CHAPTER I
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1.1 Introduction

Nutrition is an input to and foundation for health and development and is defined as the science of food and its relationship to health (WHO, 2000). Nutrition is concerned with primarily the part played by nutrients in body growth, development and maintenance (WHO, 1971). Nutrition directly improves health of children and cognitive abilities and better learning capacities. Better nutrition is a prime entry point to ending poverty and a milestone to achieving better health quality of life (WHO, 1988). “UNICEF view nutrition as a basic human right, articulated in numerous human rights instruments from the convention on the Rights of the Child to the Universal Declaration of Human Rights”. The associations of nutrition with infection, immunity, fertility, maternal and child health and family health have engaged scientific attention, in recent times.

Children are considered one of the groups at greatest nutritional risk. Undernutrition affects the rate of morbidity and mortality among children and also poses significant impediment to their physical and mental development. The children are less able to cope physiologically with nutritional deficiencies than adults (Senauer and Gracia, 1991). Growth retardation, which may reflect dietary inadequacy, occurs in preschool children from low-income families at up to three times the rate as in their non-poor peers. Anemia, caused by iron deficiency is twice as common in poor children between ages 1 and 2 than it is in the general population (Parker, 1989). The consequences of malnutrition in
infancy and childhood in terms of mortality and morbidity are well established (Allen et al., 2001).

An issue that has engaged researchers and development planners in recent years is that nutrition is the cornerstone of socio-economic development and that nutritional problems are not just medical problems but is “multifactorial” with roots in many other sectors of development such as education, demography, agriculture and rural development (Park, 2002). Nutrition “is something that can drive economic growth, because children who are well nourished have been shown to have much higher income potential as adults” (UNICEF, 2007). If children suffer from malnutrition they are more likely to catch the disease, and it can affect the functions of their body such as brain, eye sight, organs, height, and weight as well as the formation of body parts if the child is still in their mother’s womb (UNICEF, 2007).

Currently the world’s most serious health related problem is malnutrition. More children die from poor nutrition than for any infectious disease. When large numbers of children suffer from malnutrition, their entire populations suffer. Poverty causes malnutrition and malnutrition, in turn, causes poverty (World Bank, 2006). Undernutrition in children is the consequences of a range of factors which are often related to insufficient food intake, poor food quality, lack of knowledge about feeding practices and severe and repeated infectious diseases. The inadequacy is measured relative to the food and nutrients needed to maintain good health, provide for growth and allow a level of physical activity (National Nutrition Policy, Government of India, 1993). Malnutrition affects all age groups, but particularly children and is especially common among the poor and those with inadequate access to health, education, water and good sanitation.
The 55th World Health Assembly (2002) adopted a Global Strategy on Infant and Young Child Nutrition recognizing the importance of nutrition of women throughout their life cycle for ensuring optimum nutrition of the child. The inter-generational cycle of malnutrition perpetuated by the poor nutritional status of the girl child was also recognized. Inadequate weight gain during pregnancy can increase the risk of having a low birth weight (under 5.5 pounds) baby. Low birth weight infants are more likely than other infants to have hearing, vision, or learning problems and to require special education services. Recent evidence indicates that 15% of very low birth weight (less than 3.5 pounds) children and nearly 5% of low birth weight children require special education, compared to 4.3% of children born at normal birth weight (Newman, 1991).

Anaemia is one of the most prevalent nutritional problems of children in India. Anaemia in infancy may cause a permanent loss of IQ later in life. Iron deficiency and anemia lead to shortened attention span, irritability, fatigue and difficulty with concentration. Consequently, anemic children tend to do poorly on vocabulary, reading and other tests (Parker, 1989). Children who are hungry or undernourished also have more difficulty fighting infection. Therefore, they are more likely to become sick, miss school, and fall behind in class. Malnourished children suffer from impaired immunity, which increases the likelihood of infection, disease and health. Disease, in turn, can cause poor nutrient absorption, altered metabolism and lack of appetite, leading to inadequate nutritional intake. In 56 per cent of all child deaths in developing countries, undernutrition is a contributing factor; 83 per cent of these deaths are associated with mild or moderate rather than severe malnutrition (Pelletier and Frongillo, 2003). Eliminating malnutrition
would remove a-third of the global burden of disease and increase child survival (Mason, 2003).

The cost of malnutrition is high, both for individuals and nations. Malnutrition implies high budget outlays for health services and lost gross domestic product (GDP) as a result of diminished productive potential. Low and middle income countries (LMICs) lose an average of 0.6 percent of GDP to iron deficiency in adults. Including iron-deficiency induced damage to children’s cognitive and motor development brings the economic loss to 4 per cent of GDP (Horton and Ross, 2003). Early childhood stunting is closely associated with poor cognitive and educational performance in children (Gregor et al., 2007). Low birth weight has been shown to reduce IQ scores by 5 points; stunting reduces IQ by 5 to 11 points and iodine deficiency reduces IQ by 10 to 15 points (Alderman et al., 2005). While the human and societal costs of malnutrition are large, the costs of addressing the problem proactively are small, and the benefits are dramatic. Beyond reducing mortality, decreased malnutrition can lead to higher school completion rates, better learning outcomes and in turn high wages. The World Bank estimates that reducing the prevailing micronutrient deficiencies would increase GDP by at least $ 2.5 billion per year in India (World Bank, 2006).

One of the millennium development goals (MDGs), agreed upon by countries of the world is to reduce the proportion of underweight children by half by the year 2015. India has the highest proportion of undernourished children in the world along with Nepal, Ethiopia and Bangladesh (Dreze, 2006). This is despite official claims that the well-being of children has been a priority and an integral part of the country’s development planning since 1951 (Planning Commission, 2002b). A recent study of malnourished children in
India by Gragnolati et al. (2006) suggested that without a major shakeup in policy and an improvement in the effectiveness of its implementation, the attainment of the MDGs in this regard by India looks extremely unlikely. Mere economic development or even the adequacies of food at household levels are no guarantees for a stable and satisfactory nutritional status. Malnutrition is not just a medical problem, but it stems from social-discrimination and inequality (Strauss and Thomas, 1998).

1.2 Intervention programmes to combat undernutrition among children

I. Integrated Child Development Services (ICDS): The government of India is making concerted efforts to reduce the prevalence of malnutrition in the country. In consonance with this, the scheme of Integrated Child Development Services (ICDS) was launched in 1975. This programme is implemented by the Nodal Department i.e. the Department of Women and Child Development. Starting with 33 experimental projects in 1975-76, the ICDS programme has been expanded tremendously over its 30 years of operation to cover almost all development blocks in India. The packages of services provided to the beneficiaries of the programme are supplementary nutrition, Immunization, Health check-up, Referral services, Non-formal pre-school education and Nutrition and Health Education. Supplementary nutrition is one of the major components of the programmes.

The strategy adopted in ICDS is one of the integrated deliveries of early childhood services so that their synergistic effect will fulfill the objective of the programme. The beneficiaries of the programme are children below 6 years, pregnant and lactating mothers and women in the age-group 15-44 years. This programme supplements the
health, nutrition and family welfare activities with appropriate cooperation and coordination between functionaries of the Health Department and nodal department.

**II. Special Nutrition Programme (SNP):** The Special Nutrition Programme (SNP) was launched in the country in 1970-71. It provides supplementary feeding to the extent of about 300 calories and 10 gm. of proteins to pre-school children and about 500 calories and 20 gm. of protein to expectant and nursing mothers for 300 days a year. At present SNP is operated, as a part of the Minimum Needs Programme in various states. The nutrition component of the ICDS programme is funded by States and Union Territories from the SNP budget. At present about 21.5 million beneficiaries are covered under this programme.

**III. Balwadi Nutrition Programme (BNP):** The Balwadi Nutrition Programme (BNP) is being implemented since 1970-71 through five national voluntary organizations. The central grant is given for supplementary feeding of children. It consists of 300 calories and 10 gm. of protein per child per day for 270 days a year. During 1991-92, about 0.23 million children in the age-group 3-5 years in 5640 balwadis were covered by the scheme.

**IV. Wheat Based Supplementary Nutrition Programme (WNP):** A centrally sponsored scheme called Wheat-based Supplementary Nutrition Programme (WNP) was introduced in 1986. This programme follows the norms of SNP or of the nutrition component of the ICDS. Central assistance for the programme consists of supply of free wheat and supportive costs for other ingredients, cooking, transport etc. At present
around 3 million children and expectant and nursing mothers are covered under this programme. This scheme is now being transferred to the state sector.

V. Tamil Nadu Integrated Nutrition Programme (TINP): Tamil Nadu Integrated Nutrition Programme (TINP) is being implemented in the state of Tamil Nadu since 1981. At present the scheme covers 316 blocks in Tamil Nadu. Under this project nutritional surveillance and supplementary nutrition is being provided to children below six years and expectant and nursing mothers. The project is assisted by World Bank. The total outlay for the project is Rs. 321 crores.

VI. Mid-Day Meal Programme (MDMP): In 1956 the erstwhile Madras State launched the mid-day meal programme of providing free meal to the elementary school children with a view to (a) enrolling poor children who generally remain outside the school due to poverty; and (b) giving one meal to the children attending the school. The MDM operated as a centrally sponsored scheme from 1962-63 in all the states. The objectives were (a) to improve nutritional status of the school children; and (b) to attract children to enroll themselves into school and encourage regular attendance by providing supplementary nutrition.

The other programmes for combating specific nutritional Deficiency Diseases such as Nutritional Anaemia Prophylaxis Programme, Goitre Control Programme and Programme for Prevention of Nutritional Blindness due to Vitamin A deficiency.
1.3 Nutritional problems among children

According to NFHS-3 (2005-06), 46 percent of children below three years of age were underweight, 38 percent were stunted, and 19 percent were wasted. The corresponding level of child malnutrition are much lower in sub-Saharan Africa where 28 percent of children below five years are underweight, 37 percent are stunted, and 9 percent are wasted (Griffiths et al., 2002). The NFHS-3 data also reveals that, in general, undernourishment is higher among lowest wealth quintile, uneducated and rural children than their other counterparts. For instance, in 2005-06, the proportion of underweight children in urban areas was 36 percent as against 49 percent in rural areas. Similarly, levels of stunting and wasting are higher in rural than in urban areas. The magnitude of differences (rural-urban) in the proportion of underweight children is 13 percent at the national level.

Anaemia is a widely existing health problem in India and also a nutritional status indicator for the children. Anaemia levels for children 6-59 months are very high. According to NFHS-3 (2005-06), 70 percent of these children are anaemic, including 26 percent who are mildly anaemic (10.0-10.9 g/dl), 40 percent who are moderately anaemic (7.0-9.9 g/dl) and 3 percent who are severely anaemic (less than 7.0 g/dl). There are substantial differentials in the prevalence of anaemia by socioeconomic characteristics of women and households.

The levels of undernourishment vary widely across Indian states. According to NFHS-3 (2005-06), the proportion of underweight children varies, for instance, from less than 30 percent in Punjab, Kerala, and Jammu & Kashmir to over 47 percent in Uttar Pradesh,
Gujarat, Chhattisgarh, Bihar, Jharkhand and Madhya Pradesh. Virtually half of the children are underweight in these states. The proportion of stunted children is the lowest in Kerala (24 percent), Tamil Nadu (30 percent) and Himachal Pradesh (38.6 percent) and the highest in Uttar Pradesh and Bihar (56 percent). The extent of wasting among children is the least in Punjab (9 percent), Andhra Pradesh and Assam (both 13 percent) and highest in Uttar Pradesh and Bihar (38 percent), Jharkhand (32 percent) and Madhya Pradesh (35 percent). Proportions of underweight children are consistently higher in rural than in urban areas across all Indian states.

The progress of India in reducing undernourishment among children over the past seven years – between 1998-99 (corresponding to NFHS-2) and 2005-06 (corresponding to NFHS-3) – has been poor. The NFHS-2 and NFHS-3 data show that between 1998-99 and 2005-06 (i) the proportion of stunted children below three years has come down from 46 per cent to 38 per cent – an insignificant improvement of 8 per cent points over seven years; (ii) the proportion of wasted children below three years has gone up from 16 per cent to 19 per cent, and (iii) the proportion of children underweight has come down from 47 per cent to 46 per cent – a 1 per cent point decline over seven years (as against a 5 per cent point improvement between 1992-93 and 1998-99). There is also a practically no change in the rural-urban differentials over the last seven years in the proportion of stunting, wasting and underweight children.

Over the past seven years (from 1998-99 to 2005-06), the proportion of stunted children has come down in all states except Karnataka. The proportion of wasted children has come down in four states (Maharashtra, Orissa, Chhattisgarh and Karnataka) and increased in the remaining 16 states. Finally, child malnutrition as measured by the
The proportion of underweight children has worsened in seven states – Gujarat, Kerala, Bihar, Jharkhand, Assam, Madhya Pradesh and Haryana.

Anaemia is a major health problem in Uttar Pradesh, especially among children. Anaemia can result in weakness, diminished physical and mental capacity, and increased morbidity from infectious diseases, perinatal mortality, impaired cognitive performance, motor development and scholastic development. Among children between the ages of 6 and 59 months, a great majority, 74 percent, is anaemic that is above from the national level (69 percent).

1.4 Review of literature

Several recent studies have considered the relationship between socio-economic characteristics and child nutritional status measured most commonly by anthropometrical indicators. Som et al. (2006) found that children from households with better economic conditions have better nutritional status. Also the different ethnic groups show variation with respect to nutritional status. Mishra et al. (1999) found that the demographic and socio-economic factors like child’s age, child’s birth order, mother’s education, household standard of living are strong predictors of child malnutrition in India.

Sommerfelt and Stewart (1994) have found that undernutrition is higher among children born to mothers at age below 18 and at age after 34, among children of higher birth orders (often order 4 and above) and among children born with a short birth interval of less than 24 months, than their counterparts.
Among the household characteristics, the living conditions emerge as the important determining factor of nutritional status of children. Brennan et al. (2003) observed that, a lower prevalence of underweight and stunting was associated with household standard of living and higher level of mother’s education. There was a positive association between the length of breastfeeding and malnutrition indicators. The prevalence of underweight and severe underweight was much more sensitive to mother’s BMI than were the prevalence of stunting and severe stunting. Overall this study confirms that infant feeding practices and demographic and socio-economic characteristics are important predictors of malnutrition. The predictors of wasting perform more poorly than predictors of stunting and underweight.

The relationship between prolonged breastfeeding and nutritional status of young children has been subject to debate for last 10 years. Many studies show that breastfed children have a lower nutritional status than do fully weaned children. A study of 19 national Demographic and Health Survey (DHS) showed that breastfed children aged 9-36 months were shorter and lighter than weaned children (Caulifield et al., 1996). It is also found in many studies that longer duration of breastfeeding and initiation of supplementary feeding at age 4-6 months of the child help improve its nutritional status (Vijayasree and Satayavani, 1992; Punhani and Mahajan, 1989). Achraya et al. (2004) have found that children weaned completely (and do not breastfeed at all) tend to be underweight or stunted than children who were partially weaning (i.e., also breastfeeding). Children who were not weaning at all were worse in respect to growth. The diet of the child plays a very important role, for three of the four growth indicators.
In India, male children are valued higher than female children, and there are evidences of discrimination in respect of food and health care. As a result, the prevalence of undernutrition is often found higher among girls than among boys (Gupta, 1986; Geetha and Swaminathan, 1996; Gopalan, 1995). According to Rajaretnam et al., (2000) there are sex differentials in nutritional status of children, female children are at a disadvantageous position compared with male children. Mishra et al., (2004) in their study observed that in the case of childhood feeding in India, there is discrimination against girls in breastfeeding. Regarding measure nutritional status, they found clear gender discrimination for stunting and underweight but not for wasting and anaemia. However, there are also evidences that the differences are not well marked (Arokiasamy, 1992). Indeed, the relationship between malnutrition and gender is more complex and is linked to mother’s socio-economic status (Osmani and Sen, 2003).

Most of the studies in developing countries have focused on diarrhoeal diseases and respiratory infections, the two most important causes of morbidity. A number of studies conducted in different parts of India and elsewhere reveal that infectious diseases, in particular diarrhoeal diseases, are the important causes of malnutrition among children (Punhani and Mahajan, 1989; Martorell and Ho, 1984; Sommerfelt and Stewart, 1994). It is found in many studies that women with better education have lower infectious diseases to children than their counterparts (Ramachandran, 1989; Punhani and Mahajan, 1989; Xu et al., 1995).

Rao et al. (2004) observed children born at shorter intervals, has lower z-scores of weight-for-age. The study also confirmed that the nutritional status of anaemic children were poor. Children who suffer from diarrhea, fever and cough in the two week
preceding the survey were also likely to have a poor nutritional status. It was found from this analysis that children who were breastfed the prescribed optimum duration of 4-6 months were nutritionally better off than those children those children who were breastfed even beyond their first birthday. The nutritional status of children born to mother whose Body Mass Index (BMI) was below the critical value of 18.5 kg/m² were significantly poor. This study also confirmed that father’s education seems to have little impact on the nutritional status of children as compared to mother’s education background.

Many studies have shown that severely malnourished children are at a greater risk of dying than healthy children. Malnutrition is not only a cause but also a sensitive indicator of infant and child mortality. According to Subbulaxmi et al. (1990) 20 to 75 percent of child deaths can be attributed directly to malnutrition in the less developing countries. If not death, they are suffered from various childhood morbidities. Mosely and Chen (1984) have stated that since growth faltering indicates the current health status of a population, a health status index based on grade of malnutrition can serve as a measure of the relative risk of various subgroups of the population to mortality in the future. Kielmann et al. (1982) concluded that while nutrition intervention seems to have its clear and most effect on child mortality, the prevalence of malnutrition as a precursor to child mortality is similarly affected.

1.5 Need for the study

The prevalence of child undernutrition in India is among the highest in the world; nearly double that of sub-Saharan Africa, with dire consequences for morbidity, mortality,
productivity and economic growth. Moreover, inequalities in undernutrition between demographic, socio-economic and geographic groups have persistently high and increased during the last decade (World Bank, 2005). Malnutrition in general and undernutrition and anaemia in particular remain major health problems in India (Rajaretnam et al., 2000).

The global community has designated halving the prevalence of undernourished children by 2015 as a key indicator of progress towards the Millennium Development Goal (MDG) of eradicating extreme poverty and hunger. Poverty and undernutrition are intrinsically linked. Productivity losses, poor cognitive development and increased health care costs in undernourished populations lead to significant economic losses at both the individual and national level (Levinson and Basset, 2007). The cost of malnutrition to India’s Gross Domestic Product was estimated to be at least US $ 10 billion (Measham et al., 1999).

High prevalence of undernutrition and anaemia among children in India is a persistent problem. This is due, in part, to poor eating habits, lack of balanced nutrition, faulty feeding habits. The rise in poor nutrition among Indian children is also due in major parts to insufficient nutritional intake. Strong evidence exists that nutrition related disorders are greater among low-income households than among the rest of the population.

Uttar Pradesh is the most populous state of India with a population of 166 million (Census of India, 2001), which is 16 percent of the total population of the country. The state lags behind in demographic and health indicators as compared to all major states. The TFR, 2005 for the state was 4.2 as compared 2.9 for the country (SRS, 2005), at the
same time the CDR for the state was 8.7 corresponding to 7.6 at national level. While the IMR, 2005 for the state was 73 as compared to 58 at the national level (SRS, 2005). On the other hand, the state of Uttar Pradesh has 33 percent of the population living below the poverty line as compared 28 for the country (Planning Commission, 2007). Moreover, 42 percent of the rural population lives below the poverty line. With an infant mortality rate of 83 per 1000 live births. Uttar Pradesh is worse off than the average low-income country and India’s lowest rank state in terms of human development (Peters et al., 2005).

The nutritional problems among children in Uttar Pradesh, with one of the highest levels of stunting, wasting, underweight and anaemia, therefore, it is critical to study in details, the extent of nutritional problems in Uttar Pradesh, inequalities by socio-economic, rural-urban and linkage with child health and mortality.

Keeping in view the above review of the nutritional situation the broad objectives of this study are:

**Objectives**

1. To assess the levels, trends and differentials in nutritional status of children (stunting, wasting, underweight and anaemia)
2. To study the linkages of child feeding practices on nutritional status of children
3. To examine sex differentials in childhood feeding, health care and nutritional status of children
4. To examine the linkages between nutritional status of children, childhood morbidities and treatment seeking behaviour
5. To study sibling and family level clustering effects on nutritional status of children

6. To study the impact of nutritional status of child and mother vis-à-vis socio-economic and demographic factors on child survival

**Research hypotheses**

1) Early initiation of breastfeeding has positive impact on the nutritional status of children

2) Girls are discriminated in feeding practices and health care

3) Childhood morbidities are more prevalent among malnourished children

4) Significant family and sibling level clustering exists in terms of nutritional status of children

5) Child and mother nutritional status are positively associated with child survival

**1.6 Organization of thesis**

The thesis is organized in nine chapters.

**Chapter I Introduction** includes an introduction, a brief review of literature, need for the study, objectives of the study and research hypotheses.

**Chapter II Data and Methodology** provides a description of data and methods used to accomplish the objectives of the study.

**Chapter III Levels, Trends and Differentials in Nutritional Status of Children** comprised of two sections. In the first section, levels, trends and differentials in
nutritional status of children under 3 years of age have been examined for Uttar Pradesh using NFHS-1, NFHS-2 and NFHS-3. For the trend analysis, nutritional status of children has been measured in terms of anthropometric indicators (stunting, wasting and underweight) as well as anaemia. In the second section, the roles of various bio-demographic, socio-economic, health care and environmental factors on the nutritional status of children have been investigated through multilevel analysis of child, mother and household level factors affecting nutritional status of children.

**Chapter IV Child Feeding Practices and Nutrition Status of Children** is an effort to assess the effects of child feeding practices on the nutritional status of children aged 0-59 months. The core purpose of this chapter is to assess the linkages between proper child feeding practices as recommended by the WHO and nutritional status of children, which is measured by three anthropometric indicators (stunting, underweight and wasting), as well as anaemia.

**Chapter V Gender Discrimination in Nutrition among Children** examines the gender bias in childhood feeding practices, health care and nutritional status of children under age 5 by birth order and sex composition of older living siblings.

**Chapter VI Linkages between Nutritional Status of Children, Childhood Morbidities and Treatment Seeking Behaviour** investigates the relationship between child nutritional status and childhood morbidities as well as factors that influence childhood morbidity and health-seeking behaviour. More specifically, This chapter traces the importance of child nutritional status in determining childhood morbidities outcomes by keeping socio-
economic and demographic variables as control variables and proceeds to explore the identification of variables influencing health seeking behaviour.

**Chapter VII Sibling and Family Level Clustering of Child Nutrition** examine the sibling and family level clustering effect on nutritional status of children. Individual clustering is the undernutrition of a sibling is related to undernutrition of another sibling, while family level clustering is the concentration of multiple undernourished children among a small fraction of mothers in families. The case of connected sibling undernutrition may also originate due to genetic frailty of mothers passed to the children. Binary logistic and binomial models have been adopted to examine clustering with various bio-demographic, socio-economic and health care variables as covariates in the models.

**Chapter VIII Impact of Child and Mother Nutritional Status on Child Survival** attempts to present an assessment of impact of child and mother nutritional status on child survival that is measured in terms of infant and under five deaths. The effects of infant and mother nutrition, socio-economic, bio-demographic and health care utilization on child survival have been investigated in a multidisciplinary framework. Though literature suggests that nutrition plays a very important role in child survival, a confirmatory in-depth analysis has been carried out in this chapter.

**Chapter IX Summary and Conclusion** incorporated summary of findings, discussion and conclusion, and limitations of the study.