)	1115
Formerly married	10 (76.92)	2 (15.38)	7 (53.84)	1 (7.69)	3 (23.07)	13
Age at first marriage						
<18	423 (75.4)	154 (27.45)	254 (45.27)	15 (2.67)	138 (24.59)	561
>=18	348 (68.91)	129 (25.54)	207 (40.99)	12 (2.37)	157 (31.08)	505
Age at first birth* (for 3010 cases)						
<18	258 (75.88)	96 (28.23)	152 (44.7)	10 (2.94)	82 (24.11)	340
>=18	512 (70.71)	186 (25.69)	309 (42.67)	17 (2.34)	212 (29.28)	724
Age group						
<30	615 (72.6)	230 (27.15)	366 (43.21)	19 (2.24)	232 (27.39)	847
>=30	157 (71.68)	53 (24.2)	95 (43.37)	9 (4.1)	62 (28.31)	219
Birth in last three years						
0	646 (72.09)	234 (26.11)	389 (43.41)	23 (2.56)	250 (27.9)	896
1+	125 (73.96)	49 (28.99)	72 (42.6)	4 (2.36)	44 (26.03)	169

(Cont..)

[1] Column 3 in each table is the break up for column two. While column 2 express the percentage of over all prevalence of anaemia in each category, column 3 presents the degree of prevalence in each category.

Characteristics (1)	*Anaemic* (2)	Degree of anaemia[2] (3)			*Non-Anaemic* (4)	*Total* (5)
		Mild (3a)	*Moderate (3b)*	Severe *(3c)*		
Family size						
1-4	249 (70.53)	101 (28.61)	144 (40.79)	4 (1.13)	104 (29.46)	353
5-7	352 (72.42)	125 (25.72)	211 (43.41)	16 (3.29)	136 (27.98)	486
8+	170 (75.22)	57 (25.22)	106 (46.9)	7 (3.09)	56 (24.77)	226
One or more than one eligible women						
One	573 (73.74)	204 (26.25)	346 (44.53)	23 (2.96)	204 (26.25)	777
More than one	199 (68.85)	79 (27.33)	116 (40.13)	4 (1.38)	90 (31.14)	289
Number of children under age five or else						
Zero	153 (76.11)	71 (35.32)	77 (38.3)	5 (2.48)	48 (23.88)	201
One or two	591 (71.54)	198 (23.97)	371 (44.91)	22 (2.6)	235 (28.45)	826
More than two	29 (72.5)	14 (35.0)	14 (35.0)	1 (2.5)	11 (27.5)	40
Current age of the child in years*						
0	201 (79.44)	75 (29.64)	120 (47.43)	6 (2.37)	52 (20.55)	253
1	323 (73.57)	106 (24.14)	205 (46.68)	12 (2.73)	116 (26.42)	439
2	292 (66.66)	116 (26.48)	164 (37.44)	12 (2.73)	146 (33.33)	438
Total number of children ever born						
Less than two	349 (74.73)	132 (28.26)	202 (43.25)	15 (3.21)	118 (25.26)	467
More than two	422 (70.45)	150 (25.04)	259 (43.23)	13 (2.17)	177(29.54)	599
Sex of the household head						
Male	781 (72.11)	282 (26.03)	470 (43.39)	29 (2.67)	302 (27.88)	1083
Female	34 (73.91)	15 (32.6)	18 (39.13)	1 (2.17)	12 (26.08)	46
Sex of the child						
Male	439 (72.68)	265 (43.87)	160 (26.49)	14 (2.31)	165 (27.31)	604
Female	376 (71.61)	224 (42.66)	136 (25.9)	16 (3.04)	149 (28.38)	525
Marital duration grouped						
0-9	543 (71.25)	206 (27.03)	321 (42.72)	16 (2.09)	219 (28.74)	762
10-19	209 (74.110	70 (24.82)	127 (45.03)	12 (4.25)	73 (25.88)	282
20-29	19 (90.47)	6 (28.57)	13 (61.9)	-	2 (9.52)	21
30+	1 (100.0)	1 (100.0)	-	-	-	1

Here * denotes statistical association at 5% level of significance. ** denotes statistical association at 10% level of significance.
Source: NFHS-2: 1998-99

[2] Column 3 in each table is the break up for column two. While column 2 express the percentage of over all prevalence of anaemia in each category, column 3 presents the degree of prevalence in each category.

The age at first marriage and first birth for the mother seem to have an impact on anaemia outcome of their children. We found that women who marry or bear child before age 18 have proportionately more anaemic children with any degree of anaemia when compared to children of women marrying or bearing child after 18 years of age. Age of the child also matters significantly for anaemia/non-anaemia outcome as well as degree of anaemia outcome. We found that children below one years of age are more anaemic compared to children who are older than one year. Family size matters to some extent as far as prevalence of child anaemia is concerned. In our sample we found that large families (more than 8 members in the family) have comparatively higher prevalence of child anaemia (75.2%) compared to middle (5-7 members per household; 72.4%) and small families (1-4 members per household; 70.53%). The pattern holds good for all the degree of anaemia. [For detail see table 5.1.1]. Similarly, mothers with less than two births have shown greater prevalence of anaemia among their children in comparison with mothers having more than two births. The pattern of prevalence of anaemia among male and female children are more or less identical though it is little tilt in favour of female child. The female-headed households also are found to have higher prevalence of anaemia among their children (73.9%) compare to male headed households (72.1%). This pattern holds good for all the degree of anaemia except mild anaemia. [For detail see table 5.1.1].

5.1.2 Social characteristics and prevalence of anaemia among the children

The education of father and mother separately show that it has significant association with child anaemia outcome. Mother's education has positive impact in terms of better care and health practices. [Joshi; 1994]. Father's education determines the level of income in the households, which in turn determines the availability and quality of food and health care for the mother and her child. It is found that uneducated fathers and mothers have children with comparatively higher percentage of prevalence of anaemia of any degree (78% app. for non-educated father and mother) against their higher educated counterparts (52% app.). This pattern holds good for moderate and severe anaemia as well. The children from urban households are comparatively better off than children from rural households for any degree of anaemia. [For detail see table 5.1.2]. From the table 5.1.2 one can also found out that children from Muslim

and Christian households are comparatively at higher risk of anaemia than children from Hindu households are except in case of mild anaemia.

Table 5.1.2 Pattern of anaemia among children by household characteristics

Characteristics	Anaemic	Degree of Anaemia			Non-Anaemic	Total
		Mild	Moderate	Severe		
Education level of the mother*						
No education*	466 (78.05)	151 (25.29)	293 (49.07)	22 (3.68)	31 (21.94)	597
Primary	150 (72.11)	62 (29.8)	82 (39.42)	6 (2.88)	58 (27.88)	208
Secondary	173 (62.9)	73 (26.54)	98 (35.63)	2 (0.72)	102 (37.09)	275
Higher	25 (52.08)	10 (20.83)	15 (31.25)	-	23 (47.91)	48
Partner's education level*						
No education	276 (78.85)	89 (25.42)	172 (49.14)	15 (4.28)	74 (21.14)	350
Primary	210 (77.49)	83 (30.62)	118 (43.54)	9 (3.32)	61 (22.5)	271
Secondary	268 (68.89)	101 (25.96)	163 (41.9)	4 (1.08)	121 (31.1)	389
Higher	61 (51.26)	24 (20.16)	35 (29.41)	2 (1.68)	58 (48.73)	119
Type of place of residence*						
Urban	81 (68.06)	29 (24.36)	49 (41.17)	3 (2.52)	38 (31.93)	119
Rural	734 (72.67)	267 (26.43)	440 (43.96)	27 (2.67)	276 (27.32)	1010
Religion						
Hindu	785 (72.41)	280 (25.83)	476 (43.91)	29 (2.67)	299 (27.58)	1084
Muslim	14 (60.86)	8 (34.78)	5 (21.73)	1 (4.34)	9 (39.13)	23
Christian	17 (73.91)	8 (34.78)	8 (34.78)	1 (4.34)	6 (26.08)	23
Others	-	-	-	-	-	-
Hindu Vs others*						
Hindu	785 (72.41)	280 (25.83)	476 (43.91)	29 (2.67)	299 (27.58)	1021
Others	31 (68.88)	16 (35.55)	13 (28.88)	2 (4.44)	15 (33.33)	45
Region*						
North Orissa	138 (75.09)	61 (33.15)	69 (37.5)	8 (4.34)	46 (25.0)	184
South Orissa	130 (83.68)	48 (25.26)	81 (42.63)	1(0.5)	60 (31.570	190
West Orissa	156 (69.02)	58 (25.66)	92 (40.7)	6 (2.65)	70 (30.97)	226
East Orissa	348 (74.51)	116 (24.83)	219 (46.89)	13 (2.78)	119 (25.48)	467
Ethnicity*						
SC	190 (75.09)	52 (20.550	131 (51.77)	7 (2.76)	63 (24.9)	253
Tribal	200 (83.680	63 (26.35)	125 (52.3)	12 (5.02)	39 (16.31)	239
OBC	258 (70.87)	108 (29.67)	142 (39.01)	8 (2.19)	106 (29.12)	364
None of them	168 (61.09)	74 (26.9)	91 (33.09)	3 (1.09)	107 (38.9)	275
SC/ST Vs Others						
SC/ST	390 (79.59)	115 (23.46)	256 (52.24)	19 (3.87)	102 (20.81)	490
Others	426 (73.83)	182 (31.54)	233 (40.38)	11 (1.9)	213 (36.91)	577

Here * denotes statistical association at 5% level of significance.
Here ** denotes statistical association at 10% level of significance.
Source NFHS-2; 1998-99

Over all the 83% of tribal children of pre-school age suffer from anaemia. In SC households 75% of children of pre-school age suffer from any anaemia. Since these two social groups enjoy relatively low social and economical status in Indian society, it's impact on nutrition status of the children is clearly visible from the table 5.1.2. As far as degree of anaemia is concerned for moderate and severe categories the same pattern holds good. But in case of mild anaemia, we found higher prevalence among

children from OBC households. Region wise south Orissa comprising undivided Ganjam and Koraput districts reported highest prevalence of anaemia (83.6%) of any degree, among the pre-school children of age 4-35 months, compared to any other regions of Orissa. Western Orissa reported lowest prevalence of anaemia among the children compared to any other regions (69%). But as far as mild anaemia is concerned northern Orissa is the top among all the regions (33.1%). For moderate anaemia eastern Orissa reports the highest prevalence (46.89%) compared to any other regions. North Orissa also tops the list for severe anaemia cases compared to other regions (4.3%).

5.1.3 Economic characteristics of the households and anaemia among the children

Children from low economic status households (low SLI) are found to have higher incidence of anaemia (75.1%) compared to children from medium (medium SLI; 72%) and high economic status households (high SLI; 54.08%). This pattern holds good for any degree of anaemia among the children, across different economic groups. But we do not find any clear pattern for father and mother's occupation. Children from agricultural households show higher prevalence of anaemia compared to other non-agricultural households. But the result shows that for mild and moderate degree of anaemia, children from households where mother does not work for any earning have the highest incidence. For father's occupation also we found a similar pattern. [For detail see table 5.1.3].

Table 5.1.3 Pattern of anaemia among children by basic economic characteristics

Charact-eristics	Anaemic	Degree of Anaemia			Non-Anaemic	Total
		Mild	Moderate	Severe		
Household Standard of Living Index*						
Low	471 (75.11)	168 (26.79)	281 (44.81)	22 (3.5)	156 (24.88)	627
Medium	286 (72.04)	105 (26.44)	173 (43.57)	8 (2.01)	111 (27.95)	397
High	53 (54.08)	21 (21.42)	32 (32.65)	-	45 (45.91)	98
Mother's occupation*						
Not working	613 (71.77)	277 (32.43)	364 (42.62)	22 (2.57)	241 (28.22)	854
Agriculture	99 (72.26)	40 (29.19)	55 (40.14)	4 (2.91)	38 (27.73)	137
Non-agri.	89 (64.49)	30 (21.73)	55 (39.85)	4 (2.89)	34 (24.63)	138
Father's occupation*						
Not working	17 (60.71)	9 (32.14)	8 (72.72)	-	11 (39.28)	28
Agriculture	404 (68.94)	161 (27.47)	230 (39.24)	13 (2.21	182 (31.05)	586
Non-agri.	394 (76.5)	127 (24.66)	250 (48.54)	17 (3.3)	121 (23.49)	515

Here * denotes statistical association at 5% level of significance.
Here ** denotes statistical association at 10% level of significance.
Source: NFHS-2; 1998-99

5.1.4 Quality of hygiene and sanitation in the household and anaemia outcome of the children

Children from households using open source for drinking water reported higher prevalence of anaemia (78.5%) compared to households using well water (72.6%) and public pipe water (60.0%). The pattern holds good for moderate and severe form of anaemia as well. However for mild anaemia children from households using well water show the highest prevalence compared to households using any other source. The households having toilet ensure a better disease free environment which is reflected in the table 5.1.4. Children from households using any types of toilet facility reports 59.2% of anaemia prevalence compared to children from households having no such facility (73.8%). The pattern holds good for any degree of anaemia as well. The association between different infrastructure variables (sanitation and hygiene facilities) and anaemia outcome is found to be statistically significant at 1-% level. [For detail see table 5.1.4].

Table-5.1.4. Pattern of anaemia among children by basic infrastructure characteristics

Characteristics	Anaemia	Degree of Anaemia			Non-Anaemic	Total
		Mild	Moderate	Severe		
Sources of drinking water*						
Public Water	51 (60.0)	21 (24.7)	27 (31.76)	3 (3.52)	34 (40.0)	85
Well	688 (72.65)	257 (27.13)	415 (43.82)	16 (1.68)	259 (27.34)	947
Surface water	77 (78.57)	19 (19.38)	46 (46.93)	12 (12.24)	21 (21.42)	98
Have Toilet*						
Have toilet	74 (59.2)	29 (23.2)	45 (36.0)	-	51 (40.8)	125
No toilet	741 (73.8)	268 (26.69)	443 (44.12)	30 (2.98)	263 (26.19)	1004
Has electricity*						
No	542 (75.27)	197 (27.36)	321 (44.58)	24 (3.3)	178 (24.72)	720
Yes	274 (68.45)	100 (24.44)	168 (41.07)	6 (1.46)	135 (33.0)	409

Here * denotes statistical association at 5% level of significance.
Here ** denotes statistical association at 10% level of significance.
Source: NFHS-2; 1998-99

5.1.5 Dietary practices of the mother and anaemia among the children

The dietary practices of the mother are used as an indirect proxy for child anaemia. The basic assumption is that if the mother is well fed then she will be healthy enough to take proper care of her child. She herself will not suffer from anaemia in pre and postnatal stage of the pregnancy. Her milk will be more nutritious to meet the requirement of child in his infancy. The healthy mother will also take extra care for her child with out much difficulty. Hence, the consumption of some important food items like milk or milk products, pulses or beans, green and other vegetable, fruits, eggs and fish/meat by mothers may have some implication for child anaemia. We

found that those mothers who take all these items regularly (daily or at least once in a week), also have less percentage of undernourished children in terms of anaemia, compared to the mothers who take these items occasionally (once or twice in a month) or do not take at all. The pattern holds well in almost all the degree of anaemia. [For detail see table 5.1.5].

Table-5.1.5. Pattern of Anaemia among children by food habits of their mothers

Characteristics	Anaemia	Degree of Anaemia			Non-Anaemic	Total
		Mild	*Moderate*	*Severe*		
Milk/curd*						
Daily	67 (66.33)	24 (32.67)	33 (32.67)	-	44 (43.56)	101
weekly	74 (57.36)	35 (30.23)	39 (30.23)	-	55 (42.63)	129
occasionally	534 (76.06)	186 (46.15)	324 (46.15)	24 (3.41)	168 (23.43)	702
Never	150 (76.14)	52 (26.39)	92 (46.7)	6 (3.04)	47 (23.85)	197
Pulses*						
Daily	310 (67.98)	126 (27.63)	177 (38.81)	7 (1.53)	146 (32.01)	456
weekly	325 (71.9)	114 (25.22)	198 (43.8)	13 (2.87)	127 (28.09)	452
occasionally	170 (81.73)	50 (24.03)	110 (52.88)	10 (4.8)	38 (18.26)	208
Never	9 (81.81)	6 (54.54)	3 (27.27)	-	2 (18.18)	11
Green leafy vegetables*						
Daily	462 (69.74)	185 (27.81)	264 (39.69)	13 (1.95)	203 (30.52)	665
weekly	276 (75.2)	86 (23.43)	177 (48.22)	13 (3.54)	91 (24.79)	367
occasionally	74 (79.56)	25 (26.88)	46 (49.46)	3 (3.2)	19 (20.43)	93
Never	1 (50.0)	-	1 (50.0)	-	1 (50.0)	2
Other Vegetables*						
Daily	639 (71.07)	243 (27.03)	378 (42.04)	18 (20.02)	260 (28.92)	899
weekly	135 (75.84)	42 (23.59)	85 (47.75)	8 (0.91)	43 (24.15)	178
occasionally	41 (78.84)	12 (23.07)	25 (48.01)	4 (7.6)	11 (21.15)	52
Never	-	-	-	-	-	-
Fruits*						
Daily	19 (55.88)	12 (35.29)	7 (20.580	-	15 (44.11)	34
weekly	89 (64.96)	33 (24.08)	53 (38.68)	3 (2.18)	48 (35.03)	137
occasionally	658 (73.6)	232 (25.95)	400 (44.74)	26 (2.9)	236 (26.39)	894
Never	49 (76.56)	19 (29.68)	29 (45.31)	1 (1.56)	15 (23.43)	64
Eggs						
Daily	4 (57.14)	1 (14.28)	3 (42.85)	-	3 (42.85)	7
weekly	54 (26.47)	54 (26.47)	73 (35.78)	4 (1.96)	73 (35.78)	204
occasionally	502 (74.81)	178 (26.52)	306 (45.60	18 (2.68)	169 (25.18)	671
Never	178 (72.06)	64 (25.91)	106 (42.91)	8 (3.23)	69 (27.93)	247
Chicken/Meat/Fish*[4]						
Daily	13 (59.09)	4 (18.18)	9 (40.90	-	9 (40.09)	22
weekly	201 (65.68)	81 (26.47)	115 (37.58)	5 (1.630	105 (34.31)	306
occasionally	560 (75.16)	199 (26.71)	336 (45.1)	25 (3.35)	185 (24.83)	745
Never	42 (75.0)	13 (23.21)	29 (51.78)	-	14 (25.0)	56

Here * denotes statistical association at 5% level of significance.

Here ** denotes statistical association at 10% level of significance.

Source NFHS-2; 1998-99

[4] Here consumption of chicken/meat/fish found to be statistically significant at 10% level for anaemic/non-anaemic, however the result is not significantly associated with degree of anaemia.

5.1.6 Mother and child's care related characteristics and anaemia among children

The vaccinated children are found to have less prevalence of anaemia (72.34%) compared to the children who do not have vaccination (81.72%). But prevalence of diarrhea shows a contradictory pattern, the children who had diarrhea before two weeks from the interview show comparatively less prevalence of anaemia (71.2%) with those who had not suffered from the diarrhea in last two weeks (74.4%). This might be due to the inability of the variable to capture the long run nutrition status of the children since the time period is too short. The pattern holds good for all the degree of anaemia as well. The birth size shows that children having relatively small birth size hive higher percentage of anaemic cases compared to children having bigger birth size. But the birth weight shows children having birth weight more than 2.5 K.g. have higher prevalence of anaemia. This might be due to the fact that the initial birth weight may not ensure absence of anaemia, unless the postnatal care is satisfactory. The mothers, who do not go for antenatal visits, have no institutional delivery (at places, other than public and private hospitals), having not taken any disease prevention at pregnancy, reported higher prevalence for any degree of anaemia among their children compared to women who took all these measures. [For detail discussion see table 5.1.6]. Difference in initiation of breastfeeding and duration of breastfeeding do not show any substantial variation regarding the prevalence of anaemia. This might be due to the fact that anaemia might not be dependent on breastfeeding alone. Another unusual observation could be made about mother's BMI (nutrition status in terms of anthropometry) and child nutrition status in terms of anaemia. It is a widely accepted fact that mothers with good nutritional status have the well-nourished children. But here we notice that obese mothers have higher percentage of anaemic children (81%) compared to mothers with low BMI (70.1%). This observed pattern holds good for all other degree of anaemia as well, except moderate anaemia. In case of moderate degree of anaemia, the low BMI mothers have highest percentage of moderately anaemic children. Here very small sample size for obese and severely obese mothers might have role in these exceptional findings.

Table-5.1.6 Pattern of Anaemia among Children by pre-natal and post-natal characteristics of mother and the child.

Charact-eristics	Anaemia	Degree of Anaemia			Non-Anaemic	Total
		Mild	*Moderate*	*Severe*		
Ever had Vaccination (for 610 cases only)						
No	76 (81.72)	30 (32.25)	42 (45.16)	4 (4.3)	17 (18.27)	93
Yes	374 (72.340	139 (26.88)	220 (42.55)	15 (2.9)	143 (27.65)	517
Ever had diarrhea in last two weeks						
No	567 (71.23)	205 (25.75)	344 (43.21)	18 (2.26)	229 (28.76)	796
Yes	248 (74.47)	92 (27.62)	144 (43.24)	12 (3.6)	85 (25.52)	333
Drinking pattern with diarrhea* (for 1112 cases only)						
Less to drink	83 (74.1)	22 (19.64)	54 (48.21)	7 (6.25)	29 (25.89)	112
Same to drink	213 (79.77)	63 (23.59)	139 (52.05)	11 (4.11)	54 (20.22)	267
More to drink	507 (69.16)	208 (28.37)	287 (39.15)	12 (1.63)	226 (30.83)	733
Birth size of the child*						
Larger than average	133 (66.83)	53 (26.63)	75 (37.65)	5 (2.51)	66 (33.16)	199
Average	510 (73.38)	191 (27.48)	301 (43.3)	18 (2.58)	185 (26.61)	695
Smaller than average	154 (72.98)	49 (23.22)	101 (47.86))	4 (1.89)	57 (27.01)	211
Very small	18 (75.0)	3 (12.5)	12 (50.0)	3 (12.5)	6 (25.0)	24
Birth weight						
Less than 2.5 Kg	39 (67.24)	13 (22.41)	24 (41.37)	2 (3.44)	19 (32.75)	58
More than 2.5 Kg	732 (72.61)	270 (26.78)	437 (43.35)	25 (2.48)	176 (17.46)	1008
Number of antenatal visits						
No	168 (77.06)	57 (26.14)	105 (48.16)	6 (2.75)	50 (22.93)	218
Less than five	571 (71.82)	206 (25.91)	342 (43.01)	23 (2.89)	226 (28.42)	795
More than five	75 (64.65)	33 (28.44)	42 (36.2)	-	39 (33.62)	116
Delivery by c section (for 410 cases only)						
No	228 (65.51)	97 (27.87)	126 (36.2)	5 (1.43)	120 (34.48)	348
Yes	42 (67.74)	14 (22.58)	27 (43.54)	1 (1.61)	20 (32.25)	62

(Cont....)

Charact-eristics	Anaemia	Degree of Anaemia			Non-Anaemic	Total
		Mild	*Moderate*	*Severe*		
Place of delivery						
Public facility	4 (100.0)	1 (25.0)	3 (75.0)	-	-	4
Private facility	579 (72.83)	208(26.16)	348 (43.77)	23 (2.89)	216 (27.16)	795
Home	32 (76.19)	10 (23.8)	20 (47.61)	2 (4.76)	10 (23.8)	42
Other	156 (69.64)	64 (28.57)	90 (40.17)	2 (0.8)	68 (30.35)	224
Starting of breast feeding						
Immediately	68 (76.4)	22 (24.71)	42 (47.19)	4 (4.49)	21 (23.59)	89
After 1 hour	81 (76.41)	32 (30.18)	45 (42.45)	3 (2.83)	26 (33.96)	106
More than 1 hour	192 (72.45)	72 (27.16)	114 (43.01)	6 (2.26)	72 (27.16)	265
Months of breast feeding						
0-6	165 (70.81)	60 (25.75)	96 (41.2)	9 (3.86)	68 (29.18)	233
7-12	154 (73.68)	63 (30.14)	89 (42.58)	2 (0.9)	55 (26.31)	209
13^{+}	451 (72.5)	160 (25.72)	275 (44.21)	16 (2.57)	171 (27.49)	622
Drank from nipple or not						
No	737 (72.04)	259 (25.31)	449 (43.89)	29 (2.83)	286 (27.95)	1023
Yes	79 (73.83)	38 (25.51)	40 (37.38)	1 (0.9)	28 (26.16)	107
Mother has any disease prevention or not (for 174 cases only)						
No	108 (76.59)	38 (26.95)	63 (44.68)	7 (4.96)	33 (23.4)	141
Yes	24 (72.72)	12 (36.36)	12 (36.36)	-	9 (27.27)	33
Mother's Body Mass Index						
Low	368 (70.09)	132 (25.14)	235 (44.76)	1 (0.19)	147 (28.0)	525
Normal	377 (72.63)	142 (27.36)	218 (42.0)	17 (3.27)	142 (27.36)	519
Obesity	9 (81.18)	5 (45.45)	4 (36.36)	-	2 (18.18)	11
Severe Obesity	5 (62.5)	2 (25.0)	3 (37.5)	-	3 (37.5)	8

Here * denotes statistical association at 5% level of significance.
Here ** denotes statistical association at 10% level of significance.
Source NFHS-2; 1998-99

5.1.7 A discussion on association of prominent characteristics with anaemia and degrees of anaemia controlling for household economic status

In this section we will re-examine the strength of association of some important characteristics with child anaemia outcome, controlling for the household economic status. This will give us an important clue how nutrition status of the children might be affected by characteristics other than household economic status. The table 5.1.7 shows household size has no significant association with either anaemia or degrees of anaemia once controlled for their economic status.

Total childbirth is important only for low economic status households once controlled for household economic status of the children. For high economic status households total child born to the mother is significantly associated with anaemia/non-anaemia outcome. Sex of the household head matters for low and medium economic status households for degrees of anaemia only. Age at first marriage and age at first birth both have association with child anaemia for low economic status households. Education level of the father and mother is important for child nutrition outcome in low economic status households.

The social background is significant for anaemia outcome of the children from low economic status households. This is also true for degree of anaemia as well. Occupation of the father seems to have detrimental effect on child anaemia for low economic status households. Availability of water supply does not have any significant association with anaemia and degree of anaemia once controlled for household economic status. But for toilet facility it is significant for low economic status groups.

Table 5.1.7: Description of Association of relevant characteristics with prevalence of Anaemia and its differential degree controlled for household standard of living index

Characteristics	Groupings	Standard of living index	Anaemia/Non-Anaemia	Degree of Anaemia
Household Size	1-4	Low	-	-
	4-7	Medium	-	-
	8+	High	-	-
Total child birth	No child	Low	-	*
	One or two	Medium	-	-
	More than two	High	*	-
Sex of the head of the household	Female	Low	-	*
	Male	Medium	-	*
		High	-	-
Age at first marriage for the mother	Less than 18	Low	**	-
	18 or more	Medium	**	-
		High	-	-
Age at first birth For the mother	Less than 18	Low	-	-
	18 or more	Medium	**	-
		High	-	-
Sex of the child	Female	Low	-	-
	Male	Medium	-	-
		High	-	-
Age of the child (in years)	0	Low	*	*
	1	Medium	*	*
	2	High	-	-
Types of place of residence	Rural	Low	-	-
	Urban	Medium	-	-
		High	-	-
Region	North Orissa	Low	**	-
	Southern Orissa	Medium	-	-
	Western Orissa	High	-	-
	Eastern Orissa			
Education level of the mother	No education	Low	*	*
	Primary	Medium	-	-
	Secondary	High	*	-
	Higher			
Education level of the father	No education	Low	*	*
	Primary	Medium	*	-
	Secondary	High	-	-
	Higher			
Ethnicity	SC	Low	*	*
	Tribal	Medium	-	-
	OBC	High	-	-
	General			
Occupation of mother	No work	Low	-	-
	Work in agriculture	Medium	-	-
	Work in non-agriculture	High	-	-
Occupation of father	No work	Low	*	-
	Work in agriculture	Medium	-	-
	Work in non-agriculture	High	-	-

(Cont...)

Characteristics	Groupings	Standard of living index	Anaemia/Non-Anaemia	Degree of Anaemia
Source of drinking water	Well Public supply Surface water	Low Medium High	- - -	- - -
Toilet	Have toilet No toilet	Low Medium High	* - -	- - -
Electricity	No Yes	Low Medium High	- * -	- * -
Take milk or curd	Daily Weekly Occasionally Never	Low Medium High	* - *	* - *
Intake of pulses or beans	Daily Weekly Occasionally Never	Low Medium High	* - -	* - -
Intake of green vegetables	Daily Weekly Occasionally Never	Low Medium High	- - *	- - **
Intake of other vegetables	Daily Weekly Occasionally Never	Low Medium High	- - -	- * -
Intake of Fruits	Daily Weekly Occasionally Never	Low Medium High	- - -	- - -
Intake of Eggs	Daily Weekly Occasionally Never	Low Medium High	- - -	- - -
Intake of Chicken/meat/fish	Daily Weekly Occasionally Never	Low Medium High	- - -	- - -
Received disease prevention before pregnancy	No Yes	Low Medium High	- - -	- - -
Ever had vaccination for child	No Yes	Low Medium High	- - -	- - -
Has diarrhoea recently	No Yes	Low Medium High	- - -	- - -
Has cough recently	No Yes	Low Medium High	- - -	- - -
Has fever recently	No Yes	Low Medium High	- - -	- - -

Characteristics	Groupings	Standard of living index	Anaemia/Non-Anaemia	Degree of Anaemia
Place of delivery	No facility Private facility Home Public health facility	Low Medium High	- - -	- - -
Number of antenatal visits	No visits Five or less than five times More than six times	Low Medium High	- - -	- - -
Months of breast feeding	0-6 months 7-12 months More than 13 months	Low Medium High	- - -	- - -
Size of child at birth	Bigger than average Average Lower than average Very small	Low Medium High	* - -	- - *

Here * denotes statistical association at 5% level of significance.
Here ** denotes statistical association at 10% level of significance.
Source NFHS-2; 1998-99

5.1.8 Regional variation: Role of regional variation in nutrition outcome for given economic and social status of the household with in the region

In this section we only discuss the significance level of the association between child anaemia and household economic and social status across different regions of Orissa. We found in northern and southern Orissa economic and social status does not show any statistically significance association to anaemic outcome of the child. But in western Orissa the social status is found to have statistically significant association with any degree of anaemia. But for eastern Orissa we found both economic and social status have statistically significant association with both anaemia/non-anaemia and degree of anaemia outcomes. We did not mention the exact pattern in terms of figure because we discuss it in earlier sections.

Table 5.1.8
Regional variation in child Anaemia-non anaemia and degree of child anaemia controlling for social and economic status of the household

Region	Economic status		Social status	
	Anaemia/ Non-anaemia	Degree of Anaemia	Anaemia/ Non-anaemia	Degree of Anaemia
North Orissa	-	-	-	-
South Orissa	-	-	-	-
Western Orissa	-	-	-	*
Eastern Orissa	*	*	*	*

Here * denotes statistical association at 5% level of significance.
Source: NFHS-2; 1998-99

5.1.9 Role of economic and social status of the households in determining child anaemia outcome

Here we want to examine how economic and social status of the household can determine the anaemia outcome. This section will have two parts. In the first part we will discuss how child anaemia outcome vary across different economic status for a particular social group. The other part will try to see how the prevalence of anaemia varies within a given economic status, for the various social groups.

5.1.9a Role of economic status of the households in determining child anaemia outcome within different social groups

This sub-section will focus on weather the economic background matters for child anaemia outcome with in all social groups. We found that with in the scheduled caste the prevalence of anaemia is very high across all the economic levels (approximately 75% in each economic category). Three out of four children from scheduled caste households with high economic status are also found to be moderately anaemic (75%). But with such a small sample it is very difficult to conclude that the same pattern will hold good in a larger sample of children from households having high economic status (high SLI) but with scheduled caste background.

For tribal children we found that around 80% of children belonging to low and medium economic status households (low and medium SLI) are anaemic. The pattern is more or less same across all the degree of anaemia as well (mild, moderate and severe anaemia). Only two children are found to come from tribal households with high economic status. And one of them found to be moderately anaemic, in percentage terms 50% of the children from tribal households with high economic status are found to be anaemic. But it is very difficult to conclude weather this pattern will be observed for a large sample of tribal children from high economic status households. In both the cases (for scheduled caste and tribal households) sample size of children from high economic status is too small to conclude any thing firmly, about the association between economic status and nutritional outcome of children in these social groups. However medium level households fare relatively better than low economic status households for both tribal and scheduled caste categories. So we can conclude that upward economic mobility might change the child undernutrition scenario among these social groups. Another interesting fact can be observed for children from other backward castes and general category (others in this case). Here

children from medium economic status households show higher prevalence of anaemia of various degrees compared to both low and high economic status households. So any direct conclusion about association between economic status and social background for the children from OBC and other categories could not be drawn here. [For details see table 5.1.9a]. All these associations between economic status and anaemia outcome are found to be statistically significant at 1-% level, within different social groups.

Table 5.1.9a: Pattern of Anaemia among Children across various social groups by standard of living.

Charact-eristics	Anaemia	Degree of Anaemia			Non-Anaemic	Total
		Mild	*Moderate*	*Severe*		
Scheduled caste*						
Low	138 (75.4)	38 (20.7)	93 (50.81)	7 (3.82)	45 (24.59)	183
Medium	49 (74.24)	14 (21.21)	35 (53.03)	-	17 (25.75)	66
High	4 (100.0)	-	3 (75.0)	-	1 (25.0)	4
Scheduled Tribe*						
Low	162 (84.81)	51 (26.7)	101 (52.87)	10 (5.23)	29 (15.18)	191
Medium	37 (80.43)	11 (23.91)	24 (52.17)	2 (4.37)	9 (19.56)	46
High	1 (50.0)	-	1 (50.0)	-	1 (50.0)	2
Other backward caste*						
Low	113 (70.18)	50 (31.05)	59 (36.64)	4 (2.48)	48 (29.81)	161
Medium	117 (74.52)	45 (28.66)	68 (43.31)	4 (2.54)	40 (25.47)	157
High	25 (59.62)	12 (28.57)	13 (30.95)	-	17 (40.47)	42
Others*						
Low	60 (63.82)	30 (31.91)	28 (29.78)	2 (2.12)	34 (36.17)	94
Medium	83 (64.84)	35 (27.34)	46 (35.93)	2 (1.56)	45 (35.15)	128
High	25 (48.07)	9 (17.3)	16 (30.76)	-	27 (51.92)	52

Here * denotes statistical association at 5% level of significance.
Here ** denotes statistical association at 10% level of significance.
Source NFHS-2; 1998-99

The table 5.1.9b is a little modification of the table 5.1.9a. Here we try to find out how children from different social background are placed against each other as far as undernutrition is concerned, within a given economic condition of their respective households. We found that with in low economic status households children from tribal households are relatively at higher risk compare to any other social groups. Around 80% of children from tribal households are anaemic, compared to 75.4% from scheduled caste households, 70.1% from OBC households and 63.2% from households of other castes. The pattern holds good for moderate and severe degree of anaemia as well, but for mild anaemia the pattern is little unclear. [For detail see able 5.1.9b] Among medium economic status households we found tribal children are most vulnerable social groups (80.4% of children are anaemic), followed by children from

SC and OBC (around 74%), and others or general category (64.84%). For high economic status we found children from tribal groups fare better than (50%) children from SC households (75%) and OBC households (59.5%). The pattern is little unclear if we go by degree of anaemia. But children from SC and tribal households found to be more vulnerable to moderate and severe form of anaemia with in all-economic status. Thus we found social background which is also detrimental to life style behaviour of the household and care practices for the children, might be one of the crucial link between economic status of the household and anaemia outcome for the child. A further exploration is necessary to determine the exact role of these childcare and life style related factors in child anaemia outcome. [For detail see table 5.1.9b].

Table 5.1.9(b)
Pattern of Anaemia among children by Social Groups within SLI groups

Charact-eristics (1)	Anaemia (2)	Degree of Anaemia			Non-Anaemic (3)	Total (4)
		Mild (2a)	*Moderate (2b)*	*Severe (2c)*		
Low[5]						
SC	138 (75.4)	38 (20.7)	93 (50.81)	7 (3.82)	45 (24.59)	183
ST	162 (84.81)	51 (26.7)	101 (52.87)	10 (5.23)	29 (15.18)	191
OBC	113 (70.18)	50 (31.05)	59 (36.64)	4 (2.48)	48 29.81)	161
General	60 (63.82)	30 (31.91)	28 (29.78)	2 (2.12)	34 (36.17)	94
Medium						
SC	49 (74.24)	14 (21.21)	35 (53.03)	-	17 (25.75)	66
ST	37 (80.43)	11 (23.91)	24 (52.17)	2 (4.37)	9 (19.56)	46
OBC	117 (74.52)	45 (28.66)	68 (43.31)	4 (2.54)	40 (25.47)	157
General	83 (64.84)	35 (27.34)	46 (35.93)	2 (1.56)	45 (35.15)	128
High						
SC	3 (75.0)	-	3 (75.0)	-	1 (25.0)	4
ST	1 (50.0)	-	1 (50.0)	-	1 (50.0)	2
OBC	25 (59.52)	12 (28.57)	13 (30.95)	-	17 (40.47)	42
General	25 (48.07)	9 (17.3)	16 (30.76)	-	27 (51.92)	52

Here * denotes statistical association at 5% level of significance.
Here ** denotes statistical association at 10% level of significance.
Source NFHS-2; 1998-99

5.1.10 Rural-Urban pattern in child anaemia across various social groups[6]

The rural-urban divide with in the different social groups for child anaemia outcome also found to be statistically significant for rural areas. We found that 78% of scheduled caste children from rural households are anaemic where as in case of their counterparts in urban households, it is 75.1%. This pattern holds good for moderate

[5] * Refers to significance level of 5% for both anaemia and degree of anaemia for low and medium status households.
[6] For rural area we found social background is important for both anaemia and degree of anaemia prevalence among the pre-school children (4-35 months of age).

and severe degrees of anaemia as well. For tribal children we found that 84% of the children from rural areas have anaemia prevalence compared to 75% among urban children. The pattern also holds good for all the degree of anaemia. So children from tribal households living in urban areas are comparatively better off than their counterparts from urban set-up.

For OBC category we found that children from urban households are relatively at higher risk compared to their rural counterparts. In case of children from other category (which include socially forward castes and economically well to do groups) there is a clear-cut rural-urban divide for all the degrees of anaemia. [For detail see table 5.1.10].

But if we look with in rural set up we can see that tribal children are at highest risk for anaemia compared to any other social groups. 84% of children from tribal households and rural background are found to have some degree of anaemia. Among scheduled caste children with rural background, 75.1% are found to have some degree of anaemia. The corresponding figures for OBC and others stands at 70.9% and 61.75 respectively.

Table 5.1.10 Pattern of Anaemia among Children by rural-urban residence within different social groups

Charact-Eristics	Anaemia	Degree of Anaemia			Non-Anaemic	Total
		Mild	*Moderate*	*Severe*		
Scheduled cast						
Rural*	172 (75.1)	48 (20.9)	117 (51.09)	7 (3.05)	57 (24.89)	229
Urban	18 (78.26)	3 (13.04)	14 (60.86)	1 (4.34)	5 (21.73)	23
Scheduled Tribe						
Rural*	187 (84.61)	59 (26.69)	117 (52.94)	11 (4.97)	34 (15.38)	221
Urban	12 (75.0)	3 (18.75)	8 (50.0)	1 (6.25)	4 (25.0)	16
Other backward caste						
Rural*	230 (70.98)	97 (29.93)	126 (38.88)	7 (2.16)	94 (29.01)	324
Urban	(71.79)	11 (28.2)	16 (41.02)	1 (2.56)	11 (28.2)	39
Others						
Rural*	145 (61.7)	63 (26.8)	80 (34.04)	2 (0.85)	90 (38.29)	235
Urban	23 (57.5)	11 (27.5)	11 (27.5)	1 (2.5)	17 (42.5)	40

Here * denotes statistical association at 5% level of significance.
Source NFHS-2; 1998-99

In urban areas we found scheduled cast children are the most vulnerable social group as far as child anaemia is concerned. 78.2% of scheduled caste children are found to have some kind of anaemia followed by tribal children (75.0%), Children from OBC (71.7%) and others (57.5%). But as far as prevalence of severe anaemia is concerned tribal children show the highest prevalence (6.25%) compared to 4.3% for scheduled

cast children in the urban set-up. Thus tribal and scheduled caste children are found to be the most vulnerable social groups to undernourishment in rural as well as urban set-ups.

5.1.11 Analysis of binomial and multinomial logit regressions on child undernutrition (in terms of anaemia) in Orissa.

In this section we will discuss the results of binomial and multinomial logit models. In the binomial modes anaemia/non-anaemia is the endogenous or dependent variable. In the multinomial model degree of anaemia is the endogenous or dependent variable. For convenience we have divided the section in to two subsections. Section 5.1.11a discusses about findings of binomial model. Section 5.1.11b focuses on findings of multinomial logit model. Both the models are presented in table 5.1.11.

5.1.11a. Results of binomial logistic regression analysis on the determinants of anaemia/non-anaemia among the children.

The binomial logit results show that father's education (for the entire education category with respect to reference category) and ethnicity (for tribal and SC children) is statistically significant for anaemia outcome among the pre-school children of age 4-35 months. Children of low educated fathers (for uneducated and primary educated fathers) are twice more likely to be anaemic compared to children of higher educated fathers. This reflects that father's education is important because it also determines the major source of income for the household. Children from tribal households are twice (2.5 times) more likely to be anaemic compared to children from other social groups. Children from agricultural households, of uneducated mothers2, with siblings more than two, children born to the mother's married before 18 years of age, from low and medium economic status groups (low and medium SLI), from households using open source for drinking water are found to have greater likelihood to be anaemic against their respective reference categories. [For detail see table 5.1.11].

5.1.11b. Results of multinoial logistic regression analysis on the determinants of anaemia/non-anaemia among the children.

Father's educational background (for no education and primary education) and social background of the household (for SC and tribal households) are found to be the statistically significant determinants for mild and moderate anaemia outcome. For severe anaemia among the children, the ethnicity (for tribal households) is found to be statistically significant (for tribal and scheduled caste households.

Table 5.1.11 Binomial and Multinomial logit analysis for child undernutrition in Orissa by anaemia indicators

Variable	Value levels	Anemia-Non-Anemia [7]		Degree of anemia[8]					
				Mild		Moderate		Severe[9]	
		Exp.β	S.E.[10]	Exp. β[11]	S.E.	Exp. β	S.E.	Exp. β	S.E.
Age Group for the mother	< 30	1.34	.195	1.22	.230	1.4	.215	2.51	.645
	> 30	1[12]	-	1	-	1	-	1	-
Age of the child in years	0	2.16*	.286	2.03	.339	2.30*	.314	1.04	.983
	1	1.42*	.160	1.23	.194	1.57*	.176	1.41	.478
	2	1	-	1	-	1	-	1	-
Religion	Hindu	1.47**	.342	.920	.390	2.53*	.493	.556	.977
	Non-Hindu	1	-	1	-	1	-	1	-
Mother's education	uneducated	.716	.452	.498	.564	.870	.514	332836	1779.76
	Primary	.828	.441	.676	.551	.868	.503	459301	1779.76
	Secondary	.784	.390	.665	.493	.848	.449	957807	1779.76
	Higher	1	-	1	-	1	-	1	-
Father's education	uneducated	2.55*	.336	2.95*	.431	2.38*	.375	.881	1.09
	Primary	2.59*	.319	3.57*	.410	2.20*	.359	.500	1.05
	Secondary	1.65*	.274	1.91*	.362	1.62**	.311	.222	1.04
	Higher	1	-	1	-	1	-	1	-

(Cont...)

[7] This represents binomial logit regression for anemia and non-anemia. Here the reference category is children with non-anaemia, against which odds ratio and standard error are calculated for children with anaemia.

[8] This represents multinomial logit regression where dependent variable is degree of anaemia. The reference category is non anaemia against which odds ratio and standard error are calculated for children with mild, moderate and severe degree of anaemia

[9] For severe degree of anaemia, most of the odds ratio and standard error have extreme low or high values. Because of the fewer cases of severe anaemia among the children which is only 29, the corresponding figure might not be reliable for describing likelihood of severity in anaemia.

[10] S.E. refers to standard error.

[11] Exp. implies likelihood ratio for the respected group.

[12] 1 refers to reference group.

Variable	Value levels	Anemia-Non-Anemia		Degree of anemia					
				Mild		Moderate		Severe	
		Exp.β	S.E.	Exp. β	S.E.	Exp. β	S.E.	Exp. β	S.E.
Place of residence	Rural	1.61	.228	1.204	.227	.996	.019	.425	.729
	Urban	1	-	1	-	1	-	1	-
Ethnicity	SC	1.72*	.225	1.10	.278	2.22*	.247	1.65	.774
	Tribal	2.56*	.255	2.01*	.302	2.91*	.279	3.86*	.796
	OBC	1.45*	.190	1.58*	.227	1.39	.215	.970	.786
	Others[13]	1	-	1	-	1	-	1	-
Family Size	8+	1.02	.215	1.16	.261	.937	.234	.803	.867
	5-7	1.11	.201	1.27	.244	.957	.220	4.45*	.846
	1-4	1[a]	-	1	-	1	-	1	-
Total birth in last 3 years	> 2	.273	.126	.0021	3734.68	.599	1.308	.0029	.205
	<= 2	1	-	1		1		1	-
Total number of child birth	> 2	1.44*	.185	1.5*	.218	1.41**	.201	.887	.514
	<= 2	1	-	1	-	1	-	1	-
Age at first marriage	< 18	1.36*	.163	1.23	.195	1.42*	.177	2.48**	.545
	>= 18	1	-	1	-	1	-	1	-
Respondent's occupation	No work	.960	.240	.799	.281	1.06	.264	1.35	.669
	Agriculture	.705	.316	.609	.377	.792	.342	.545	.854
	Non-Agri.	1	-	1	-	1	-	1	-
Husband's Occupation	No work	1.07	.464	1.53	.524	.815	.541	.0045	2332.41
	Agriculture	1.31	.167	1.01	.200	1.45	.183	2.017	..503
	Non-Agri.	1	-	1	-	1	-	1	-

(Cont...)

[13] Other include all the non-SC, non-tribal, non-OBC groups including forward casts

Variable	Value levels	Anemia-Non-Anemia		Degree of anemia					
				Mild		Moderate		Severe	
		Exp.β	S.E.	Exp. β	S.E.	Exp. β	S.E.	Exp. β	S.E.
Region	N.O.	1.24	.225	1.12	.269	1.31	.241	1.2	.629
	S.O.	.715**	.202	.715	.246	.726	.223	.503	.710
	W.O.	.872	.194	.927	.230	.854	.214	.348	.711
	E.O.	1	-	1	-	1	-	1	-
Household economic status	Low	1.34	.354	1.50	.433	1.24	.399	18990.5	1207.59
	Medium	1.73**	.309	1.57	.381	1.81	.350	48831.3	1207.59
	High	1	-	1	-	1	-	1	-
Birth weight of the child	< 2.5 Kg.	.932	.331	1.26	.380	.746	.376	.459	1.15
	>= 2.5 Kg.	1		1	-	1	-	1	-
Month's of breastfeeding	0-6	1.24	.324	1.39	.380	1.19	.359	1.004	1.27
	6-12	.849	.255	.565	.307	.830	.283	1.22	.861
	13	1	-	1	-	1	-	1	-
Body mass index of the mother	Low BMI	.915	.149	1.14	.178	.882	.163	.342	483
	Normal BMI	-	-	1	-	1	-	1	-
Any types of Toilet[14]	No	.665	.317	.767	.386	.548**	.352	3941093	1052.51
	Yes	1	-	1	-	1	-	1	
Drinking water source[15]	Open Source	1.35	.386	.811	.476	1.71	.429	1.22	.907
	Well	1.36	.268	1.12	.324	1.67	.308	.248	.805
	Public water Supply	1	-	1	-	1	-	1	-
Total no. of Observation	N = 1035 cases for all types of anemia indicators								
Model fitting Information	Log likelihood for binomial logit model (for anemia including the intercept) = 1139.375, chi-square=69.745*, degree of freedom = 33. Log likelihood for multinomial logit model (for degree of anemia including the intercept) = 2229.618, chi-square = 175.15, degree of freedom = 99.								

[15] Open Source comprises river, ponds, streams, open well and other open sources.
Well includes public, private, covered well public and private hand pumps. Public water supply includes public and private tap inside or outside the households and tanker supply.

154

Children from tribal households are 3.8 times more likely to be severely anaemic compared to children from general castes (others in this case). Children from rural set ups are more likely to be mildly anaemic (odds ratio is 1.2) compared to children from urban households. Children from northern region have greater likelihood of being severely anaemic compared to children from eastern Orissa (1.3 times). Children from low and medium economic status also found to be at higher risk for different degree of anaemia compared to children from high economic status households. The respective odds ratio for mild anaemia for children from low economic status and medium economic status households is 1.5. Thus we can conclude that children of uneducated parents, agricultural households, low economic status, from scheduled caste and tribal households, from northern region of Orissa, from households lacking proper water and sanitation facility are most vulnerable to anaemia in Orissa.

Part-II

Anthropometric approach: This part of analysis will contain analysis of child under nutrition on the basis of three anthropometric indicators like Stunting, Under weight and Waisting. The sections 5.2 to 5.9 are included in this part.

5.2 Stunting approach (Height-for-age)

First we will take the case of Stunting which is considered to be the reflection of nutrition status of very long past. [Osmani; 1987, Svedberg; 2002]. It happens due to lack of protein, which is necessary for growth of cells and growth enzymes. But protein is it self a complex macronutrient (different types of proteins are there) which is derived from various sources. So the availability of protein ultimately depends upon over all economic status and in turn occupation status of the household. It also depends upon the protein absorption capacity of our body. [Gopaln; 1989]. The absorption on the other hand depends upon various other characteristics like hygiene, care practices, preventive measures taken against diseases etc. Other characteristics like the health of the mother in pre-natal and post-natal age, the birth size and weight of the child also matter. [Ashworth et al; 1997].

5.2.1 Demographic characteristics and stunting among the children

Our analysis shows that mothers of age below 30 have low prevalence of both severe and moderate stunting. This may suggest that women who give birth in latter years are more likely to have stunted children because of their earlier births or close intervals. The age at first marriage also show that women marrying below 18 years of age are more likely to have moderate and severe stunted children. Same pattern could be seen for age at first birth. The women who are widowed and divorced (formerly married) are more likely to have severe and moderate stunted children than their counterparts who have husbands (currently married). Those who have three or more than three children in last three years of interview are more likely to have severe and moderately stunted children. But in case of family size we found that those children from bigger families (8 or more than 8 members) are more moderately stunted compared to the children who belong to smaller family (less than8 members). But in case of severe stunting we found those children from smaller families (especially four or below members) are in disadvantaged position. [See table 5.2.1] The reason might be that in case of moderate stunting the larger families might have negative impact in terms of their care where as in case of smaller families it might be due to shortage of economic resources. But this pattern needs more careful analysis, which is not our objective here. Total number of children born to the mother do not show any clear pattern for moderate stunting but in case of severe stunting it shows that women with less than two births are more likely to have stunted children. This might be due to the fact that those women having less than two births are at earlier stage of their reproductive life and are less informed about care practices. But this observation also needs a further scrutiny to find out the exact cause behind this outcome. Sex of the household head does not show any clear-cut pattern for both moderate and severe stunting. [See table 5.2.1]. But age of the child is not focused here because of the very fact that both stunting and underweight are adjusted for the age of the children.

Table 5.2.1 Pattern of stunting among children by demographic characteristics

Characteristics	*Severely Stunted*	*Moderately stunted*	*Normal height-for-age*	*Total*
Age group				
15-19	13 (10.92)	36 (30.25)	70 (58.82)	119
20-24	70 (14.95)	131 (27.99)	267 (57.05)	468
25-29	88 (20.22)	103 (23.67)	244 (56.09)	435
30-34	35 (17.76)	53 (26.9)	109 (55.32)	197
35-39	10 (22.22)	12 (26.66)	23 (51.11)	45
40-44	8 (57.14)	3 (21.42)	3 (21.42)	14
45-49	2 (66.66)	-	1 (33.33)	3
Total	226 (17.64)	338 (26.38)	717 (55.97)	1281
Age group two category				
< 30	171 (16.73)	270 (26.41)	581 (56.84)	1022
>= 30	54 (20.84)	68 (26.25)	137 (52.89)	259
Marital status				
Currently married	222 (17.52)	333 (26.28)	712 (56.19)	1267
Formerly married	3 (23.07)	4 (30.76)	6 (46.15)	13
*Age at first marriage**				
<18	127 (18.7)	201 (29.6)	351 (51.69)	679
>=18	98 (16.27)	137 (22.75)	367 (60.96)	602
*Age at first birth**				
<18	75 (17.94)	131 (31.33)	212 (50.71)	418
>=18	150 (17.4)	206 (23.89)	506 (58.7)	862
Birth in last three years				
Less than 3	189 (17.48)	280 (25.9)	612 (56.61)	1081
3 or more than 3	37 (18.5)	57 (28.5)	106 (53.0)	200
*Family size**				
1-4	73 (17.42)	94 (22.43)	252 (60.14)	419
5-7	108 (18.24)	152 (25.67)	332 (56.08)	592
8+	44 (16.29)	91 (33.7)	135 (50.0)	270
One or more than one eligible women				
One	167 (18.03)	253 (27.32)	508 (54.85)	926
More than One	59 (16.66)	85 (24.01)	210 (59.32)	354
No. of children under age five or else				
Zero	42 (18.1)	59 (25.43)	131 (56.46)	232
One or two	178 (17.87)	268 (26.9)	550 (55.22)	996
More than two	5 (8.06)	11 (17.74)	36 (58.06)	62
*Total no of children ever born**				
Less than two	127 (22.24)	148 (25.91)	296 (51.83)	571
More than two	99 (13.94)	189 (26.61)	422 (59.43)	710
Sex of the house hold head				
Male	217 (17.62)	324 (26.32)	690 (56.05)	1231
Female	8 (16.32)	13 (26.53)	28 (57.14)	49
Sex of the child				
Male	119 (17.5)	181 (26.61)	380 (55.88)	680
Female	107 (17.8)	156 (25.95)	338 (56.23)	601
*Marital duration grouped**				
0-9	141 (15.51)	235 (25.85)	533 (58.63)	909
10-19	72 (21.05)	98 (28.65)	172 (50.29)	342
20-29	13 (43.33)	5 (16.66)	12 (40.0)	30
30+	-	-	1 (100)	1

Here * refers to confidence interval at 5% level.

Here ** refers to confidence interval at 10% level.

Source NFHS-2; 1998-99

5.2.2 Social characteristics of the households and stunting among the children

The parental education does play an important role in nutritional outcome of the children. Orissa example also confirms the existing literature. Both severe and moderate stunting are very low among higher educated mother and father compared to non-educated couple. This positive relation between parental education and child nutritional status is also significant at 1-% level. Mother's education has it's impact through better care and feeding practices [Joshi; 1994] and father's education through income of the household [Kassuf and Senaur; 1996]. Children from urban households are less stunted (both moderately and severely) compared to rural households. This confirms rural-urban gap persisting in other indicators as well in a developing society like India and Orissa. Hindu children are comparatively at more disadvantageous position than non-Hindu children are as far as stunting of any kind is concerned. One of the factors might be that the Hindu population in Orissa is more than 97% and it is also reflected in the sample. So we can not conclude anything firmly from this. So we include ethnic division among children in Orissa. We found children from scheduled caste and scheduled tribe categories are more stunted comparative to other general caste (others in this case). In Orissa caste is also an important determining factor for economic status of the households. [Kumbahr; 2002]. Even if the tribals do not come under caste system, they lived in Jungle and hilly areas, which remain backward in terms of education, health, employment and other basic infrastructures. We also looked at regional pattern. The western Orissa reports highest percentage of severely stunted children followed by south Orissa, eastern Orissa and least in northern Orissa. But north Orissa reports highest moderate stunting while western Orissa which tops the severe stunting cases, was least affected. The cause might be that western Orissa, which suffers from starvation in many pockets, reported severe protein-energy under nutrition in terms of severe stunting while northern Orissa might have factors other than chronic food shortage. The well-developed eastern or coastal Orissa also reported high prevalence of moderate and severe stunting as reflected in close percentage gap between regions. [See table 5.2.2].

Table 5.2.2. Pattern of stunting among children by household characteristics

characteristics	*Severely Stunted*	*Moderately stunted*	*Normal height-for-age*	*Total*
Education level of the mother of the child*				
No education	155 (22.49)	195 (28.3)	339 (49.2)	689
Primary	36 (15.25)	68 (28.81)	132 (55.93)	236
Secondary	32 (10.56)	69 (22.77)	202 (66.66)	303
Higher	2 (3.77)	6 (11.32)	45 (84.9)	53
Education level of the father of the child*				
No education	93 (23.19)	113 (28.17)	195 (48.62)	401
Primary	64 (20.71)	92 (29.77)	153 (49.51)	309
Secondary	58 (13.18)	111 (25.22)	271 (61.59)	440
Higher	10 (7.75)	21 (16.27)	98 (75.96)	129
Types of place of residence				
Rural	206 (18.02)	306 (26.77)	631 (55.2)	1143
Urban	19 (13.86)	31 (8.01)	87 (63.5)	137
Religion				
Hindu	222 (18.0)	326 (26.43)	685 (55.55)	1233
Muslim	3 (12.5)	8 (33.33)	13 (54.16)	24
Christian	1 (4.16)	4 (16.66)	19 (79.16)	24
Hindu Vs others				
Hindu	222 (18.01)	326 (26.43)	685 (55.55)	1233
Non-Hindus	3 (6.25)	12 (25.0)	33 (68.75)	48
Ethnicity*				
SC	66 (22.83)	81 (28.02)	142 (49.13)	289
States	55 (19.78)	82 (29.49)	141 (50.71)	278
OBC	74 (18.09)	106 (25.91)	229 (55.99)	409
Others	30 (9.8)	69 (22.54)	207 (67.64)	306
SC/ST VS Others*				
SC/ST	121 (21.34)	163 (28.74)	283 (49.91)	567
Others	105 (14.68)	175 (24.47)	435 (60.83)	715
Region				
North Orissa	29 (15.42)	58 (30.85)	101 (53.72)	188
South Orissa	38 (17.92)	57 (26.88)	117 (55.18)	212
Western Orissa	55 (19.36)	65 (22.88)	164 (57.74)	284
Eastern Orissa	103 (17.25)	158 (26.46)	336 (56.28)	597

Here * refers to confidence interval at 5% level.

Here ** refers to confidence interval at 10% level.

Source NFHS-2; 1998-99

5.2.3 Economic characteristics of the household and stunting among the children

The set of economic characteristic shows that children from low economic status households suffer more from any kind of stunting compared to their counterparts from higher economic status households. [See table 5.2.3]. The more important issue here is that in the high economic status category (High SLI) around 20% children suffer from different kinds of stunting which is worse by any standard, as in developed societies of west report only 3 to 4% of stunted children on aggregate irrespective of their economic status. The situation is very bad if we compare with some developing

countries like Sri Lanka, Indonesia, China, Malaysia, and Brazil. Children from households, whose prime occupation is agriculture, are stunted more than children from households, who are engaged in non-agricultural sector. The association between economic and occupational status of the household and the children's nutrition outcome are significantly associated at 1-% level of significance. [See table 5.2.3]. The low wage rate in agricultural sector, lack of social security for this sector, uncertain job and employment opportunity in terms of seasonal nature of the Orissa agriculture might affect the income for the households in this sector. This might in turn reduce the quality of food, care and sanitation for the children in these households. Similarly mothers who work in agriculture where there is no regulation of working hour might trade-off with the care of their children. [Ashworth et al; 1997, Engle and Menon; 1999, Ruel et al; 1999].

Table 5.2.3 Pattern of stunting among children by household economic characteristics

Characteristics	*Severely Stunted*	*Moderately stunted*	*Normal height-for-age*	*Total*
Household Standard of Living Index*				
Low	146 (20.44)	217 (30.39)	351 (49.15)	714
Medium	73 (16.33)	99 (22.14)	275 (61.52)	447
High	5 (4.42)	19 (16.81)	89 (78.76)	113
Occupation status of the mother of the child*				
Not working	163 (16.8)	246 (25.36)	561 (57.83)	970
Non-Agriculture	4 (10.52)	5 (13.15)	29 (76.31)	38
Agriculture	58 (21.16)	87 (31.75)	129 (47.08)	274
Occupation status of the father of the child*				
Not working	6 (21.42)	4 (14.28)	18 (64.28)	28
Non-Agriculture	20 (8.29)	47 (19.5)	174 (72.19)	241
Agriculture	199 (19.66)	287 (28.35)	526 (51.97)	1012

Here * refers to confidence interval at 5% level.
Here ** refers to confidence interval at 10% level.
Source NFHS-2; 1998-99

5.2.4 Quality of sanitation and hygiene in the household and stunting among the children

The set of basic infrastructure shows that children from those households, who use water from open sources and have no toilet and electricity facility have higher prevalence of both severe and moderate stunting. The associations are also significant at 1-% level. These results are in line with earlier findings. [For more see table 5.2.4].

Table 5.2.4. Pattern of stunting among children by Basic Services

characteristics	*Severely Stunted*	*Moderately stunted*	*Normal height-for-age*	*Total*
Source of drinking water*				
Well	184 (17.16)	283 (26.39)	605 (56.43)	1072
Open sources Public	31 (28.18)	31 (28.18)	48 (43.63)	110
supply	11 (9.9)	23 (23.23)	65 (65.65)	99
Type of toilet facility*				
Yes	5 (11.36)	24 (16.66)	115 (79..86)	144
No	220 (19.34)	314 (27.61)	603 (53.03)	1137
Has Electricity*				
Yes	60 (12.98)	111 (24.02)	291 (62.98)	462
No	165 (20.14)	227 (27.71)	427 (52.13)	819

Here * refers to confidence interval at 5% level.
Here ** refers to confidence interval at 10% level.
Source NFHS-2; 1998-99

5.2.5 Mother's dietary practice and stunting among the children

Mother's dietary practices and their implication on child nutrition are focused in our study. We found frequency of intake of milk/curd, pulses, green leafy vegetables, fruits and other animal proteins by the mother are significantly associated with positive nutritional outcome of the children. The associations are significant for milk/milk products, pulses and green vegetables. Mothers who take all these items more frequently (for e.g. daily or weekly) have reported less stunted of any degree among their children compare to others who do not take them or take occasionally. [See table 5.2.5].

Table 5.2.5 Pattern of stunting among children by dietary practices of mothers

characteristics	*Severely Stunted*	*Moderately stunted*	*Normal height-for-age*	*Total*
Milk or curd*				
Daily	8 (6.89)	22 (18.96)	86 (74.13)	116
Weekly	23 (16.66)	28 (20.28)	87 (63.04)	138
Occasionally	152 (18.92)	223 (27.77)	428 (53.3)	803
Never	42 (18.75)	65 (29.01)	117 (52.23)	224
Pulse or Beans*				
Daily	66 (12.76)	120 (23.21)	331 (64.02)	517
Weekly	104 (20.35)	142 (27.78)	265 (51.85)	511
Occasionally	49 (20.5)	72 (30.12)	118 (49.37)	239
Never	7 (53.84)	3 (23.07)	3 (23.07)	13
Green leafy vegetables*				
Daily	139 (18.7)	171 (23.01)	433 (58.27)	743
Weekly	65 (15.29)	137 (32.23)	223 (52.47)	425
Occasionally	20 (18.34)	29 (26.6)	60 (55.04)	109
Never	1 (33.33)	-	2 (66.66)	3
Other Vegetables				
Daily	174 (17.14)	286 (28.17)	573 (56.45)	1015
Weekly	40 (19.32)	52 (25.12)	115 (55.55)	207
Occasionally	12 (20.0)	18 (30.0)	30 (50.0)	60
Never	-	-	-	
Fruits				
Daily	3 (8.1)	12 (32.43)	22 (59.45)	37
Weekly	18 (9.52)	45 (23.8)	96 (50.79)	189
Occasionally	192 (18.99)	266 (26.31)	553 (54.68)	1011
Never	12 (16.43)	14 (19.17)	47 (64.38)	73
Eggs				
Daily	2 (33.33)	-	4 (66.66)	6
Weekly	31 (13.36)	60 (25.86)	41 (17.67)	232
Occasionally	136 (17.87)	211 (27.72)	414 (54.4)	761
Never	56 (19.85)	67 (23.75)	159 (67.02)	282
Chicken/meat/fish				
Daily	4 (16.66)	7 (29.16)	13 (54.16)	24
Weekly	49 (13.8)	89 (25.07)	217 (61.12)	355
Occasionally	161 (19.18)	225 (26.81)	453 (53.99)	839
Never	12 (18.75)	17 (26.56)	35 (54.68)	64

Here * refers to confidence interval at 5% level.
Here ** refers to confidence interval at 10% level.
Source NFHS-2; 1998-99

5.2.6 Mother and child's care related practices and stunting among the children

In table 5.2.6 we focus on children and mother's individual characteristics and care practices. The result shows that children who are vaccinated reported less stunting of any kind compared to those who do not take at all. Children suffering from diarrhea are more likely to be stunted of any kind. The mothers who do not know care practices for diarrhea reports highest percentage of severely and moderately stunted children compared to mothers who know better care practices.

Table 5.2.6 Pattern of stunting among children according to birth characteristics

Characteristics	*Severely Stunted*	*Moderately stunted*	*Normal height-for-age*	*Total*
Ever had vaccination*				
No	27 (10.38)	35 (21.87)	98 (61.25)	160
Yes	108 (19.67)	150 (27.32)	291 (53.0)	549
Do not know	-	2 (100.0)	-	2
Had diarrhoea before two weeks of interview				
No	158 (17.24)	232 (25.32)	526 (57.42)	916
Yes	67 (18.45)	106 (30.03)	190 (52.34)	363
Drinking pattern with diarrhoea*				
Less to drink	26 (19.4)	41 (30.59)	67 (50.0)	134
Same amount to drink	68 (21.72)	80 (25.55)	165 (52.71)	313
More to drink	123 (15.09)	214 (25.25)	478 (58.65)	815
Do not know	9 (45.0)	3 (15.0)	8 (40.0)	20
Birth size of the child*				
Larger than average	34 (14.52)	53 (22.64)	147 (62.82)	234
Average	131 (16.66)	211 (26.84)	444 (56.48)	786
Smaller than average	52 (22.31)	65 (27.89)	116 (49.78)	233
Ver small	8 (29.62)	8 (29.62)	11 (40.74)	27
Birth weight				
Less than 2.5 kg	12 (20.68)	14 (24.13)	32 (55.17)	58
2.5 Kg or more	213 (17.61)	324 (26.49)	686 (56.09)	1223
Number of antenatal visits*				
No	49 (8.05)	66 (27.96)	121 (51.27)	236
Less than five times	152 (18.26)	228 (27.4)	452 (54.32)	832
More than five times	24 (11.21)	44 (20.56)	146 (68.22)	214
Delivery by Cesarean section* (only for 340 cases)				
No	44 (11.79)	76 (20.37)	253 (67.82)	373
Yes	8 (11.94)	22 (32.83)	37 (55.22)	67
Place of delivery*				
Public facility	25 (10.08)	51 (20.56)	172 (69.35)	248
Private facility	4 (8.33)	9 (18.75)	35 (72.91)	48
Home	195 (19.89)	276 (28.16)	509 (51.93)	980
Other	1 (25.0)	1 (25.0)	2 (50.0)	4
Starting of breastfeeding* (Only 546 cases)				
Immediately	60 (18.98)	82 (25.94)	174 (55.06)	316
After one hour	12 (9.09)	46 (34.58)	75 (56.39)	133
After one day	16 (16.49)	22 (22.68)	59 (60.82)	97
Months of breastfeeding*				
0-6	11 (4.45)	33 (12.74)	215 (83.01)	259
7-12	29 (11.5)	56 (22.22)	167 (66.26)	252
13+	86 (11.16)	248 (32.2)	336 (43.63)	770
Drank from nipple or not*				
No	210 (18.29)	307 (26.74)	631 (54.96)	1148
Yes	15 (11.36)	30 (22.72)	87 (65.9)	132
Mother has taken any disease prevention* (for 213 cases)				
No	14 (7.95)	50 (28.4)	112 (63.63)	176
Yes	10 (26.31)	10 (26.31)	18 (47.36)	38
Mother's BMI*				
Low BMI	116 (18.64)	171 (27.49)	335 (53.85)	622
BMI Normal	107 (16.85)	161 (25.35)	367 (57.79)	635
Obesity	-	5 (31.25)	11 (68.75)	16
Severe Obesity	3 (50.0)	-	3 (50.0)	6

Here * refers to confidence interval at 5% level. ** refers to confidence interval at 10% level.
Source NFHS-2; 1998-99

(Here we take the feeding practice during diarrhea as the proxy for mother's knowledge about child care, we found that the mothers who administer more liquid to children during diarrhea reported lowest stunting of all kind among their children compared to those who give same or less amount of liquid or who do not know at all what to give during diarrhoea). Birth size and birth weight also have significant association with children's nutritional outcome. Children of average or larger than average birth size and birth weight of more than 2.5 Kg are less stunted of any kind compared to their counterparts who are small and low weight a birth. Mother's BMI is crucial to child's birth weight and size. [Ashworth et al; 1997]. The result shows that mothers having normal BMI are less likely to have stunted children of any degree, compared to low BMI and obese mothers. [See table 5.2.6]. Nature of pre-natal care for mothers in terms of antenatal visits and vaccination for mother has positive and significant association with child nutritional outcome. The feeding practices in terms of duration of breast feeding shows that who start early supplementation after six months have less stunted children of any degree compared to those mothers who breastfed for more than six months.

5.3 Weight-for-age analysis

Weight-for-age is one of the anthropometric measures widely used to determine the nutrition status of the children. However it is considered as a reflector of short-term nutrition status because weight is very sensitive to current amount of food and health status, even psychological distress. But in case of children it is the health of the child (in terms of it's frequent susceptibility to infection, diarrhoea, fever, worm and other diet and water related diseases), the care practice of the mother and mother's ability to understand the dynamic behaviour of the child are important aspects of determining their intake which in turn is responsible for severe or moderate weight loss. [Engel and Menon; 1999, Ruel et al; 1999]. Severe weight loss is more likely to occur in case the child suffers from frequent infections, worm infection in stomach, diarrhoea, cough and fever which in turn reduce the absorption capacity of the body. The moderate underweight might be due to lack of calorie and fat in appropriate amount. [Foster and Leather; 2000, Hadad and Smith; 2000]. Like stunting analysis, here also we take same sets of demographic, social, economic, basic infrastructure, dietary

practices of mother and other care related practices to find out the pattern of underweight among different groups across different characteristics.

5.3.1 Demographic characteristics and underweight among the children

First we will take the demographic characteristics. We found that older mothers are more likely to have underweight children as we found in case of stunting analysis. It is more in case of severe underweight. In case of moderate underweight the patterns are more or less same across different age groups. The causes might be due to the factors mentioned in section 5.2. As the maternal age increases the younger child is more likely to suffer from undernutrition like stunting and underweight. It might due to health status of the mother, which prevent her to have child in normal age. The cases for women above 30 years and having a children of age between 4-35 months are also less (259 cases) compared to those who give birth before 30 years (1022 cases). This disparity in two sample sub-groups might have some role to play.

The formerly married (widowed and divorcee) women are more likely to have under weight children of different degree. The female headed households on the other hand reported more underweight of moderate degree which might be due to lack of adequate food intake in these households because of their weak economic background. [Ruel et al; 1999]. But severe underweight, which is due to health status of the child and over all care practice of the mother, is less reported in female-headed households. [See table 5.3.1]. Though the number of female headed households in our sample is 50 compared to 1231 male headed households, the pattern might not be overruled in view of current empirical findings from similar developing societies.

Age at first marriage and age at first birth have significant association with nutritional outcome of the children in terms of under weight of various degree. It is more pronounced in case of severe underweight. This finding is in line with the existing literature. The women who marry and bear children before 18 years of age are more likely to have severe underweight children in contrast with mothers who marry and give birth after 18 years of age. As far as moderate underweight is concerned which is the result of shortfall of calorie and fat intake, the pattern is same for women marrying and having child after or before 18 years of age.

Table 5.3.1 Pattern of underweight among children according to demographic characteristics

characteristics	*Severely underweight*	*Moderately underweight*	*Normal weight-for-age*	*Total*
Age group				
15-19	25 (20.66)	43 (35.53)	53 (43.8)	121
20-24	100 (20.87)	147 (30.68)	222 (46.34)	479
25-29	92 (21.14)	144 (33.01)	199 (45.74)	435
30-34	32 (16.24)	77 (39.08)	88 (44.67)	197
35-39	11 (24.44)	14 (31.11)	20 (44.44)	45
40-44	6 (42.85)	6 (42.85)	2 (14.28)	14
45-49	1 (33.33)	1 (33.33)	1 (33.33)	3
Total	267 (20.79)	432 (33.64)	585 (45.63)	1284
Age group two category				
< 30	171 (16.73)	270 (26.41)	581 (56.84)	1022
>= 30	54 (20.04)	68 (26.25)	137 (52.89)	259
Marital status				
Currently married	262 (20.67)	423 (33.38)	582 (45.93)	1267
Formerly married	3 (23.07)	8 (61.53)	2 (15.38)	13
*Age at first marriage**				
<18	107 (25.53)	139 (33.17)	173 (41.28)	419
>=18	158 (18.32)	293 (33.99)	411 (47.67)	862
*Age at first birth**				
<18	168 (24.7)	237 (34.85)	275 (40.44)	680
>=18	98 (16.27)	195 (32.39)	309 (51.32)	602
Birth in last three years				
Less than 3	224 (20.7)	373 (34.47)	485 (44.82)	1082
3 or more than 3	41 (20.6)	59 (29.64)	99 (49.74)	199
*Family size**				
1-4	77 (18.33)	137 (32.61)	206 (49.04)	420
5-7	129 (21.79)	190 (32.09)	273 (46.11)	592
8+	60 (22.22)	105 (38.88)	105 (38.88)	270
One or more than one eligible women				
One	198 (21.33)	320 (34.48)	410 (44.18)	928
More than One	68 (19.26)	112 (31.72)	174 (49.29)	353
No. of children under age five or else				
Zero	51 (21.88)	65 (27.89)	117 (50.21)	233
One or two	207 (20.76)	351 (35.2)	439 (44.03)	997
More than two	8 (15.38)	16 (30.76)	28 (53.84)	52
*Total no of children ever born**				
Less than two	132 (23.15)	191 (33.5)	247 (43.33)	570
More than two	133 (18.73)	240 (33.8)	337 (47.76)	710
Sex of the house hold head				
Male	258 (20.95)	408 (33.14)	565 (45.89)	1231
Female	7 (14.0)	24 (48.0)	19 (38.0)	50
Sex of the child				
Male	144 (21.17)	227 (33.38)	309 (45.44)	680
Female	122 (20.29)	204 (33.94)	275 (45.75)	601
*Marital duration grouped**				
0-9	184 (20.28)	289 (31.86)	434 (47.85)	907
10-19	71 (20.69)	132 (34.48)	140 (40.81)	343
20-29	10 (33.33)	11 (36.66)	9 (30.0)	30
30+	-	-	1 (100.0)	1

Here * refers to confidence interval at 5% level.
Here ** refers to confidence interval at 10% level.
Source NFHS-2; 1998-99

Family size is also significantly associated with under nutrition of different degree. The smaller families like in case of stunting also have more underweight children of different degree. This puzzle might imply that it is not family size but their capacity to feed their children adequately is more important for nutritional outcome. The same inconsistency and deviation from normal perception and fact are also visible in case of associations between degree of underweight and characteristics like total children under age five in the household, and total number of children born to the mother. The association between sex of the child and underweight outcome shows us that the pattern of different degree of underweight is more or less same for both male and female child.

5.3.2 Social characteristics and underweight among the children

Mother's education is also found to be positively and significantly associated with under nutrition outcome. The table 5.3.2 shows a clear declining pattern for underweight among children of the mothers who are better educated. Better-educated mothers have 9.53% of severely underweight children compared to uneducated mothers (25.29%). For moderate underweight the figure stands at 15.09% for better-educated mothers and 35.46% for uneducated mothers. The mothers having primary education also reports higher percentage of moderate underweight compared to their uneducated counterparts. Mother's education has positive impact on nutritional status of the children in terms of better care and feeding practices, this is clearly shown from the table 5.3.2. The father's education also has a favourable impact on nutritional outcome of the child via better income. More educated father might have better occupation, which enable them for better feeding for their children and also afford good care related services for the mother and child. The better-educated fathers have lowest undernutrition in terms of both severe and moderate degree. [See table 5.3.2]. The rural urban divide is clearly visible from the table 5.2.2. The prevalence of severe underweight is 21.15% for children from rural households compared to 16.78% for children from urban households. The same pattern holds good for moderate underweight also. By ethnic background, the scheduled caste children and tribal children are more likely to be underweight compared to the children from other ethnic households. Around 26% of tribal and scheduled caste children are found to be severely undernourished compared to children from non-SC/ST households (17.06%).

Table 5.3.2. Pattern of underweight among children by household characteristics

characteristics	*Severely underweight*	*Moderately underweight*	*Normal weight-for-age*	*Total*
Education level of the mother of the child*				
No education	174 (25.29)	240 (35.46)	274 (39.82)	688
Primary	48 (20.33)	87 (36.86)	101 (42.79)	236
Secondary	38 (12.54)	97 (32.01)	168 (55.44)	303
Higher	5 (9.53)	8 (15.09)	40 (75.47)	53
Education level of the father of the child*				
No education	110 (27.5)	146 (36.5)	144 (36.0)	400
Primary	65 (21.03)	115 (37.21)	129 (41.74)	309
Secondary	74 (16.81)	143 (32.5)	233 (52.95)	440
Higher	16 (12.3)	26 (20.0)	88 (67.69)	130
Types of place of residence*				
Rural	242 (21.15)	393 (34.35)	509 (44.49)	1144
Urban	23 (16.78)	39 (28.46)	75 (54.74)	137
Religion				
Hindu	254 (20.61)	421 (34.17)	557 (45.21)	1232
Muslim	6 (25.0)	7 (29.16)	11 (45.83)	24
Christian	5 (20.83)	3 (12.5)	16 (66.66)	24
Hindu Vs others				
Hindu	254 (20.61)	421 (34.17)	554 (44.96)	1232
Non-Hindus	11 (22.91)	10 (20.83)	27 (56.25)	48
Ethnicity*				
SC	76 (26.29)	102 (35.29)	117 (40.48)	289
tribal	74 (26.61)	90 (32.27)	114 (41.0)	278
OBC	85 (20.73)	146 (35.6)	179 (43.65)	410
Others	37 (12.13)	94 (30.81)	174 (57.04)	305
SC/ST VS Others*				
SC/ST	144 (25.39)	192 (33.86)	231 (40.74)	567
Others	122 (17.06)	240 (33.56)	353 (44.37)	715
Region				
North Orissa	47 (25.0)	66 (35.1)	75 (39.89)	188
South Orissa	52 (25.42)	70 (33.01)	90 (42.45)	212
Western Orissa	50 (17.6)	93 (32.74)	141 (49.64)	284
Eastern Orissa	116 (19.43)	203 (34.0)	278 (46.56)	597

Here * refers to confidence interval at 5% level.
Here ** refers to confidence interval at 10% level.
Source NFHS-2; 1998-99

We know from earlier discussions in this section that severe underweight occurs due to severe calorie deficiency or more frequent health disorders due to infection or various diseases, which in turn might be due to poor economic status and lack of capability to access basic facilities like education, health and sanitation for these households. Region wise, northern and south Orissa suffer more from severe child under weight (25% approximately) in comparison to western (17.6%) and eastern Orissa (19.43%). If we go back to our analysis on stunting we find that the percentage of stunted children are highest in western Orissa compared to other parts [see table 5.2.1]. But as far as moderate underweight is concerned the western Orissa reports lowest percentage (22.0% app.) compared to other parts (26% app. for eastern and

south Orissa and 30% for north Orissa.). [See table 5.3.2]. North Orissa tops the list for both moderate stunting and underweight compared to other regions.

5.3.3 Economic characteristics of the household and underweight among the children

The economic and occupation status of the households shows significant association with respect to different degree of underweight among children. Around 26% of children from poor households (low economic status households in terms of low SLI) suffered from severe underweight compared to approximately 10% of children from households having higher economic status (high SLI). The same pattern persists for moderate underweight also. As far as occupation of father and mother is concerned it is clear from table (5.3.3.) that those working in agriculture are likely to have higher percentage of undernourished of all degree compared to those who do not work or work in non-agricultural sector. The pattern is consistent with the findings from table 5.2.3 for stunting analysis. The argument given for stunting might well apply for explaining prevalence of underweight of different degree among children from poor and agricultural households.

Table 5.3.3 Pattern of underweight among children by economic characteristics

Characteristics	*Severely underweight*	*Moderately underweight*	*Normal weight-for-age*	*Total*
Household Standard of Living Index*				
Low	185 (25.94)	256 (35.9)	272 (38.14)	713
Medium	69 (15.47)	149 (33.4)	228 (51.12)	446
High	11 (9.82)	20 (17.85)	81 (72.32)	112
Occupation status of the mother of the child*				
Not working	192 (19.81)	322 (33.23)	455 (46.95)	969
Non-Agriculture	3 (8.82)	13 (38.23)	23 (67.64)	34
Agriculture	71 (25.91)	97 (35.4)	106 (38.68)	274
Occupation status of the father of the child*				
Not working	3 (10.34)	5 (17.24)	21 (72.4)	29
Non-Agriculture	29 (12.03)	75 (31.12)	137 (56.84)	241
Agriculture	233 (23.04)	352 (34.8)	426 (42.13)	1011

Here * refers to confidence interval at 5% level.
Here ** refers to confidence interval at 10% level.
Source NFHS-2; 1998-99

5.3.4 Quality of sanitation and hygiene in the household and underweight outcome among the children

Availability of basic infrastructure like safe drinking water, toilet and electricity in the household determines the state of environment, hygiene and quality of life. These have important implication on children's nutrition outcome measured in terms of

weight-for-age. Because these basic infrastructures have a role to play in providing a disease free environment to the child which in turn regulate the health status of the child and the capacity to absorb the food he or she takes. This argument is incorporated in almost all empirical evidence on child nutrition. The table 5.3.4 shows that children from households with drinking water from open sources are more likely to be severely under weight (27%) compared to those children, whose household drink water from public water supply (10%). For moderate underweight the figure stands at 28.18% for open source users compared to 23% for public supply users. The households using well water are better off than open source users but not as much as public supply users. Similarly for households having toilet facility report 7.69% severe under weight among their children while the corresponding figure stands at 22% approximately for households with out toilet. The figure for moderate underweight shows that households having toilet report 23.07% of their children suffer from moderate under weight. But for the non-users of the toilet, the figure stands at 34% (approximately). [See table 5.3.4]. The pattern holds good for electricity as well. Households having electricity have lower prevalence of underweight compared to households without electricity.

Table 5.3.4. Pattern of underweight by among children by household infrastructure

characteristics	*Severely underweight*	*Moderately underweight*	*Normal weight-for-age*	*Total*
Source of drinking water*				
Well	225 (23.8)	356 (33.23)	490 (45.75)	1071
Open sources	30 (27.02)	43 (36.73)	38 (34.23)	111
Public supply	10 (10.10)	33 (33.33)	50 (50.5))	99
Type of toilet facility*				
Yes	11 (7.69)	33 (23.07)	99 (69.23)	143
No	255 (22.4)	398 (34.97)	485 (42.61)	1138
Has Electricity*				
Yes	189 (23.07)	303 (36.99)	327 (39.92)	819
No	77 (16.63))	129 (27.86)	257 (55.5)	463

Here * refers to confidence interval at 5% level.
Here ** refers to confidence interval at 10% level.
Source NFHS-2; 1998-99

5.3.5 Dietary practice of the mother and underweight outcome among the children

We incorporate a set of dietary intake of mothers in our analysis. Though there might not be any direct relationship between mothers dietary practice and that of children's nutrition status, there might be some significant association between mother's dietary

practices, mother's health and it's implication on children's birth size and weight. In maternal nutrition analysis (chapter-3) we have examined the association between dietary practices of mother and it's implication on their nutrition status in detail. Here we want to stretch that argument little further. The nutrient rich milk of the mother might have favourable impact on child's nutrition status. [ICMR; various reports].

Table 5.3.5 Pattern of underweight among children by dietary intake of mothers

Characteristics	*Severely underweight*	*Moderately underweight*	*Normal weight-for-age*	*Total*
Milk or curd*				
Daily	13 (11.2)	23 (19.82)	80 (68.96)	116
Weekly	20 (14.49)	41 (29.71)	77 (55.79)	138
Occasionally	177 (22.04)	291 (36.23)	335 (41.71)	803
Never	55 (24.55)	77 (4.37)	92 (41.07)	224
Pulse or Beans*				
Daily	81 (15.63)	158 (30.5)	279 (53.96)	518
Weekly	117 (22.89)	187 (36.598)	207 (40.5)	511
Occasionally	62 (25.94)	82 (34.3)	95 (39.74)	239
Never	5 (38.46)	5 (38.46)	3 (23.07)	13
Green leafy vegetables*				
Daily	157 (21.13)	237 (31.89)	349 (46.97)	743
Weekly	83 (19.48)	159 (44.36)	184 (43.19)	426
Occasionally	24 (22.01)	35 (32.11)	50 (45.87)	109
Never	1 (33.33)	1 (33.33)	1 (33.33)	3
Other Vegetables				
Daily	191 (18.79)	348 (34.25)	477 (46.94)	1016
Weekly	56 (27.05)	63 (30.47)	88 (42.57)	207
Occasionally	19 (32.2)	21 (35.59)	19 (32.2)	59
Never	-	-	-	-
Fruits				
Daily	6 (16.21)	13 (35.13)	18 (48.64)	37
Weekly	27 (16.87)	52 (32.5)	81 (50.62)	160
Occasionally	218 (21.71)	344 (34.02)	449 (44.41)	1011
Never	15 (22.34)	23 (31.08)	36 (48.64)	74
Eggs				
Daily	2 (28.57)	2 (28.57)	3 (42.85)	7
Weekly	36 (15.51)	74 (31.59)	122 (52.68)	232
Occasionally	165 (21.71)	259 (34.07)	336 (44.21)	760
Never	63 (22.34)	97 (34.39)	122 (43.26)	282
Chicken/meat/fish*				
Daily	7 (30.43)	7 (30.43)	9 (39.13)	23
Weekly	52 (16.48)	120 (33.89)	182 (51.41)	354
Occasionally	191 (22.9)	284 (34.05)	364 (43.64)	834
Never	15 (23.07)	21 (32.3)	29 (44.61)	65

Here * refers to confidence interval at 5% level.
Here ** refers to confidence interval at 10% level.
Source NFHS-2; 1998-99

Since we are taking children of 4-35 months of age in our analysis, mother's dietary practice might throw some light on children's nutrition status. We found consumption

and frequency of consumption of milk/curd, pulses and beans, green vegetables and chicken/meat/fish by the mother have significant association with child's under weight status. But for other food items also (apart from eggs and animal proteins) we found that the regular takers (who take daily or at least once in a week) have lower prevalence of any degree of underweight among their children compared to those who do not take regularly or never take these items. Surprisingly our analysis shows that those who do not take any animal proteins or take occasionally have lower percentage of under nourished children for severe underweight. But as far as moderate under weight is concerned the pattern is not clear for those who take animal protein regularly or those who do not. [For detail see table 5.3.5].

5.3.6 Mother and child's care related practices and underweight outcome among the children

As far as child's birth and mother's care related characteristics are concerned; we found vaccination has a significant association with under weight outcome of the children. But children who have vaccinated have higher percentage of under nourishment of any kind compared to those children who do not have any vaccination. The gap is wider in case of moderately underweight (34.6% for those who have any vaccination and 28.12% for those who have any vaccination). This might be a very exceptional case as it goes against well-established empirical findings. There is not much difference in pattern for any kind of underweight for the children who suffer from any diarrhoea in last two weeks. But mother's knowledge about care practices measured in terms of amount of liquid administered to sick children shows that those mothers who know to give more liquid to the diarrhoea affected children have lowest percentage of severe under weight children (18% compared to 35%). But for moderate underweight the result does not show any clear pattern across different behavioural groups. The birth size of the child is also significantly associated with child's weight. Those children who have larger or normal birth size are less likely to be under weight of any degree compared to those children who are very small at birth. [See table 5.3.6]. Birth weight also has the similar pattern. Children from the group with birth weight of more than 2.5 Kg., have shown less percentage of child being under weight (20.6% for severe underweight and 33.27% for moderate underweight) compared to the children having weight lower than 2.5 kg. at birth (22.41% for severe under weight and 43.1% for moderate underweight).

Table 5.3.6. Pattern of underweight among children according to birth characteristics

characteristics	*Severely underweight*	*Moderately underweight*	*Normal weight-for-age*	*Total*
Ever had vaccination*				
No	34 (21.25)	45 (28.12)	81 (50.62)	160
Yes	120 (21.85)	190 (34.6)	239 (43.53)	549
Had diarrhoea before two weeks of interview				
No	168 (18.32)	304 (33.15)	441 (48.09)	917
Yes	97 (26.72)	124 (34.15)	142 (39.11)	363
Drinking water pattern with diarrhoea*				
Less to drink	25 (18.65)	49 (36.56)	60 (44.77)	134
Same amount to drink	86 (27.47)	112 (35.78)	115 (36.74)	313
More to drink	148 (18.15)	268 (32.88)	399 (48.95)	815
Do not know	7 (35.0)	3 (15.0)	10 (50.0)	20
Birth size of the child*				
Larger than average	37 (15.74)	70 (29.78)	128 (54.46)	235
Average	151 (19.21)	266 (33.84)	369 (46.94)	786
Smaller than average	67 (28.75)	85 (36.48)	81 (34.76)	233
Ver small	11 (40.74)	10 (37.03)	6 (22.22)	27
Birth weight				
Less than 2.5 Kg.	13 (22.41)	25 (43.1)	20 (34.48)	58
More than 2.5 Kg.	252 (20.6)	407 (33.27)	564 (46.11)	1223
Number of antenatal visits*				
No	18 (7.59)	49 (28.82)	170 (71.72)	237
Less than 5 times	29 (3.15)	188 (20.43)	703 (76.41)	920
More than 5 times	3 (2.38)	24 (19.05)	99 (78.57)	126
Mother's BMI*				
Low BMI	159 (26.41)	221 (35.53)	242 (38.9)	622
BMI Normal	107 (16.82)	206 (32.28)	323 (50.78)	636
Obesity	-	3 (18.75)	13 (81.25)	16
Severe Obesity	-	-	5 (100.0)	5
Delivery by Cesarean section* (only for 340 cases)				
No	56 (15.01)	111 (29.75)	206 (55.22)	373
Yes	10 (15.87)	25 (39.68)	32 (50.79)	63
Place of delivery*				
Public facility	-	2 (50.0)	2 (50.0)	4
Private facility	230 (23.44)	341 (34.76)	410 (41.79)	981
Home	8 (17.02)	10 (21.27)	29 (61.7)	47
Other	27 (10.84)	79 (31.72)	143 (54.72)	249
Starting of breastfeeding*				
Immediately	19 (19.58)	34 (35.05)	44 (45.36)	97
After one hour	25 (18.93)	41 (31.06)	66 (50.0)	132
After one day	65 (20.16)	102 (32.27)	149 (47.15)	316
Months of breastfeeding*				
0-6	13 (5.01)	41 (15.83)	205 (79.15)	259
7-12	28(11.15)	84 (33.46)	129 (51.39)	251
13+	214(27.75)	307 (39.81)	250 (39.42)	771
Drank from nipple or not*				
No	246 (21.42)	393 (34.23)	509 (44.33)	1148
Yes	19 (14.28)	39 (29.32)	75 (56.39)	133
Mother has taken any disease prevention* (for 213 cases)				
No	5 (2.84)	25 (14.2)	146 (82.95)	176
Yes	2(2.54)	11 (29.72)	24 (64.86)	37

Here * refers to confidence interval at 5% level.
Here ** refers to confidence interval at 10% level.
Source NFHS-2; 1998-99

The number of antenatal visits by mother also shows that mothers who do not have any antenatal care have higher percentage of under nourished children. For mother's BMI we found that mothers having low BMI are more likely to have severe under nourished children (26%) compared to women having normal BMI (16%). Obese mothers do not have any severely under weight children as compared to stunting where obese mothers have higher percentage of stunted children. [See table 5.2.6 and table 5.3.6]. This pattern also holds good for moderate under weight. Obese mothers have lowest percentage of moderately under weight children. The duration of breast-feeding is significantly associated with weight of the children. Mothers who give only breast milk for a longer period without any solid supplementation are likely to have higher percentage of both severe and moderate under weight children. The table 5.3.6. shows that mothers who had breast feeding duration of 0-6 months have only 5% severely under weight and 15% (app.) moderately under weight children compared to those who give milk for a longer duration e.g. more than one year (27% app. for severe under weight and 40% app. for moderate under weight).

5.4 Waisting (Weight-for-Height):

Waisting or weight-for-height reflects severe form of undernutrition. This measure shows severe form of under nourishment excluding the age effect. The logic behind this measure is that the human body should have some specified weight for its given height. Here we exclude the effect of age to know the exact nutritional status of the individual. The failure of body to attain a given weight for given height occurs mainly due to lack of adequate calorie and protein from dietary front and severe health disorder which reduce the immune and absorption capacity of the body. Since it is independent of age effect we can analyse the nutritional status of children also with this indicator. The similar set of characteristics used for nutrition analysis through stunting and underweight approaches is also used here.

5.4.1 Demographic characteristics and waisting among the children

The demographic category shows those women more than 30 years of age are likely to have higher percentage of severely waisted children (6%) compared to women below 30 years of age (3.3%). But the pattern is more or less similar for women of both the age categories as far as moderate Waisting is concerned.

Table 5.4.1 Pattern of waisting among children by demographic characteristics

Characteristics	*Severely waisted*	*Moderately waisted*	*Normal height-waisted*	*Total*
Age group				
15-19	7 (5.8)	22 (18.33)	91 (75.83)	120
20-24	14 (2.9)	109 (23.29)	345 (73.71)	468
25-29	13 (2.98)	76 (17.43)	347 (79.58)	436
30-34	11 (5.61)	40 (20.4)	145 (73.97)	196
35-39	2 (4.44)	12 (26.66)	31 (68.88)	45
40-44	2 (15.38)	1 (7.69)	10 (76.92)	13
45-49	-	1 (33.33)	2 (66.66)	3
Total	49 (3.82)	261 (20.37)	969 (75.64)	1281
*Age group two category***				
< 30	34 (3.32))	208 (20.33)	781 (76.34)	1023
>= 30	16 (6.17)	54 (20.84)	189 (72.97)	259
Marital status				
Currently married	49 (3.86)	257 (20.26)	962 (75.86)	1268
Formerly married	1 (7.1)	5 (35.71)	8 (57.14)	14
*Age at first marriage**				
<18	25 (3.68)	152 (22.38)	502 (73.93)	679
>=18	25 (4.15)	109 (18.1)	468 (77.74)	602
*Age at first birth**				
<18	22 (5.26)	91 (21.77)	305 (72.96)	418
>=18	28 (3.24)	170 (19.72)	664 (77.03)	862
Birth in last three years				
Less than 3	46 (3.7)	224 (20.72)	811 (75.02)	1081
3 or more than 3	4 (2.0)	37 (18.5)	159 (79.5)	200
*Family size**				
1-4	16 (3.81)	73 (17.42)	330 (78.75)	419
5-7	29 (4.89)	118 (19.93)	445 (75.16)	592
8	5 (1.85)	71 (26.29)	194 (71.85)	270
One or more than one eligible women				
One	36 (3.88)	202 (21.79)	689 (74.32)	927
More than One	14 (3.96)	59 (16.71)	280 (79.32)	353
No. of children under age five or else				
Zero	8 (3.58)	40 (17.93)	185 (82.95)	223
One or two	41 (4.11)	210 (21.08)	745 (74.79)	996
More than two	1 (1.92)	12 (23.07)	39 (72.0)	52
Total no of children ever born				
Less than two	28 (4.9)	117 (20.49)	426 (74.6)	571
More than two	22 (3.09)	144 (20.28)	544 (76.61)	710
Sex of the house hold head				
Male	48 (3.89)	249 (20.21)	935 (75.89)	1232
Female	2 (4.0)	13 (26.0)	35 (70.0)	50
Sex of the child				
Male	28 (4.11)	141 (20.73)	511 (75.14)	680
Female	22 (3.66)	121 (20.13)	458 (76.2)	601
*Marital duration grouped**				
0-9	28 (3.09)	188 (20.79)	693 (76.65)	904
10-19	19 (5.55)	71 (20.76)	252 (73.68)	342
20-29	3 (10.34)	3 (10.34)	23 (79.31)	29
30	-	-	1 (100.0)	1

Here * refers to confidence interval at 5% level.
Here ** refers to confidence interval at 10% level.
Source NFHS-2; 1998-99

The widows and divorcee women are more likely to have both the degree of waisted children (7.1% for severe waisted and 35.71% for moderately waisted) compared to women who are currently married (3.86% for severe category and 20.26% for moderate category). Age at first marriage and ages at first birth are also significantly associated with outcome of any degree of Waisting. Family size is also significantly associated with degree of waisting. Children from small families (1-4 members) and middle size families (5-7 members) have higher percentage of severe waisting (3.81% and 4.89%) compared to 1.8% for children from large families (at least 8 members or more than that). This trend is in line with our earlier findings in case of stunting and underweight. But for moderate waisting we found that children from larger families have higher percentage of prevalence (26.29%) compared to children from smaller families (17.42%). The same pattern exists for total number of children born to the mother. The female headed households also found to have slightly higher percentage of severely waisted children (4%) compared to male headed households (3.8%). But moderate waisting is very high for the children from female-headed households (26%) compared to 20.21% of male headed households. Female headed households in under developed societies generally lack adequate economic resources to meet their ends. [Ruel and Maxwell; 1999]. That might be reflected in the pattern given above. [For greater detail see table 5.4.1].

5.4.2 Social characteristics and waisting among the children

The education levels of the father and the mother have shown the similar pattern of association to various degrees of waisting among children as in case of stunting and waisting. Better-educated mother and father have less percentage of waisted children of any kind compared to less educated father and mother. [See table 5.4.2]. Interestingly the rural-urban pattern is almost similar for any degree of waisting. As far as ethnic background is concerned tribal children reported highest percentage of severe waisting (5.75%) and moderate waisting (24.82%) and children from higher caste reports lowest percentage (2.2% for severe waisting and 17.3% for moderate waisting). As far as regional distribution of waisted children is concerned, North Orissa found to have highest percentage of severely waisted children (7.9%) compared to any other regions. For moderate waisting we found that south Orissa tops the list (25.4%) compared to other regions. [See table 5.4.2]

Table 5.4.2. Pattern of waisting among children by Social characteristics

Characteristics	*Severely waisted*	*Moderately waisted*	*Normal weight-for-height*	*Total*
Education level of the mother of the child				
No education	29 (4.21)	155 (22.52)	504 (73.25)	688
Primary	9 (3.81)	42 (17.79)	185 (78.38)	236
Secondary	10 (3.3)	57 (18.81)	236 (77.88)	303
Higher	2 (3.77)	8 (15.09)	43 (81.11)	53
Education level of the father of the child*				
No education	20 (10.0)	103 (25.75)	277 (69.25)	400
Primary	13 (4.18)	53 (17.04)	245 (78.77)	311
Secondary	13 (2.95)	88 (20.0)	339 (77.04)	440
Higher	4 (3.07)	13 (10.0)	108 (83.07)	130
Types of place of residence*				
Rural	45 (3.93)	234 (20.45)	865 (75.61)	1144
Urban	5 (3.62)	28 (20.28)	105 (76.08)	138
Religion				
Hindu	47 (3.81)	254 (20.6)	932 (75.58)	1233
Muslim	1 (4.16)	3 (12.5)	20 (83.33)	24
Christian	3 (12.0)	4 (16.0)	18 (72.0)	25
Hindu Vs others				
Hindu	47 (3.81)	254 (20.6)	932 (75.58)	1233
Non-Hindus	3 (6.25)	7 (14.58)	38 (79.16)	48
Ethnicity*				
SC	9 (3.11)	57 (19.72)	223 (77.16)	289
Tribal	16 (5.75)	69 (24.82)	193 (69.42)	278
OBC	18 (4.4)	82 (20.04)	309 (75.55)	409
Others	7 (2.29)	53 (17.37)	245 (80.32)	305
SC/ST VS Others*				
SC/ST	25 (4.4)	126 (22.22)	416 (73.36)	567
Others	25 (3.49)	136 (19.02)	554 (77.48)	715
Region				
North Orissa	15 (7.97)	40 (21.27)	133 (70.74)	188
South Orissa	9 (4.24)	54 (25.47)	149 (70.28)	212
Western Orissa	9 (3.16)	60 (21.12)	215 (75.7)	284
Eastern Orissa	17 (2.85)	108 (18.12)	471 (79.02)	596

Here * refers to confidence interval at 5% level.
Here ** refers to confidence interval at 10% level.
Source NFHS-2; 1998-99

5.4.3 Economic characteristics of the household and waisting among the children

The household economic status shows that children from households with low SLI have higher percentage of waisting of different degree compared to households with medium and high SLI. The pattern is similar as in case of stunting and waisting. The occupational status of mother and father has also shown significant association with child waisting. Children from those households where either father or mother are working in agriculture have higher percentage of waisting compared to children from

non-agricultural households. These patterns are also consistent with findings from stunting and waisting. [See table 5.4.3]

Table 5.4.3 Pattern of waisting among children by economic characteristics

Characteristics	*Severely waisted*	*Moderately waisted*	*Normal weight-for-height*	*Total*
Household Standard of Living Index*				
Low	36 (5.04)	169 (23.66)	509 (71.28)	714
Medium	12 (2.68)	77 (17.22)	358 (80.0)	447
High	3 (2.65)	16 (14.15)	94 (83.18)	113
Occupation status of the mother of the child*				
Not working	41 (4.23)	182 (18.80)	745 (76.96)	968
Non-Agriculture	-	6 (17.61)	33 (84.61)	39
Agriculture	9 (3.28)	74 (27.0)	191 (69.7)	274
Occupation status of the father of the child*				
Not working	-	1 (3.57)	27 (96.42)	28
Non-Agriculture	6 (2.47)	41 (16.94)	195 (80.57)	242
Agriculture	44 (4.82)	120 (13.15)	748 (82.01)	912

Here * refers to confidence interval at 5% level.
Here ** refers to confidence interval at 10% level.
Source NFHS-2; 1998-99

5.4.4 Quality of sanitation and hygiene in the household and underweight outcome among the children

The availability of basic infrastructures likes source of drinking water, toilet facility and electricity are positively and significantly associated with waisting outcome of the children as in case of stunting and waisting. [See table 5.4.4]. Children from households who use water from open sources and have no toilet facility reported higher percentage of waisting of various degree compared to the children from households using public water supply and having any type of toilet facility.

Table 5.4.4. Pattern of waisting among children by household infrastructure

Characteristics	*Severely Waisted*	*Moderately waisted*	*Normal weight-for-height*	*Total*
Source of drinking water				
Well	43 (4.01)	222 (20.72)	806 (75.25)	1071
Open sources	6 (5.4)	23 (20.72)	82 (73.87)	111
Public supply	1 (1.0)	16 (16.16)	82 (82.82)	99
Type of toilet facility*				
Yes	46 (4.04)	242 (21.28)	849 (74.67)	1137
No	4 (2.79)	19 (13.28)	120 (83.91)	143
Has Electricity*				
Yes	15 (24.19)	77 (16.66)	370 (80.0)	462
No	35 (4.29)	184 (22.57)	599 (73.49)	815

Here * refers to confidence interval at 5% level. ** refers to confidence interval at 10% level.
Source NFHS-2; 1998-99

5.4.5 Dietary practice of the mother and waisting among children.

The dietary practices of the mother are found to have no significant association with children's waisting. The pattern is also not clear across different groups on the basis of their frequency of intake for selected food items. But earlier we found that the dietary practice of mother has some association to the stunting and under weight, but in case of waisting the association is very weak. [For detail see table 5.4.5].

Table 5.4.5 Pattern of waisting among children by dietary intake of the mothers

Characteristics	*Severely waisted*	*Moderately waisted*	*Normal weight-for-height*	*Total*
Milk or curd				
Daily	4 (3.41)	16 (13.67)	97 (82.9)	117
Weekly	2 (1.45)	27 (19.7)	108 (78.83)	137
Occasionally	36 (4.47)	167 (20.77)	601 (74.75)	804
Never	8 (3.58)	52 (23.31)	163 (73.09)	223
Pulse or Beans				
Daily	17 (3.28)	93 (17.95)	408 (78.76)	518
Weekly	23 (4.5)	113 (22.11)	375 (73.38)	511
Occasionally	10 (4.1)	53 (22.08)	117 (48.75)	240
Never	-	3 (23.07)	10 (76.92)	13
Green leafy vegetables				
Daily	32 (4.3)	156 (20.99)	555 (74.69)	743
Weekly	15 (3.52)	89 (20.89)	322 (75.58)	426
Occasionally	3 (2.77)	16 (14.81)	89 (82.4)	108
Never	-	-	3 (100.0)	3
Other Vegetables				
Daily	34 (3.34)	203 (20.0)	778 (76.65)	1015
Weekly	12 (5.79)	47 (22.7)	148 (71.49)	207
Occasionally	4 (6.89)	11 (18.96)	43 (74.13)	58
Never	-	-	-	-
Fruits				
Daily	-	10 (27.02)	27 (72.97)	37
Weekly	6 (3.75)	35 (21.87)	119 (74.37)	160
Occasionally	41 (4.05)	199 (19.66)	772 (76.28)	1012
Never	3 (4.1)	18 (24.65)	52 (71.23)	73
Eggs				
Daily	-	2 (28.57)	5 (71.42)	7
Weekly	7 (3.01)	42 (18.1)	183 (78.87)	232
Occasionally	31 (4.07)	159 (20.89)	571 (75.03)	761
Never	12 (4.25)	59 (31.56)	211 (74.82)	282
Chicken/meat/fish				
Daily	-	7 (30.43)	16 (69.56)	23
Weekly	11 (3.09)	72 (20.28)	272 (76.61)	355
Occasionally	38 (4.52)	168 (20.02)	633 (75.44)	839
Never	1 (1.56)	15 (23.43)	48 (75.0)	64

Here * refers to confidence interval at 5% level.
Here ** refers to confidence interval at 10% level.
Source: NFHS-2; 1998-99

5.4.6 Mother and child's care related practices and waisting outcome among the children

Mother and child's characteristics at prenatal and post natal period and care practices of the mother show that birth size of the child, Mother's BMI and months of breast feeding are the important characteristics having significant association with waisting of various degree. Mothers having normal Body Mass Index report 3.3% of severe waisting compared to 3.8% among mother with low BMI. For moderate waisting the table shows mothers having normal BMI reported 15% of their children as moderately waisted compared to 22% for mothers having low BMI. Similarly children with normal or larger than normal body size at birth reports around 3.5 to 4% of severe waisting, compared to the children who have smaller than average size (6%). For moderate waisting the larger than average size children reports lowest percentage of moderate waisting (14.5%) compared to children with small or very small body size at birth. [For detail see table 5.4.6]. The mothers who breastfed their children for a longer period (above 6 months or one year) without any solid supplementation also likely to have higher percentage of waisted children of various degree compared to those mothers who breasted till six months and started some kind of supplementation afterwards. [See table 5.4.6 for detail].

This proves the point that waisting as a form of under nutrition might happen due to bad nutritional status of the mother (measured in terms of BMI) at times of pregnancy and it's implication in terms of poor birth size and weight for the babies. The breastfeeding practices only worsen the matter further.

Table 5.4.6. Pattern of waisting among children according to birth characteristics

Characteristics	*Severely waisted*	*Moderately waisted*	*Normal weight-for-height*	*Total*
Ever had vaccination (710 cases only)				
No	9 (14.75)	28 (17.39)	124 (77.01)	161
Yes	22 (4.0)	121 (22.04)	406 (73.95)	549
Had diarrhoea before two weeks of interview				
No	36 (3.93)	175 (19.1)	705 (76.96)	916
Yes	14 (3.85)	86 (23.69)	263 (72.45)	363
Drinking pattern with diarrhoea				
Less to drink	2 (1.5)	29 (21.8)	102 (76.69)	133
Same amount to drink	14 (4.48)	76 (24.35)	222 (71.15)	312
More to drink	31 (3.8)	155 (19.04)	628 (77.14)	814
Do not know	2 (10.52)	1 (26.31)	16 (84.21)	19
Birth size of the child*				
Larger than average	9 (3.84)	34 (14.52)	191 (81.62)	234
Average	27 (3.42)	160 (20.30)	601 (76.26)	788
Smaller than average	14 (6.0)	61 (26.18)	158 (67.81)	233
Ver small	-	7 (25.92)	20 (74.07)	27
Birth weight				
Less than 2.5 Kg	1 (1.72)	15 (25.86)	42 (72.41)	58
More than 2.5 Kg	49 (4.0)	247 (20.19)	927 (75.79)	1223
Number of antenatal visits				
No	18 (7.59)	49 (20.67)	170 (71.71)	237
Less than five times	29 (3.53)	188 (23.92)	603 (73.53)	820
More than five times	3 (2.38)	24 (19.04)	99 (78.57)	126
Delivery by Cesarean section (only for 340 cases)				
No	14 (3.75)	72 (20.1)	287 (76.94)	373
Yes	-	12 (17.91)	55 (82.08)	67
Place of delivery*				
Public facility	-	-	4 (100.0)	4
Private facility	43 (4.38)	208 (21.22)	729 (74.38)	980
Home	3 (6.38)	9 (19.14)	35 (74.46)	47
Other	3 (1.2)	44 (17.74)	201 (81.04)	248
Starting of breastfeeding				
Immediately	3 (3.09)	20 (20.61)	74 (76.28)	97
After one hour	4 (3.03)	23 (17.42)	105 (79.54)	132
After one day	9 (2.84)	70 (22.15)	237 (75.0)	316
Months of breastfeeding*				
0-6	7 (2.7)	30 (11.58)	222 (85.71)	259
7-12	7 (2.77)	146 (57.93)	199 (78.96)	252
13+	37 (4.79)	85 (11.02)	549 (71.2)	771
Drank from nipple or not				
No	46 (4.0)	241 (20.97)	862 (75.02)	1149
Yes	4 (3.0)	21 (15.78)	108 (81.2)	133
Mother has taken any disease prevention (for 213 cases)				
No	5 (6.57)	25 (14.2)	146 (82.95)	176
Yes	2 (5.4)	11 (29.72)	24 (64.86)	37
Mothers BMI*				
Low BMI	24 (3.85)	140 (22.5)	438 (70.41)	622
BMI Normal	21 (3.3)	97 (15.25)	494 (77.67)	636
Obesity	-	-	16 (100.0)	16
Severe Obesity	-	-	5 (100.0)	5

Here * refers to confidence interval at 5% level. ** refers to confidence interval at 10% level.
Source NFHS-2; 1998-99

5.5 A discussion on association of prominent characteristics with Stunting, Underweight and Waisting controlled for household standard of living index

Like maternal nutrition in chapter-3, here also we try to examine some important characteristics from all sets mentioned above and their association with different types of undernutrition controlling for the economic status of the household. This is attempted to understand the robustness of the association between different characteristics and undernutrition outcome for the child. Household size is found to be significantly associated with stunting and waisting for low economic status households (low SLI) and with underweight for high economic status households (high SLI). Total number of childbirth is also important for low economic status of the household for stunting. Sex of the household matters for low economic status households for underweight. Age at first marriage is found to be significantly associated with stunting for low economic status household. Age at first birth and types of place of residence have no significant association with any types of undernutrition for any types of economic status. However the regional difference are not significantly associated with stunting once we control for economic status of the household. But for high economic status households' regional difference holds significantly in case of underweight and waisting. Mother's education is significant for poor households for stunting outcome. But for medium economic status households (medium SLI) also we found that mother's education becomes significant for stunting and underweight outcome. Same pattern holds good for father's education. As far as ethnicity is concerned, for low economic status households (low SLI) it matters for stunting and for high economic status, it matters for stunting and underweight. It implies that given the economic status, the ethnic or social backgrounds still play a role in child's nutrition outcome. Father's work status matters for low economic status households (low SLI) for stunting outcome and for medium economic status households (medium SLI) it is significant for both stunting and waisting. The source of drinking water and toilet do not show any significance once controlled for economic status of the households. But it does not mean that they do not have significant association with nutrition outcome, because there are overwhelming empirical evidence on availability of these facilities and nutrition outcome. So the result here might be interpreted that these facilities affect nutrition outcome of the children irrespective of their economic status.

Table 5.5: Degree of association of selected characteristics with Stunting, Underweight and Waisting controlled for household standard of living index

Characteristics	Groupings	Standard of living index	Stunting (Height-for-age)	Under weight (Weight-for-age)	Waisting (Weight-for-height)
Household Size	1-4	Low	*	-	*
	4-7	Medium	-	-	-
	8+	High	-	*	-
Total child birth	No child	Low	*	-	-
	One or two	Medium	-	-	-
	More than two	High	-	-	-
Sex of the child	Male	Low	-	-	-
	Female	Medium	-	-	-
		High	-	-	-
Sex of the head of the household	Female	Low	-	*	-
	Male	Medium	-	-	-
		High	-	-	-
Age at first marriage for the mother	Less than 18	Low	*	-	-
	18 or more	Medium	-	-	-
		High	-	-	-
Age at first birth For the mother	Less than 18	Low	-	-	-
	18 or more	Medium	-	-	-
		High	-	-	-
Types of place of residence	Rural	Low	-	-	-
	Urban	Medium	-	-	-
		High	-	-	-
Region	North Orissa	Low	-	-	-
	Southern Orissa	Medium	-	-	-
	Western Orissa	High	-	*	*
	Eastern Orissa				
Education level of the mother	No education	Low	**	-	-
	Primary	Medium	*	*	-
	Secondary	High	-	-	-
	Higher				
Education level of the father	No education	Low	-	-	-
	Primary	Medium	*	-	-
	Secondary	High	-	-	-
	Higher				
Ethnicity	SC	Low	*	-	-
	Tribal	Medium	-	-	-
	OBC	High	*	*	-
	General				
Occupation of mother	No work	Low	-	-	-
	Work in agriculture	Medium	-	-	-
	Work in non-agriculture	High	-	-	-
Occupation of father	No work	Low	*	-	-
	Work in agriculture	Medium	*	*	-
	Work in non-agriculture	High	-	-	-
Source of drinking water	Well	Low	-	-	-
	Public supply	Medium	-	-	-
	Surface water	High	-	-	-
Toilet	Have toilet	Low	-	-	-
	No toilet	Medium	-	**	-
		High	-	-	-

(Cont..)

Characteristics	Groupings	Standard of living index	Stunting (Height-for-age)	Under weight (Weight-for-age)	Waisting (Weight-for-height)
Electricity	No	Low	-	-	-
	Yes	Medium	-	-	-
		High	*	*	-
Take milk or curd	Daily	Low	-	-	-
	Weekly	Medium	-	-	-
	Occasionally	High	*	-	-
	Never				
Intake of pulses or beans	Daily	Low	*	*	-
	Weekly	Medium	-	-	-
	Occasionally	High	-	-	-
	Never				
Intake of green vegetables	Daily	Low	*	-	-
	Weekly	Medium	-	-	-
	Occasionally	High	-	-	-
	Never				
Intake of other vegetables	Daily	Low	-	*	-
	Weekly	Medium	-	-	-
	Occasionally	High	-	*	-
	Never				
Intake of Fruits	Daily	Low	-	-	-
	Weekly	Medium	-	-	*
	Occasionally	High	-	-	-
	Never				
Intake of Eggs	Daily	Low	-	-	-
	Weekly	Medium	-	-	-
	Occasionally	High	*	-	-
	Never				
Intake of Chicken/meat/fish	Daily	Low	-	-	-
	Weekly	Medium	-	-	-
	Occasionally	High	-	-	-
	Never				
Received disease prevention before pregnancy	No	Low	*	*	-
	Yes	Medium	*	-	-
		High	-	-	*
Ever had vaccination for child	No	Low	-	-	-
	Yes	Medium	-	-	*
		High	-	-	-
Has diarrhoea recently	No	Low	-	*	-
	Yes	Medium	-	-	-
		High	-	-	-
Has cough recently	No	Low	-	-	**
	Yes	Medium	-	*	-
		High	*	-	-
Has fever recently	No	Low	-	*	*
	Yes	Medium	-	-	-
		High	*	-	-
Place of delivery	No facility	Low	*	*	-
	Private facility	Medium	-	-	-
	Home	High	-	-	-
	Public health facility				
Number of antenatal visits	No visits	Low	-	-	-
	Five or less than five times	Medium	-	-	-
	More than six times	High	-	-	-
Months of breast feeding	0-6 months	Low	*	*	*
	7-12 months	Medium	*	*	-
	More than 13 months	High	*	*	-
Size of child at birth	Bigger than average	Low	-	-	*
	Average	Medium	*	*	-
	Lower than average	High	-	-	**
	Very small				

Here * refers to confidence interval at 5% level. ** refers to confidence interval at 10% level.
Source NFHS-2; 1998-99

Intake of pulses, green vegetables and other vegetables are found to be significantly associated with stunting and underweight outcome for low economic status households. Received disease prevention is also found to be significantly associated with stunting (for low and medium economic status households) and for underweight (for low economic status households). Diarrhea and fever are found to be significantly associated with underweight among children of low economic status households. The cough is also found to be associated with waisting for these children. But for high economic status households we found diarrhea has no role to play but fever and cough are significantly associated with stunting. For medium economic status we found that the cough is significantly associated with underweight. Place of delivery is also important for children from low economic status households especially for their stunting and underweight outcome. But months of breast-feeding are found to be significant for stunting and underweight among children irrespective of their household economic status. For low economic status households' months of breasfeeding is also found to be significant for waisting outcome. Birth size of the child matters for children from poor economic status households for waisting outcome and the same holds good for high economic status households. For medium economic status households birth size is found to be significant for stunting and underweight. [For detail see table 5.5]

5.6 Role of economic and social status of the household in child under nutrition given the regional background.

We also try to look at the role of economic and social status in determining various degree of undernutrition across different regions. In northern region we found out that economic status is significant for underweight outcome where as social status does not matter significantly when controlled for regional variation because the over all economic condition is very poor in the region, Underweight as an indicator of food inadequacy and repeated health disorders implies that there might be some seasonal variation involved in food availability and over all health and other facilities in the households in the region are very low. In southern region we found that social status is important than economic status especially for stunting and waisting which represent very long past undernutrition status. For western region we found that both economic and social status are important for child stunting and waisting. As far as eastern Orissa

is concerned all the three indicators shows significant association at 1-% level with both economic and social status. So a more intensive study is needed to understand this regional dynamics of undernutrition in Orissa.

Table 5.6 Role of regional variation on nutrition outcome for given economic and social status of the households with in the region

Region	Economic status			Social Status		
	Stunting	Under weight	Waisting	Stunting	Under weight	Waisting
North	-	*	-	-	-	-
South	-	-	-	*	-	*
West	*	*	-	*	*	-
Eastern	*	*	*	*	*	*

Here * refers to confidence interval at 5% level.
Here ** refers to confidence interval at 10% level.
Source NFHS-2; 1998-99

5.7a Role of economic status of the households in determining child undernutrition outcome within different social groups

In this section we will try to see how with in the given social groups the economic status matters for child undernutrition. This multivariate cross tabulation between economic status of the household and the nutrition outcome of the children (measured in terms of anthropometry) is found to be statistically significant at 1-% level (controlling for social back ground of the house holds) for tribal, OBC and general category children for height-for-age, weight-for-age. For Waisting (weight-for-height), association is only significant for general category when controlled for their ethnicity. Interestingly for scheduled caste children, economic status is not significant for all the three anthropometric outcomes of nutrition, when controlled for their ethnicity. But as economic status goes up there is some kind of improvement in over all percentages in undernutrition across all social groups.[See table 5.7 (a)]

Table 5.7 (a) Three way cross tabulation between economic status and nutritional outcome of the children controlling for the social background of their household.

Ethnicity	Economic status	Stunting			Underweight			Waisting		
		Severe	Moderate	Total	Severe	Moderate	Total	Severe	Moderate	Total
Scheduled Cast	Low	49	68	215	58	77	215	6	47	215
		(22.79)	(31.62)	(100.0)	(26.97)	(35.81)	(100.0)	(2.79)	(21.85)	(100.0)
	Medium	16	13	70	12	24	70	3	9	70
		(22.53)	(18.3)	(100.0)	(20.6)	(34.28)	(100.0)	(4.28)	(12.85)	(100.0)
	High	1	-	4	-	1	4	-	1	4
		(25.0)		(100.0)		(33.0)	(100.0)		(25.0)	(100.0)
	Total	66	81	289	70	102	(289	9	57	289.
		(22.83)	(28.02)	(100.0)	(24.22)	(35.29)	(100.0)	(3.11)	(19.72)	(100.0)
Tribal	Low	44	73	216	66	71	216	33	58	216
		(20.37)	(33.79)	(100.0)	(30.55)	(32.87)	(100.0)	(15.27)	(26.85)	(100.0)
	Medium	12	8	58	8	19	58	3	11	58
		(20.68)	(13.79)	(100.0)	(13.79)	(32.75)	(100.0)	(5.1)	(18.96)	(100.0)
	High	-	1	3	-	-	3	-	-	3
			(33.0)	(100.0)			(100.0)			(100.0)
	Total	56	82	277*	74	81	277*	39	69	277
		(20.21)	(29.6)	(100.0)	(26.71)	(32.85)	(100.0)	(14.07)	(24.9)	(100.0)

Continued from previous page

Ethnicity	Economic status	Stunting			Underweight			Waisting		
		Severe	Moderate	Total	Severe	Moderate	Total	Severe	Moderate	Total
OBC	Low	41	50	181	44	71	181	21	43	181
		(22.65)	(27.62)	(100.0)	(24.3)	(32.87)	(100.0)	(11.6)	(23.75)	(100.0)
	Medium	28	41	176	31	60	176	4	32	176
		(15.9)	(23.29)	(100.0)	(17.51)	(33.89)	(100.0)	(2.27)	(28.18)	(100.0)
	High	3	13	46	9	10	46	3	7	46
		(6.38)	(27.65)	(100.0)	(20.0)	(22.22)	(100.0)	(6.52)	(15.21)	(100.0)
	Total	72	104	403*	84	141	403*	28	82	403
		18.86)	(25.8)	(100.0)	(20.84)	(34.98)	(100.0)	(6.94)	(20.34)	(100.0)
Others	Low	11	26	101	17	36	101	6	20	101
		(10.78)	(25.09)	(100.0)	(16.83)	(37.62)	(100.0)	(5.94)	(19.8)	(100.0)
	Medium	17	37	141	18	46	141	1	24	141
		(11.97)	(26.65)	(100.0)	(12.76)	(32.62)	(100.0)	(6.7)	(17.02)	(100.0)
	High	2	6	60	2	9	60	-	8	60
		(3.27)	(9.8)	(100.0)	(3.7)	(14.75)	(100.0)		(13.33)	(100.0)
	Total	30	69	302*	37	93*	302	7	55	302*
		(9.93)	(22.8)	(100.0)	(12.25)	(30.79)	(100.0)	(2.31)	(18.21)	(100.0)

Source NFHS-2; 1998-99

188

5.7b Role of social status of the households in determining child undernutrition outcome within given economic status of the household

The next table shows with in given economic status of the household different social groups show different pattern for undernutrition. Within low economic status households' SC and OBC children are relatively higher percentage of severe stunting compared to tribal and children from other castes. But for moderate stunting in the low economic households Tribal children are worst hit (33.79%) compared to any other groups. As far as underweight is concerned tribal and scheduled caste children are worst hit in severe (30.55%) and moderate (35.3%) categories compared to any other social groups. As far as waisting is concerned tribal children are worst hit compared to any other social groups.

In medium economic status households SC children are comparatively suffer more (20.2%) for severe stunting, but for moderate stunting children from general castes have higher percentage (26.03%) compared to other groups. [See table 5.7b below]. For medium economic status households we found children from OBC households have higher percentage of underweight compared to any other social groups. For waisting in medium economic status households we found tribal children are at most disadvantageous stage compared to any other social groups. Among higher economic status households we found SC/ST children are comparatively more undernourished than any other social groups. Interestingly out of 115 households in higher economic category we found only four belongs to SC and three belong to tribal community. This shows the economic backward ness of the tribal and scheduled caste community, which is reflected in poor nutrition status of their children.

Table 5.7b Three way cross tabulation between ethnicity and nutritional outcome of the children controlling for the economic status of their household.

Economic status	Ethinicity	Stunting			Underweight			Waisting		
		Severe	Moderate	Total	Severe	Moderate	Total	Severe	Moderate	Total
Low	SC	49 (22.79)	68 (31.62)	215 (100.0)	58 (26.97)	77 (35.31)	215 (100.0)	6 (2.79)	47 (21.85)	215 (100.0)
	ST	44 (20.37)	73 (33.79)	216 (100.0)	66 (30.55)	71 (32.87)	216 (100.0)	33 (15.27)	58 (26.85)	216 (100.0)
	OBC	41 (22.65)	50 (27.62)	181 (100.0)	44 (24.3)	71 (32.87)	181 (100.0)	21 (11.6)	43 (23.75)	181 (100.0)
	Others	11 (10.78)	26 (25.09)	102 (100.0)	17 (16.83)	38 (37.25)	102 (100.0)	6 (5.94)	20 (19.8)	101 (100.0)
	Total	145 (20.3)	217 (30.39)	714 (100.0)	182 (70.81)	257 (35.99)	714 (100.0)	66 (9.24)	168 (23.52)	714 (100.0)
Medium	SC	16 (22.53)	13 (18.3)	71 (100.0)	12 (17.14)	24 (34.28)	70 (100.0)	3 (4.28)	9 (12.85)	70 (100.0)
	ST	12 (20.68)	8 (13.79)	58 (100.0)	8 (13.79)	19 (32.75)	58 (100.0)	3 (5.17)	11 (18.96)	58 (100.0)
	OBC	28 (15.9)	41 (23.29)	176 (100.0)	31 (17.61)	60 (34.09)	176 (100.0)	3 (1.7)	7 (3.97)	176 (100.0)
	Others	17 (11.97)	37 (26.05)	142 (100.0)	18 (12.76)	46 (32.62)	141 (100.0)	1 (4.16)	24 (17.02)	141 (100.0)
	Total	73 (61.34)	119 (26.62)	447 (100.0)	69 (15.5)	149 (33.48)	445 (100.0)	10 (19.6)	51 (11.46)	445 (100.0)
High	SC	1 (25.0)	-	4 (100.0)	-	1 (25.0)	4 (100.0)	-	1 (25.0)	4 (100.0)
	ST	-	1 (33.33)	3 (100.0)	-	-	3 (100.0)	-	-	3 (100.0)
	OBC	3 (6.38)	13 (27.65)	47 (100.0)	9 (20.0)	10 (22.22)	45 (100.0)	3 (6.52)	7 (15.21)	46 (100.0)
	Others	2 (3.27)	6 (9.83)	61 (100.0)	2 (3.27)	9 (14.75)	61 (100.0)	-	8 (12.72)	60* (100.0)
	Total	6 (5.21)	20 (17.39)	115* (100.0)	11 (9.73)	20 (17.69)	113* (100.0)	3 (2.65)	16 (14.15)	113 (100.0)

Source:NFHS-2; *1998-99*

5.8 Rural-Urban pattern in child undernutrition across various social groups:

In this section we make an attempt towards understanding the dynamics of undernutrition outcome for same social groups across rural-urban place of residence. Our analysis shows that severe stunting (23.62%) and severe underweight (24.89%) are higher among rural scheduled case children compared to urban scheduled caste children (14.89% for stunting and underweight). However the severe waisting is comparatively higher among urban SC children. As far as moderate form of any types of child undernutrition is concerned, urban children are relatively higher risk compared to rural SC children.

For tribal children, there is a reversal in pattern with urban disadvantage over their rural counterparts. Urban tribal children have comparatively higher percentage of moderate underweight (39.39 %) in relation to rural tribal children (31.91%). But on the whole rural tribal children are comparatively at higher risk to all kinds of undernutrition.

For OBC children, the rural-urban divide is very clear in all the nutrition indicators. For all the measures of undernutrition, children from rural households have a disadvantage compared to their urban counterparts. [For detail see table 5.8 below].

While examining the same among other social groups the pattern is not clear. The gap is reasonably wider in case of severe under weight (for rural children; 11.48% and for urban children; 16.25%). For moderate underweight we found that 32.7% of rural children are moderately underweight compared to 20.0% for urban children from same social category. But for any form of stunting and waisting the percentage of prevalence is more or less same. [For detail see table 5.8 below].

Table 5.8 Comparison of same social groups for child undernutriton across rural-urban place of residence

Ethnicity	Place of residence	Stunting			Underweight			Waisting		
		Severe	Moderate	Total	Severe	Moderate	Total	Severe	Moderate	Total
Scheduled Cast	Rural	56 (23.62)	66 (27.84)	237 (100.0)	59 (24.89)	83 (35.02)	237 (100.0)	7 (2.95)	45 (18.98)	237 (100.0)
	Urban	7 (14.89)	14 (29.78)	47 (100.0)	9 (14.89)	17 (36.17)	47 (100.0)	2 (4.2)	13 (27.65)	47 (100.0)
Tribal	Rural	46 (19.57)	70 (29.78)	235 (100.0)	64 (27.23)	75 (31.91)	235 (100.0)	14 (5.95)	60 (25.53)	235 (100.0)
	Urban	8 (24.24)	8 (24.44)	33 (100.0)	6 (18.18)	13 (39.39)	33 (100.0)	1 (3.3)	5 (15.5)	33 (100.0)
OBC	Rural	62 (19.01)	88 (36.97)	328 (100.0)	70 (21.34)	120 (36.58)	328 (100.0)	15 (4.57)	66 (20.12)	328 (100.0)
	Urban	11 (13.41)	16 (19.51)	82 (100.0)	13 (15.85)	23 (28.04)	82 (100.0)	3 (3.65)	17 (20.73)	82 (100.0)
Others	Rural	23 (9.78)	53 (22.55)	235 (100.0)	27 (11.48)	77 (32.76)	235 (100.0)	5 (2.12)	41 (17.44)	235 (100.0)
	Urban	34 (10.0)	18 (22.5)	80 (100.0)	13 (16.25)	16 (20.0)	80 (100.0)	3 (3.75)	49 (17.5)	80 (100.0)

Source NFHS-2; 1998-99

5.9 Analysis of Multinomial logit regression on child undernutrition in Orissa

The Multinomial logit results for child undernutrition indicators are presented in table 5.9. The result shows us that for severe stunting, ethnicity (social background), birth in last three years, severe obesity and toilet facility are significant determinants. Being a Scheduled caste children the likelihood of being severely stunted is two times more than a child from general caste (Others in this case). For tribal children the likelihood of being severely stunted is 1.75 times more than a child from general category and for a child from other backward caste the likelihood is 1.2 times compared to general category. If the mother is severely obese then likelihood of her child being severely stunted is as high as 18 times more compare to a child from a mother with normal BMI. Similarly a child from a household, where no toilet facility is available, his/her likelihood of being severely stunted is 3.6 times more than a child from a household which use any kind of toilet facility. For moderate stunting we found that family size and total childbirth are significant determinants. But the ethnicity still has a strong influence, as being a SC or tribal child it is 1.3 time more likely to be moderately stunted compared to a child from general category. The toilet facility is also turned out to have a value of greater than unity suggesting children from households without toilet are 1.3 times more likely to suffer from moderate stunting. Mother and father's education for uneducated and primary educated parents, father's occupation for agriculture work, household economic status for poor households, Birth weight, moths of breast feeding are the other common determinants which have a larger expected value of greater than one. Which imply children from these groups are comparatively at higher risk than children from well to do groups in their respective category. Being a child from western and southern Orissa also shows the greater risk of being stunted of any kind compared to children from eastern part of Orissa. As we have mentioned in earlier discussions, that western and southern Orissa consist of the backward regions of Orissa and have higher concentration of economically backward scheduled caste and tribal people.

For severe underweight the statistically significant determinants are ethnicity or social background (for scheduled caste and tribal children), age at first marriage (marriage before 18), regional background (for North Orissa). For moderate under weight again

the social background (for SC and Tribal), regional background (for north Orissa), household economic status (for low and medium economic status), months of breast feeding, birth weight (for less than 2.5 Kg.), body mass index of the mother (for low BMI) are found to be significant determinants and have a greater than one value for Expected . Other important determinants having no statistical significance but greater than one expected for severe under weight are education of father and mother (for low educated and uneducated categories), occupation of father (for agriculture), regional back ground (for southern and western Orissa), toilet facility and drinking water source. [For detail see table 5.9]

For severe waisting we found family size (for large families of member eight or more and middle size families of members five to seven), regional background (for northern Orissa), and months of breastfeeding are the statistically significant determinants. Apart form these determinants, other determinants like ethnicity, regional back ground (for southern and western Orissa), and sources of drinking water (from open sources and well) also have larger than one expected . It implies that children from these groups are at higher risk to severe waisting compared to the children from the reference group. [See table 5.9 below for further details].

For moderate waisting we found that tribal and SC children are 1.07 times more likely to be stunted compared to children from reference group. Similarly children from northern Orissa are 1.2 times more likely to be moderately waisted compared to reference region (eastern Orissa). For children from southern Orissa the likelihood is 1.5 times compared to eastern Orissa and for western Orissa the likelihood is 1.45. Mothers BMI also comes out to be significant for moderate waisting. It is found children of low BMI mother are1.25 times more likely to be moderately waisted compared to reference group (children from mothers having normal BMI). Households lacking toilet and safe drinking water supply (drawing water from open sources) shows that their children are 1.3 and 1.15 times more likely to be moderately waisted compared to reference group (children from households having toilet and safe drinking water supply). [For detail see table 5.9]. Mother's education has also likelihood of greater than one for uneducated and primary educated women.

Table 5.9 Multinomial logit analysis for child undernutrition in Orissa with all the anthropometric indicators

Variable	Economic status	Stunting				Underweight				Waisting			
		Severe		Moderate		Severe		Moderate		Severe		Moderate	
		Exp. β	S.E.[16]	Exp. β[17]	S.E.	Exp. β	S.E.	Exp. β	S.E.	Exp. β	S.E.	Expβ	S.E.
Age Group	< 30	1.22	.230	.935	.201	1.22	.240	.781	.197	.617	.392	.886	.203
	> 30	1[18]	-	1	-	1	-	1	-	1	-	1	-
Religion	Hindu	2.806**[19]	.625	1.38	.392	.899	.442	2.17*[20]	.428	.433	.707	1.53	.445
	Non-Hindu	1	-	1	-	1	0[a]	1	-	1	-	1	-
Mother's education	uneducated	2.18	.871	1.94	.597	1.12	.679	1.67	.551	.412	1.137	.663	.565
	Primary	1.66	.863	2.14	.587	1.4	.667	2.28	.542	.528	1.12	.676	.557
	Secondary	1.35	.830	1.89	.547	.890	.622	1.88	.499	.667	1.02	.872	.508
	Higher	1	-	1	-	1	-	1	-	1	-	1	-
Father's education	uneducated	1.13	.479	1.1	.375	1.33	.447	1.91*	.368	.795	.805	1.66	.402
	Primary	1.18	.461	1.36	.360	1.038	.435	1.67	.352	.652	.776	1.01	.396
	Secondary	.862	.438	1.18	.332	.935	.399	1.36	.320	.559	.722	1.35	.359
	Higher	1	-	1	-	1	-	1	-	1	-	1	-
Place of residence	Rural	.699	.337	.981	.274	.877	.323	1.17	.269	.671	.573	.734	.273
	Urban	1	-	1	-	1	-	1	-	1	-	1	-
Ethnicity	SC	2.09*	.290	1.38	.234	1.82*	.286	1.22	.229	1.209	.570	.825	.243
	Tribal	1.75*	.314	1.33	.252	1.73*	.303	1.1	.252	2.209	.556	1.07	.259
	OBC	1.70*	.266	1.21	.205	1.84*	.257	1.25	.198	2.143	.490	1.07	.214
	Others[21]	1	-	1	-	1	-	1	-	1	-	1	-

[16] S.E. refers to standard error.
[17] Exp. implies likelihood ratio for the respected group.
[18] 1 refers to reference category.
[19] ** Refers to statistical significance at 10% level.
[20] * Refers to statistical significance at 5% level.
[21] Other include all the non-SC, non-tribal, non-OBC groups including forward casts

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Variable	Economic status	Stunting				Underweight				Waisting			
		Severe		Moderate		Severe		Moderate		Severe		Moderate	
		Exp. β	S.E.	Exp. β	S.E.	Exp. β	S.E.	Exp. β	S.E.	Exp. β	S.E.	Exp. β	S.E.
Family Size	8+	1.034	.265	.709**	.215	1.17	.260	.967	.216	2.65**	.572	.732	.221
	5-7	.875	.244	.725**	.196	1.004	.237	.823	.200	2.82**	.536	.757	.198
	1-4	1	-	1	-	1	-	1	-	1	-	1	-
Total birth in last three years	> 2	.764	.244	.685**	.203	.955	.239	1.07	.205	1.99	.570	1.03	.212
	<= 2	1	-	1	-	1	-	1	-	1	-	1	-
Total number of child birth	> 2	1.55*	.211	.954	.179	1.006	.208	.839	.177	1.02	.381	.932	.183
	<= 2	1	-	1	-	1	-	1	-	1	-	1	-
Age at first marriage	< 18	.849	.193	1.23	.162	1.44*	.192	1.19	.161	.940	.339	1.29	.167
	>= 18	1	-	1	-	1	-	1	-	1	-	1	-
Respondent's occupation	No work	1.24	.215	1.04	.186	1.39	.215	1.22	.192	1.98**	.417	.819	.184
	Agriculture	.847	.609	.481	.573	.580	.716	1.22	.460	.0012	3331.2	.724	.507
	Non-Agriculture	1	-	1	-	1	-	1	-	1	-	0[a]	0[a]
Husband's Occupation	No work	1.13	.537	.394	.591	.179*	.686	.216*	.533	.0031	3774.33	1.4*	.954
	Agriculture	.578*	.296	.763	.219	.783	.275	1.10	.208	.0056	.537	.926	.229
	Non-Agriculture	1	-	1	-	1	-	1	-	1	-	0[a]	0[a]
Region[22]	N.O.	.927	.279	1.33	.222	1.72*	.265	1.47**	.231	2.49*	.423	1.24	.231
	S.O.	1.008	.250	1.001	.210	1.17	.242	.986	.211	1.29	.447	1.54*	.210
	W.O.	1.248	.230	1.008	.199	1.06	.235	1.03	.192	1.2	.443	1.45*	.198
	E.O.	1	-	1	-	1	-	1	-	1	-	1	-

[22] N.O. refers to North Orissa comprising undivided Keonjher, Mayurbhanja and Sundargarh districts.
S.O. refers to South Orissa comprising undivided Phulkbani and Koraput district

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Variable	Coding structure	Stunting				Underweight				Waisting			
		Severe		Moderate		Severe		Moderate		Severe		Moderate	
		Exp. β	S.E.	Exp. β	S.E.	Exp. β	S.E.	Exp. β	S.E.	Exp. β	S.E.	Exp. β	S.E.
Household economic status	Low Medium High	1.66 1.83 1	.618 .586 -	1.31 .974 1	.389 .352 -	2.07 1.12 1	.491 .452 -	2.97* 1.99* 1	.388 .348 -	3.36 1.4 1	.917 .849 -	1.24 .933 1	.412 .373 -
Birth weight	< 2.5K.g. >= 2.5 K.g.	1.58 1	.404 -	1.03 1	.369 -	2.66* 1	.422 -	2.47* 1	.351 -	.738 1	1.009 -	1.47 1	.335 -
Month's of breastfeeding	0-6 6-12 13+	.0078* .272* 1	.346 .242 -	.192* .456* 1	.214 .186 -	.0052 .338 1	.314 .223 -	.139* .534* 1	.205 .177 -	.442** .596** 1	.449 .447 -	.429* .747 1	.217 .194 -
Body Mass Index Of the mother	Low BMI Normal BMI	.977 1	.173 -	1.04 1	.146 -	1.83* 1	.171 -	1.38* 1	.145 -	1.04 1	.308 -	1.25 1	.148 -
Any types of Toilet[23]	No Yes	3.64* 1	.588 -	1.36 1	.343 -	1.45 1	.467 -	1.02 1	.318 -	.667 1	.776 -	1.30 1	.365 -

W.O. refers to Western Orissa comprising undivided Sambalpur, Bolangir and Kalahandi district.
E.O. refers to Eastern Orissa comprising undivided Puri, Cuttack, Balasore, Dhenkanal, Ganjam

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Variable	Economic status	Stunting				Underweight				Waisting			
		Severe		Moderate		Severe		Moderate		Severe		Moderate	
		Exp. β	S.E.	Exp. β	S.E.	Exp. β	S.E.	Exp. β	S.E.	Exp. β	S.E.	Exp. β	S.E.
Drinking water source[24]	Open Source Well	1.66	.500	.873	.401	1.47	.508	.850	.394	4.2	1.15	.950	.417
	Public water Supply	.886	.428	.751	.314	1.28	.425	.680	.304	4.23	1.05	1.14	.334
		1	-	1	-	1	-	1	-	1	-	1	-
Total no. of Observation	N = 1268 cases for all the three anothropometric indicators												
Model fitting Information	Log likelihood for Stunting (height-for-age) model (including intercept) = 2147.084, chi-square = 302.749*, degree of freedom=70 Log likelihood for underweight (weight-for-age) model (including intercept) = 2260.893, chi-square=365.632*, degree of freedom =70 Log likelihood for waisting (weight-for-height) model (including intercept) = 1543.771, chi-square =125.591*, degree of freedom =70												

[24] Open Source comprises river, ponds, streams, open well and other open sources.
Well includes public, private, covered well public and private hand pumps. Public water supply includes public and private tap inside or outside the households and tanker supply.

We therefore can conclude that ethnicity (being SC or tribal), regional background (being from south, north or western Orissa), availability of safe drinking water supply toilet facility in the household, mother's BMI (low BMI), birth weight (less than 2.5Kg.), months of breast feeding for the child, mother's education (for uneducated and low educated women), household economic status (for low economic status households) and father's occupation (for those who work in agriculture) are the set of important determinants (though in some cases they lack statistical significance) of child undernutrition in Orissa.

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[i] Here the measurement procedure for child anaemia is same as for their mothers. Blood samples are collected only from children of age group 4-35 months. Children below 4 months of age are not tested for anaemia. The 'hemo-cue' instrument is used for on the spot measuring of the anaemia among the children.
The anaemia here refers to iron deficiency anaemia as in case of maternal anaemia. Degree of anaemia among the children is measured in terms of mild anaemia (10-10.9 g/dl), moderate anaemia (7.0-9.9 g/dl), and severe anaemia (less than 7.0 g/dl).

[ii] All the three anthropometric indicators (indexes) we have used here (i.e. stunting, underweight and waisting) are expressed in standard deviation units (SD) from the median of 'International Reference Population'. Severe stunting, underweight and waisting refers to –3 SD from reference height-for-age, weight-for-age and weight-for-height respectively. Moderate stunting, underweight and waisting refers to –2 SD from reference height-for-age, weight-for-age and weight-for-height respectively.

[iii] In fact the categorisation of all the characteristics for different set of nutritional indicators for both maternal and child anaemia as well as anthropometry are same. So the same categorisation, that we have discussed in detail for some selected characteristics in the endnote of chapter-3, holds good for chapter –5 as well.

[iv] Public facility for delivery refers to institutional delivery i.e. birth given in a government hospital, dispensary, maternal home etc. and attended by trained personnel. Private facility includes delivery given in private clinic, nursing home or privately runned hospitals. Delivery given in other facilities refers to birth given in traditional maternal homes and attended by traditional dais.

CHAPTER VI

SUMMARY AND CONCLUSIONS

Undernutrition is another dimension of under development. It is a mixed outcome of economic backwardness, social disparity and deprivation in income, asset holdings, education, and other capabilities. This also reflects lack of awareness regarding health and nutrition concerns among the wider section of the society. Undernutrition grips the underdeveloped societies around the world which is examined in literature from both micro and macro perspectives. Macro level studies attribute the basic socio-economic disparities to the prevalence of undernutrition among a large section of the society. Here we emphasise on social and economic inequality along with life style factors for different socio-economic groups. At a micro level, one needs to relate to the mechanism behind nutrition absorption at individual level across different age and sex groups. But in social science especially in development literature, there remains greater focus on the macro level indicators. But there are very few studies, which provides both macro and micro perspectives while explaining this phenomenon. Our's is an attempt to blend these two approaches. We include macro level indicators like social and economic factors common to individuals with a group identity and also micro level indicators like age, sex, individual birth weight, disease prevalence, and dietary and care practices for the mother and child. We use both household and individual information available for nutrition analysis in the NFHS-2.

The dissertation titled "Patterns and determinants of undernutrition among women and children in Orissa- Evidence from NFHS-2 (1998-99)" tries to unfold the reasons behind under-nutrition in Orissa. Orissa is a very backward state. It's performance in every human development and economic development indicators are abysmally poor. On nutrition front too, it is the worst achiever in many indicators. Though there are some literature, which attributes poverty, lack of basic amenities, state of demography to explain the state of undernutrition among women and children in Orissa, there remains a gap in terms of explaining nutritional deprivation in the state given it's complex dynamics of poverty and backwardness. The NFHS-2 report provides a brief account of nutrition outcome of women and children and describes the differential in nutrition with regard to some selected characteristics. But this analysis attempts an in-

depth understanding of the prevalence of undernutrition across different groups given their economic, social and regional status.

The objectives of our study are:

1) To study the pattern and determinants of the maternal undernutrition in Orissa.

2) To study the pattern and determinants of the child undernutrition in Orissa.

3) To find out the rural-urban divide in these patterns with respect to it's different correlates.

4) To find out the regional variation in these patterns with respect to it's different correlates.

Keeping these objectives in mind we have tried to understand how different socio-economic and demographic determinants explain the differential nutrition outcome of children and their mothers. This will enable us to understand the nature and extent of undernutrition among women and children in Orissa and to formulate policies and incentives for most vulnerable groups. In summary, we have viewed nutritional insecurity as a prelude to Orissa's backwardness. We have considered two nutritionally vulnerable groups like women and pre-school children for our study. We have adopted an anthropometric and clinical approach to measure the prevalence of undernutrition among women and children of Orissa. The anthropometric indicators are Body Mass Index (BMI) for women and height-for-age (stunting), weight-for-age (under weight) and height-for-weight (waisting) for children. The clinical approach consists of prevalence of anaemia (due to iron deficiency) for both women and children.

Using simple, multivariate cross tabulation and logit models we have explained the pattern and determinants of undernutrition among women and children in Orissa.

The finding shows undernutrition to be much wide spread among women and children across different age, sex, economic, social groups. The study examines the dynamics of the regional background and rural-urban divide contributing to the disparity in nutrition outcomes. Our findings show that the women of age 15-24 (65%) and 40-49 (70%) age group are more vulnerable sections as far as age wise distribution is

concerned. So women at early and later stage of their reproductive life are more vulnerable to undernutrition. This is true for all level of anaemia. But in terms of BMI we found that women in early stage in reproductive life are more vulnerable. Similarly age at first marriage, age at first birth, marital status, number of children and births have inverse relationship with levels of maternal undernutrition. Widowed, divorcee women are found to be more undernourished than currently married women. Over all 63% women are found to be undernourished in terms of anaemia and 48% in terms of BMI. Similarly uneducated women are more likely to be undernourished. Women from rural background, tribal and low economic status, are more vulnerable to both anaemia and low BMI. Women working in agriculture and from poor households experience higher prevalence of anaemia compared to women working in non-agricultural sector and from better economic status households. Having larger family size also adversely affects the maternal nutrition outcome. Availability of quality sanitation and hygiene seems to have significant positive impact on nutrition outcome of the mother even for poor (low economic status) households. Women from such households without these amenities are more vulnerable to both kind of under nourishment: anaemia and low BMI. The dietary practice of the women too has a bearing on their nutritional outcome. Women who do not take protein and vitamin rich food like milk or milk products, vegetables, fruits, eggs and other animal proteins at regular interval are more prone to under nourishment. All these variable are also significantly associated with economic status of their households. Women from tribal and scheduled caste community are found to be most vulnerable compared to other social groups. But women from these groups have also shown variation according to their rural-urban residence, economic status and regional identity.

Tribal women from Western Orissa (Sambalpur, Bolangir and Kalahandi) are more vulnerable to anaemia (82%) compared to women from North Orissa (Mauyrbhanja, Sundargarh and Keonjher); 76%, women from coastal Orissa (Puri, Balasore, Cuttack, Dhenkanal, Ganjam); 72% and least among women from South Orissa (Phulabani and Koraput) 70%. For Low BMI same figure for tribal women stands at 56.6 for women from South Orissa, 56.13 for western Orissa, 54.3 for coastal and 48.19 for women from North Orissa. So in one indicator (anaemia), North Orissa is the most malnourished and in another (BMI) it is least malnourished. However on the whole the prevalence of any kind of anaemia and low BMI is 56% among tribal and

scheduled caste women followed by 47.52% and 38.93% among OBCs and General category. With regard to economic status of the households, we found women from low economic status to be more vulnerable both for anaemia prevalence of any degree and low BMI. But within the low economic status households, tribal women are more vulnerable to low BMI (58%), followed by scheduled caste women (56%), OBC (54%) and general (49%). So the caste identity matters beyond the economic status. In case of Medium and High economic status also the tribal women perform very poorly for anaemia (77% and 50%) and 53% and 25% for BMI. On the other hand for medium and high economic status households the prevalence of anaemia is 62% and 45% and the low BMI is 47% and 10%. On the contrary, in higher economic status category, SC households report lowest BMI among women (10%) compared to women from general castes (19%) and OBC (26%). According to rural-urban residence, women from same social background exhibit difference with regard to anaemia prevalence and low BMI, generally biased against rural women of all social and economic background. Where prevalence of anaemia is 67.5% for urban tribal women, it is 74% among rural tribal women. The prevalence of anaemia for SC women is (57.0%) in urban areas and SC women (67%) in rural areas. Women from general category are well off in both rural and urban areas though rural disadvantage still persists for them.

The bi-variate logit analysis carried out here confirms that age, age at first marriage, household size, total number of births, education, economic status and ethnicity are most significant determinants of anaemia. The multilogit results explaining vulnerability to differential degree of anaemia shows, age, age at first marriage, education, occupation status (for agriculture labour), economic status, ethnicity (for SC and Tribal women) to be significant determinants. Though region and rural-urban background have expected beta greater than unity it is not statistically significant.

On the other hand the child nutrition analysis is based on those children whose mothers are accounted for maternal nutrition. These children are between 4-3 months of age. From our demographic characteristic analysis we found that the mothers who gave birth at latter stage (especially after 30 years), their children are more likely to be stunted, waisted and under weight and anaemic. This is contrary to findings in literature that with the increase in age, mothers giving birth to healthier babies

(Senaur and Thomas; 1990, Ruel; 1999). But on the contrary mothers marrying and attaining maternity before 18 years of age are found to have less under nourished children in terms of moderate and severe stunting, moderate and severely under weight and moderate waisting and anaemia. Large family sizes also influence moderate stunting, moderate and severe underweight, and moderate waisting. The number of children (more than two) has adverse impact on height-for-age, weight-for-age and weight-for-height but not for anaemia or it's degree. Social indicators like parental education have expected impact on all types of indicators like anthropometry and clinical measure of anaemia. Tribal children like their mothers are worst hit by nutrition in all the observed indicators. The availability of basic infrastructures like clean drinking water and toilet are crucial for the stunting, waisting and under weight of all forms, as well as anaemia. Because these services determine the quality of hygiene and sanitation and therefore the quality of care the households provides to it's members especially mothers, which in turn have great relevance for child's health. As expected children from low economic status households are more vulnerable to all kind of undernourishment. But within the low economic status the tribal children have highest prevalence of moderate stunting (33.0%) followed by scheduled caste children (31.0%). For moderately under weight category children from general category and children from SC category are the worst sufferer (37% and 35%). As far as moderate waisting is concerned the tribal children (26%) are worst hit followed by children from OBC category (23.75%) and SC category (21%). For severe stunting, we found that the scheduled caste and OBC children are most vulnerable followed by children from tribal category within low economic status. For severe under weight tribal and SC children are worst sufferers. (30.5 and 26.2%). As far as severe waisting is concerned, OBC children are the most disadvantaged followed by Tribal, General and SC children (6.7%, 6.1% 5.9%, and 2.7% respectively.). For medium economic status category, SC children have more prevalence of severe stunting (22.0%) and OBC children have highest prevalence of severe under weight and severe waisting (24.0%), while for waisting, in middle economic status, tribal children are more vulnerable. For high economic status, we found that tribal children have more prevalence of severe and moderate stunting. For other indicators no children is found from this groups in high economic status. So we conclude that given the economic status, social background contributes largely towards the differential nutrition levels of children.

As far as the regional variation is concerned in northern Orissa prevalence of moderate stunting, moderate under weight and severe waisting among the children are the highest compared to other regions. Western Orissa on the other hand have highest concentration of severe stunting. Southern Orissa also shows highest concentration of moderate waisting among the children.

On count of rural-urban divide, rural disadvantage is uniform across all social and economic categories. While in rural areas children from Scheduled caste population are more vulnerable to severe stunting, in urban areas tribal children are most vulnerable. So this points towards the inadequate basic infrastructure and sanitary facilities in rural areas, which affect the nutrition outcome at household and community level, which needs to be strengthened. People in rural areas also need greater awareness of the benefit of the use of such services.

In case of prevalence of anaemia we found father's education and ethnicity to be important determinants. This might be implying that father's income, which depends upon education, and their social backgrounds are important determinants because these determinants might determine the overall economic status of the household. But the multi-variate logit results on differential degree of anaemia indicate that for mild anaemia; father's education, ethnic background (for tribal), total number of births to the mother, parents occupation (for agriculture), are important determinants. For moderate anaemia father's education, occupation and ethnicity (for SC and tribal) are important determinants. For severe anaemia father's occupation, education ethnicity (for tribal) and economic status of the households are significant determinants. Thus we find for any degree of anaemia father's education, occupation and social background of the households are common determinants. Anaemia compared to BMI is more determined by over all economic status in terms of assets and occupation of the household.

The multi-variate logit regression results show that in case of severe stunting, ethnicity, total childbirth, husband working in agriculture, economic status of the household, body mass index of mother, months of breast feeding are found to be significant determinants. For moderate stunting ethnicity, birth in last three years for more than three, occupation of father, months of breast-feeding are important determinants. For underweight of severe kind, we found that ethnicity, age at first

marriage, father's occupation (for agriculture), and region (for northern region of Orissa), economic status, months of breast-feeding and mother's BMI are significant determinants. For moderate under weight, ethnicity, father working in agriculture, economic status, months of breast-feeding, birth weight and mother's BMI are found to be significant determinants. For severe waisting caste, mothers' occupation (in agriculture), region (for North Orissa), months of breast-feeding are important. For moderate waisting father's occupation (for agriculture), region (for south and western Orissa) duration of breast-feeding are significant determinants. The region plays an important role since the districts in north, south and western Orissa are tribal and SC dominated, Poverty is very high, economic infrastructure is very low, which contributes to acute undernutrition measured in terms of waisting. Thus this study concludes that tribal and SC women and children especially from lower economic strata are most vulnerable groups as far as maternal and child undernutrition is concerned. The tribal and SC dominated regions also show concentration of undernourished mothers and children. In rural set-up tribal and in urban set up SC is the most vulnerable for maternal and child nutrition. Children and mother who belong to households engaged in agricultural occupation seem to have a disadvantage in nutrition.

On the whole, anthropometric indicators for children are more responsive to a set of explanatory factors compared with anaemia. This is mostly because anaemia is a short run measure of nutrition as against anthropometric indicators, which reflect long term effects. They are able to capture the past nutrition status and life style of the children better than the anaemia, since it is measured from height and weight of the children, which were not sensitive to very short-term variations. As far as intervention is concerned, mother's education, information about better child care practices like breast feeding and vaccination, taking balanced nutrient diets are few of the short term measures. But in long run the income generation among weaker sections, especially in hands of women, building infrastructure for better sanitation and water supply, schemes of nutrition security for women and children might be considered as long term intervention.

Limitations

The limitations of this study are the following;

1) It only talks about undernutrition among women and children of the selected household, but not for other groups like adolescent boys and girls, the male members of the household and more importantly about old members of the household.

2) It is a cross section study and has limitations in capturing the time trend variations in nutritional status of the women and children. But BMI and other anthropometric indicators reflect past nutrition status as well and they do not change in short run like anaemia.

3) It only brings out the significant determinants from a set of possible correlates of maternal and child undernutrition. But it can not assert a singular feature that increases the vulnerability for under-nutrition.

4) The present dissertation is also unable to explore the differential dynamics of influence of the said determinants in different regions and rural-urban scene independently.

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