PREVALENCE OF CHILD MALNUTRITION IN RAJASTHAN: EVIDENCE FROM NFHS-3 (2005-06)

Dissertation submitted to Jawaharlal Nehru University
in partial fulfillment of the requirements
for award of the degree of

MASTER OF PHILOSOPHY

SUNIL KUMAR JHAJHARIA

Centre for the Study of Regional Development
School of Social Sciences
Jawaharlal Nehru University
New Delhi-India
2010

जवाहरलाल नेहरू विश्वविद्यालय
JAWAHARLAL NEHRU UNIVERSITY
Centre for the Study of Regional Development
School of Social Sciences
New Delhi-110067

28th July 2010

Certificate

I, Sunil Kumar Jhajharia, certify that the dissertation entitled **"Prevalence of Child Malnutrition in Rajasthan: Evidence from NFHS-3"** for the degree of Master of Philosophy is my bonafide work and may be placed before the examiners for evaluation.

(Sunil Kumar Jhajharia)

Forwarded by

Prof.
(Chairperson)
Chairperson
Centre for the Study of Reg. Dev.
School of Social Sciences
Jawaharlal Nehru University
New Delhi-110067

July 29, 2010
Prof. Murli Dhar Vemuri
(Supervisor)
Centre for the Study of Reg. Dev.
School of Social Sciences
Jawaharlal Nehru University
New Delhi-110067

Tel.: 26704463, Gram : JAYENU Fax : 91-11-26742586, 26741504

ACKNOWLEDGEMENT

First of all, I would like to thank God, for giving me the strength and health to do this thesis. I am indebted to God and my parents by whose kindness, mercy, I have been able to complete another chapter of my life.

Words cannot explicate the feeling of gratitude and indebtedness that I wish to evince of my esteemed supervisor, Professor, ***Murali Dhar Vemuri****, Centre for the Study of Regional Development (CSRD), School of Social Sciences, Jawaharlal Nehru University, New Delhi for his intellectual guidance, unceasing encouragement, ever willing help, creative suggestions and parental attitude throughout the period of my study, research and preparation of this manuscript. I feel proud to be associated with him. I am greatly indebted to the faculty members of the CSRD, for going through the manuscript and making valuable solutions.*

It is a great pleasure to express my deep sense of gratitude of Mr. Vergese K., for teaching of statistical programme for handling the data, in each and every step of the study. I also want to thank Mr. Mahesh Kumar Sharma for his support and help regarding the preparing this manuscript and all official work.

I would like to thank all my friends Abhishek Khandal, Manish Arya, Aditya Ruhela, Elizabeth Ike, Bunty, Dhaka, Ruchika Singh, Deepika, Debashrita, Sanjeev Chahar, ChhaviRaj, Kuldeep Singh, Chandraveer Bika, Raj Kumar Meena, Rakesh Chahar, Vikram Maan, and all Chittorians, for their constant support, help and encouragement.

Last but not the least, I would like to thank my parents, sisters, and brother whose blessings and inspiration have brought me up to this stage of my career. I really feel that without their love, consistent encouragement, motivation, countless blessing, everlasting desire and untiring struggle, I would have never completed my degree. Lastly, I offer my regards and blessings to all of those who supported me in any respect during the completion of the project.

Date: July, 2010

Place: New Delhi **Sunil Kumar Jhajharia**

CONTENTS

List of Tables & Figures

CHAPTER 1

Introduction

Malnutrition is defined as a pathological state resulting from relative or absolute deficiency of one or more essential nutrients. It is primary when there is deficiency of food available or secondary when food is available but the body cannot assimilate it for one or other reason.

Health of an individual is defined as "a state of complete physical, mental and social well being that enables an individual to be productive, free from disease and thus able to access opportunities available in the environment" (WHO 1946). Nutrition refers to the availability of energy and nutrients to the body's cells in relation to the body's requirement. Thus nutrition has major effects on health. Malnutrition refers to any imbalance in satisfying nutrition requirements either in terms of quality or quantity or both. Such a state retards physical growth and also affects mental and intellectual development (Mishra et al., 1999).

Adequate nutrition is critical to child development. The period from birth to two years of age is important for optimal growth, health, and development. At this age, children are particularly vulnerable to growth retardation, micronutrient deficiencies, and common childhood illnesses such as diarrhoea and acute respiratory infections (ARI). Child malnutrition significantly increases the risk of infant and child death, some estimates suggests that child malnutrition is responsible for half of more of child deaths in the developing world. The relationship between undernutrition and risk of child mortality has been well demonstrated (Pelletier et al. 1993). With worsening nutritional status, the risk of death increases logarithmically. Malnutrition is responsible as underlying factor for 55 percent of deaths in children under 5 years of age (Nelson textbook of Paediatrics, 16th Ed. Saunders, 2001). The WHO estimates that approximately 50 percent of childhood deaths from infectious diseases in developing countries could be due to malnutrition because of additional risk that this deficit imparts. Malnutrition is one of the prime causes of morbidity and mortality among young children (Rajaratnam 2000). According to Pelletier et al., (1995), malnutrition is associated with more than half of all child deaths

worldwide. The UNICEF report (2004) says that malnutrition is a contributing factor for death in over half of under five year of age children in the developing world. Malnutrition predisposes children to infection and impairs body's defence mechanism and thus severely malnourished children are at a greater risk of dying than healthy children (Rajaratnam and Hallad 2000). According to the United Nations panel report (1971), "in the developing world malnutrition is an important cause of infant and young children mortality, stunted physical growth, low work output, premature ageing and reduced life span". Malnutrition is thus a primary obstacle to the development process. (Mason et al., 1999).

The assessment of growth not only serves as a means of evaluating the health and nutritional status of children but also provide an excellent measurement of the inequalities in human development faced by populations. Children who suffer from growth retardation as a result of poor diets and/or recurrent infections tend to have increased number of severe diarrhoea episodes and a heightened susceptibility to certain infectious diseases, e.g. malaria, meningitis and pneumonia (Tomkins A., 2000). There is an association between increased severity of anthropometric deficits and mortality, and a substantial contribution is made by all degrees of malnutrition to child mortality. Strong evidences exists that poor growth is associated with delayed mental development and that there is a relationship between impaired growth status and both poor school performance and reduced intellectual achievement. Growth retardation in early childhood is also associated with significant functional impairment in adult life and reduced work capacity, thus affecting economic productivity. (Pollitt E et al, 1993).

There is growing international awareness of the importance of early-childhood nutrition to development outcomes. Strong evidences shows that nutritional failure during pregnancy and in the first two years of life leads, ineluctably, to lower human capital endowments, negatively affecting physical strength and cognitive ability in adults. This feeds directly into the reduced earnings potential of individuals and damages national economic growth and competitiveness potential. Faced with this evidence, no country which seeks to be prosperous in the 21st century can afford to neglect the nutritional condition of its children. Freedom from hunger and malnutrition was declared a basic

child and human right in the Geneva declaration of the rights of the child (1924) and in the universal declaration of human rights (1948) respectively. According to the article 47 of the Indian constitution, "the state shall regard the raising the levels of nutrition, standards of living and the improvements of public as among its primary duties". The goal of attaining health at its best is indeed a desirable milestone for an individual as well as the nation. This milestone is achieved when individuals who enjoy a full, rich and wholesome life must have an adequate amount of wholesome food.

1.1 Causes of Malnutrition

The most important factors associated with lower prevalence of stunting are the availability of high energy, female literacy and gross national product. (Frongillo E A, 1997). The causes of child malnutrition are complex and multidimensional, ranging from factors as fundamental as political instability and slow economic growth to highly specific ones such as infectious diseases. Stunting is a cumulative process that starts in uterus, and there is substantial evidence that intrauterine growth is a strong predictor of postnatal growth. An important correlate of child nutritional status is nutrient intake, which in turn depends on the nature and duration of feeding (including breastfeeding) practices. Feeding practise is especially critical during the first few days and months of an infant's life, since growth is faster and protection against illnesses and infections is most needed during this crucial period. Ideally a baby should be put to the mother's breast immediately after birth. However, NFHS-3 data indicate that nearly one-half of Indian babies have to wait to be breastfeed for more than a day after they are born. The delay in breastfeeding is often related to an incorrect perception that the first breast milk (colostrums) is an inferior food, when in fact colostrums are rich in antibodies and highly beneficial to new-born infant. Also early termination of exclusive breast-feeding and introduction of supplementary feeding has an adverse implication on status of child malnutrition. Premature introduction of food other than breast milk greatly increases the risk of infection in the small infant, and this sets in motion the process of malnutrition. (Frongillo EA, 1997)

Malnutrition is widely prevalent among socially and economically deprived population groups around the world is associated with a cluster of related factors, which together may be termed as the 'poverty syndrome'. The major attributes are:

1) Poor income levels inadequate to meet basic needs of food, clothing and shelter.
2) Diets that is quantitatively and often qualitatively deficient.
3) Poor environment, poor access to safe water and poor sanitation.
4) Poor access to healthcare, and
5) Large family size and high levels of illiteracy, especially female illiteracy (Gopalan 1989, p.70).

According to Sommerfelt and Stewart (1994), a number of factors affect child nutrition, either directly or indirectly. The most commonly cited factors are availability of food and dietary intake, breastfeeding, prevalence of infections and parasitic diseases, access to healthcare, immunisation against major childhood diseases, vitamin A supplementation, maternal care during pregnancy, water supply and sanitation, socio-economic status and health seeking behaviour. Besides, demographic characteristics such as the child's age and sex, birth intervals (both preceding and following) and mother's age at child birth are also associated with child nutrition.

According to the United Nations Children's Fund (UNICEF 1998), the conceptual framework for the causes of child malnutrition, death and disability lays out three causes of child malnutrition: the immediate, underlying and basic. The two immediate causes of child malnutrition, death and disability are inadequate dietary intake and disease. Children can become malnourished either because they do not eat sufficient food of the appropriate form or quality or because they are sick. Illness depresses a child's appetite and inhibits the absorption of nutrients. It also diverts nutrients away from contributing to a child's growth and towards fighting the illness. The underlying causes of malnutrition which manifest themselves at the household level are food insecurity, inadequate maternal and child care practices and poor health environment and services. Finally, basic causes of child malnutrition manifest themselves at the societal level. They are the

potential and actual resources available-environmental, technological and human-and how they are controlled.

Several other studies conducted by Lutter et al., (1989) shows that proper treatment of acute infectious diseases, especially diarrhoea, has beneficial effects of children's growth and nutritional status Brown et al., (1982) and are repeated episodes of infectious diseases adversely affect children's nutritional status and child survival. Studies conducted by Mertens et al., (1990) found that the presence of clean water supply and sanitary facilities have beneficial effects on child growth and nutrition.

The correlation between dietary inadequacy and the degree of severity of malnutrition depends upon infections and infections and parasitic diseases, infant feeding and child rearing practices and the time lag between dietary deprivation and onset of clinical malnutrition (Gopalan 1984). Indian children in poor rural communities not only suffer from calorie deficiency but from other nutrient deficiencies like moderate and severe iron deficiency anaemia, vitamin A deficiency and iodine deficiency goitre (Gopalan 1984). According to Ali (1992), the most glaring nutritional disorders in India are protein energy malnutrition and iron, iodine, vitamin A and vitamin B deficiencies.

1.2 Scenario of malnutrition

Malnutrition has long been recognised as a consequence of poverty and is more prevalent in the developing regions of the world. However, malnutrition shows substantial differences even across the developing reasons. South Asia with 86 million malnourished children has the highest number. Sub-Saharan Africa has the second highest rate. East-Asia and the near East and North Africa follow. Latin America and the Caribbean have the lowest rate and number of malnourished children (Smith and Haddad 2000). According to the most recent estimate that Hunger Notes could find, malnutrition, as measured by stunting, affects 32.5 percent of children in developing countries--one of three (de Onis 2000). Geographically, more than 70 percent of malnourished children live in Asia, 26 percent in Africa and 4 percent in Latin America and the Caribbean. According to a UNICEF report underweight prevalence declined from 32 per cent to 28

per cent in developing countries over the past decade and the most remarkable progress has been made by East Asia and Pacific. The high levels of undernutrition in children and women in South Asia and sub-Saharan Africa pose a major challenge for child survival and development.

India is a developing country. Since attaining independence in 1947, one of the greatest problems for India has been undernutrition among children. The country is still being confronted with this problem. As in other developing nations, malnourishment is a burden on a considerable proportion of population, the most vulnerable being the youngest of the country.

Undernutrition in childhood was and is one of the reasons behind the high child mortality rates observed in developing countries. It is highly detrimental for the future of those children who survive. Chronic under-nutrition in childhood is linked to slower cognitive development and serious health impairments later in life that reduce the quality of life of individuals. Nutritional status is an important index of this quality. Improved child health and survival are considered universal humanitarian goals. In this respect, understanding the nutritional status of children has far reaching implications for the better development of future generations.

According to Swaminathan (1979), a review of studies conducted during the 1960's and 1970's revealed that the prevalence of severe forms of malnutrition such as kwashiorkor, marasmus, pellagra and beriberi among young children was almost the same in various parts of India. A survey conducted during 1988-90 by the National Nutrition Monitoring Bureau revealed that 43 percent of the children in Kerala and 70 percent children in Orissa are malnourished (Gopalan 1995). However, by mid 1980's the severe forms of malnutrition related diseases as mentioned above declined. The NFHS-1 of 1992-93 showed that over 50 percent of the children of age 0-47 months are malnourished and 25 percent are severely malnourished. NFHS-2 estimates that nearly half of the children under 3 yrs of age in India are underweight (47%) and stunted (46%) and one in six children are wasted (16%). The prevalence of malnutrition is among the highest levels found in any country of the world. Demographic and health surveys conducted in 58

developing countries around the world using the same methodology as NFHS-3 found only Niger with a higher level of underweight children than India, two countries with higher levels of stunted children (Burundi and Madagascar), and six countries with higher levels of wasted children (Burkina, Faso, Chad, Cote D'lvoire, Mali, Niger and Cambodia).

There is no gainsaying the fact that malnutrition among children is a major problem in almost all part of India. From NFHS-3, it is evident that malnutrition is most prevalent in Bihar, Madhya Pradesh and Orissa where more than half of the children under three years of age are underweight. In addition to these three states, about half of the children are underweight in Rajasthan and Uttar Pradesh. Underweight among children is also a serious concern in West Bengal, Maharashtra and Gujarat. The states with the lowest percentage of underweight children are Goa, Kerala and all of the North-Eastern states except Meghalaya. Stunting among children is also high in Orissa, Gujarat, Haryana and Meghalaya. The lowest percentage of stunted children under-three years of age are found in Goa and Kerala. The geographical pattern of wasting among children as presented in fig. 1.3 shows very high levels of it in Orissa, Bihar and Maharashtra. Wasting among children is also a major problem in Madhya Pradesh, Karnataka and Tamil Nadu. The prevalence of all types of malnutrition among children is, as can be expected, considerably lower in all three metros namely Chennai, Kolkata and Mumbai than in India as a whole. Kolkata has lower percentage of malnourished children than Chennai or Mumbai (Arnold et al., 2004).

The trend in nutritional status shows decreasing levels of malnutrition in India but at a very slow rate. In India, 52 percent of children were stunted in 1992-93 (NFHS-1) which decreased by only one percent in 1998-99 (NFHS-2) and in 2004-06 (NFHS-3) 45 percent children was stunted. The similar trend is followed by underweight measurements, 53 percent children was underweight in NFHS-1 survey which decreased by 10 percent in NFHS-2 and 40 percent children were underweight in 2004-06 survey (NFHS-3). Unfortunately the percentage of wasted is on increase, 18 percent children was wasted in NFHS-1, 20 percent children was wasted in NFHS-2 and 23 percent children was wasted in NFHS-3.

Table 1.1 Trends in Nutritional Status of Children under age of three years in India

	Stunted (%)	Wasted (%)	Underweight (%)
NFHS-1	52	18	53
NFHS-2	51	20	43
NFHS-3	45	23	40

Sources: IIPS, 2007

If we look at state level prevalence of malnutrition in children more than half of children under age five are stunted in Bihar, Chhattisgarh, Madhya Pradesh, Uttar Pradesh and Meghalaya whereas least prevalence of stunting is found in Kerala with 24.5%. Sikkim, Punjab and Mizoram have least prevalence of wasting with 9.7 percent, 9.2 percent 9 percent children wasted respectively. Again, Madhya Pradesh is having highest prevalence of underweight children with 60 percent also in Bihar and Jharkhand more than half children are underweight. Mizoram and Sikkim are having lowest prevalence of underweight in children less than five years with 19 percent.

Although condition of Rajasthan do not fall in the category of worst condition of nutrition but the condition of children Rajasthan is also not so good, as 44 percent children are stunted whereas 23 percent are severely stunted. 20.4 percent children are wasted whereas this percent for all India is 19.8. 39.9 percent children are underweight and 15.3 percent children are severely underweight in Rajasthan. 19 states of India have better condition of underweight children than Rajasthan.

1.3 Introduction of Rajasthan

Rajasthan is the second largest state in India in terms of geographic area with an area of 342,239 square kilometres. Administratively it is divided in 33 districts with Jaipur as its capital city. Aravalli ranges divide the state in two geographical divisions, the northwest and the northeast. The north-western part of Rajasthan, known as the Western Sandy Plain, is the most arid and infertile part of the state. In contrast, the south-eastern region of the state consists of extensive hilly ranges, long stretches of rocky surfaces and

woodlands, wide vales, fertile tablelands, Vindhyan scrapland projections, and Deccan plateau extensions.

Rajasthan is predominately a rural state consisting of 33 districts, which are sub - divided into 237 blocks and 39810 villages. Out of a population of 56.5 million (2001 census), three fourth of the total population is residing in villages including a substantial nomadic population, which migrates over long distances during the time of scarcity of water. The SC & ST populations, who have low levels of literacy and low economic status, are 12% and 17% respectively.

Agriculture is the single largest sector of Rajasthan's economy. At the time of the 2001 Census, the agriculture sector provided a livelihood to 64 percent of Rajasthan's working population (office of the Registrar General and Census Commissioner, 2002). Rajasthan grows both *kharif* and *rabi* crops. Major agriculture products include bajra, jawar, maize, oilseeds, pulses, wheat, chillies, and tobacco. Cultivation of vegetables and citrus fruits such as oranges and malta has also increased in recent years. Rajasthan ranks sixth in India in terms of per capita food grain production and tenth in terms of growth rate of food grain production. Between 1987-88 and 1989-90, Rajasthan's average annual per capita food grain production was 188 kilograms. The annual rate of increase of food grain production from 1969-70 to 1989-90 was 2.8 percent (Centre for Monitoring Indian Economy, 1991). The annual per capita net domestic product in the state is Rs.9,215 current prices (EPW Research foundation, 1998). As per the estimates given by planning commission for 1993-94, 26 percent of rural population and 30 percent of the urban population in Rajasthan were below the poverty line (Central Statistical Organisation, 1999).

According to 2001 Census, Rajasthan had a population of around 56.5 million, accounting for approximately 5 percent of India's total population. The population density per square kilometre is 165. Although the population density in the state is much lower than the density for the country as a whole (324), the increasing density indicates an increasing pressure of population on land and other resources of state. The level of urbanization in state (23.38 percent) is lower than India's overall level (27.78 percent) of urbanization. Sex ratio for Rajasthan (910) is also lower than that for India as a whole

(927). The percentage of Schedule Caste and schedule Tribe population is 12 and 17 respectively. Life expectancy at birth for both males and females is less than the national average in the state.

Rajasthan is one of the most educationally backward states in India. According to 2001 Census, the literacy rate among population age 7 and above was 60.41 percent in Rajasthan, compared with 65.38 percent as a whole for India. The literacy rate for females is 44.34 percent compared with 54.16 percent for females in India as a whole.

Infant Mortality Rate in Rajasthan is at 83 per 1,000 live births (Sample Registration System, 1998), which is much higher than the rate of 71 for all India.

Rajasthan conjures up a vision of valour, forts, palaces and heritage but on the other hand it is also known for its highly patriarchal society, Sati and the poor status of women and children. This social milieu has led to an unsatisfactory status of women with many retrogressive customs and practices such as Child marriage, Sex selective Abortions and Female Infanticide and Deprivation of girls from education. Deprivation of girls from education results in low female literacy rate – among lowest in the country. The health indicators reveal high IMR 86, MMR 670 and a high morbidity rate. The high crude birth rate of 33.6 has also added to the already alarming population growth. Both chronic and acute "under nutrition" levels are high.

According to the Human Development Index (HDI), Rajasthan's rank is in the lowest quartile of Indian states. Rajasthan's HDI is 0.356, in comparison to an all-India level of 0.603 (Human Development Report, Rajasthan, 1999). A main problem of Rajasthan is the extremely low and irregular rainfall, which caused serious drought conditions in 40 of the past 50 years, affecting 215.07lakhs of people in 1997-98 (source: Relief Department - Government of Rajasthan).

Table 1.2 Demographic Indicators of Rajasthan and India

S. No.	Item	Year	Unit	Rajasthan	India
1.	Geographical area	2001	000 sq. km.	342	3287
2.	Population	2001	Crores	5.65	102.70
3.	Population density	2001	Per sq. Km.	165	324
4.	Urban population to total population	2001	%	23.38	27.78
5.	Population growth rate	1991-2001	%	28.33	21.34
6.	Literacy Total Female	 2001 2001	 % %	 61.03 44.34	 65.38 54.16
7.	Per capita income at current prices	2001-02	Rs.	13,151	17,789
8.	Per capita income at constant (1993-94) prices	2001-02	Rs.	8,559	10,618
9.	Life expectancy at birth	1996-2001	Years Male Female	 60.3 61.4	 62.4 63.4
10.	Schedule caste	2001	%	12	16
11.	Schedule tribe	2001	%	17	8

Source: Draft Annual Plan of Rajasthan, 2001-02 and Census of India 2001

Health and family welfare services in the state are provided through a network of Sub-centres, PHCs, CHCs, Postpartum Centres, Referral Hospitals and other private facilities. Yet, it is a fact that human resources, who are available, are indeed limited and rather insensitive to the shy and diffident rural masses, especially towards women.

Many factors have contributed to this situation including the geographical position consisting of a desert in the west with scarcity of water resources everywhere, a large tribal population in the south, and wide disparity in the socio-economic status. The other reasons are the prevailing attitudes and practices related to pregnancy and childcare and the unsatisfactory conditions of the health services, which are still reaching the deprived and poorer sections of society in spite of a vast infrastructure and many programmes related to women and children.

The percent of children under age five who were stunted was 52 in NFHS-1 which decreases to 41.8 in NFHS-2 and to 38.7 in NFHS-3. Percent of underweight children reduced to 44.3 in NFHS-2 that of 50.6 in NFHS-1 but it remains more or less constant i.e. no improvement in NFHS-3 as 44 % children was found underweight. The prevalence of wasting increased from 11.7 percent to 21.2 percent from NFHS-1 to NFHS-2 which shows slight improvement in NFHS-3 with 19.7 percent children under age are stunted.

There is growing international awareness of the importance of early-childhood nutrition to development outcomes. Strong evidences shows that nutritional failure during pregnancy and in the first two years of life leads, ineluctably, to lower human capital endowments, negatively affecting physical strength and cognitive ability in adults. This feeds directly into the reduced earnings potential of individuals and damages national economic growth and competitiveness potential. Faced with this evidence, no country which seeks to be prosperous in the 21st century can afford to neglect the nutritional condition of its children.

Adequate nutrition is critical to child development. The period from birth to two years of age is important for optimal growth, health, and development. At this age, children are particularly vulnerable to growth retardation, micronutrient deficiencies, and common childhood illnesses such as diarrhoea and acute respiratory infections (ARI). Child

malnutrition significantly increases the risk of infant and child death, some estimates suggests that child malnutrition is responsible for half of more of child deaths in the developing world. The child malnutrition rates in India are extraordinarily high and the state of Rajasthan falls in the category of BIMARU states.

1.4 Maternal and Child Health Condition of Rajasthan

Information on household characteristics namely demographic and socioeconomic characteristics and housing conditions provides a context for understanding the demographic, health, and nutritional situation of the population. In Rajasthan 71 percent households are in rural area in rural areas among which only 54 percent of household have electricity. Only 36 percent of women (15-49 yrs.) are literate in Rajasthan. The median age at first marriage among women age 20-49 in Rajasthan is 15 years. Almost two-thirds (65 percent) of women 20-24 years got married before the legal minimum age of 18. By age 19, 36 percent of women have begun childbearing. TFR of Rajasthan is 3.2 comparing with India's 2.7 which is sixth highest of any state in India. Almost two-thirds (65 percent) of births occur within three years. Research shows that waiting at least three years between children reduces the risk of infant mortality. There is strong son preference in Rajasthan, about one-third of women want more sons than daughters. If all women in Rajasthan were to have only the number of children they wanted, the Total fertility rate would be 2.2 instead of 3.2. More than half of women (53 percent) of women (currently married) in Rajasthan are not using any contraceptive method, whereas 68 percent women (currently married) in India are using any contraceptive method. Fifteen percent of married women in Rajasthan have an unmet need for family planning. The Infant Mortality Rate (IMR) is 65 in Rajasthan whereas it is 57 for All India which is sixth highest in the country. Only four in ten women in Rajasthan received at least three antenatal care visits for their last birth in the past five years. Even when women receive antenatal care, they do not receive most of the services needed to monitor their blood pressure taken, their urine tested and their blood tested. Only 13 percent consumed IFA for the recommended 90 days or more. Only one percent women took a deworming drug during pregnancy. Seventy percent of births in Rajasthan take place at home and 11 percent of home births were followed by postnatal check-up. Less than one-third of

mothers in Rajasthan (29 percent) had a postnatal check-up within two days of birth (as is recommended).

Rajasthan is having third least fully immunized children (in percent) in India after Nagaland and Utter Pradesh. Only 27percent of children age 12-23 months are fully vaccinated against six major childhood illnesses: tuberculosis, diphtheria, pertussis, tetanus, polio and measles. Moreover in spite of the Pulse Polio Campaign which is attempting to eradicate the disease in India, more than one-third of children still have not received three doses of polio vaccine. Forty percent of children under age five years are still underweight in Rajasthan. Only fifty four percent women are at a healthy weight for their height. Among children between the ages of 6-59 months the majority (70 percent) are anaemic. More than half of women in Rajasthan (55 percent) are anaemic. 49 percent of ever-married women have experienced physical or sexual violence and it is second highest in India after Bihar.

1.5 Objectives:

- To find out the prevalence of malnutrition in children of Rajasthan.
- To find out the variation and effect of socio-economic factors on child malnutrition.
- To find out the effect of background and health status of mother on nutritional condition of child.
- To find out the variation and effect of demographic conditions of child on malnutrition.

1.6 Organisation of Study:

The study of prevalence of malnutrition in children of Rajasthan is divided in five chapters. Review of literature to determine dependent and independent variables is presented in second chapter. Conceptual framework for the analysis of literature, research questions, database, dependent variables and methodology adopted is explained in chapter three. The analysis of effects of demographic and socio-economic factors on

child malnutrition is presented in chapter. This chapter also explains the variation and prevalence of child malnutrition in Rajasthan. The fifth chapter concludes the study and its results and suggests some steps to improve the condition of child malnutrition in the state.

CHAPTER 2

Literature Review

The effects of malnutrition on human performance, health and survival have been the subject of extensive research for several decades. There is now considerable evidence that malnutrition has effects on physical growth, morbidity, mortality, cognitive development, reproduction, physical work capacity and risks for several adult onset chronic diseases. The increased salience of nutrition as a central concern for social and economic development is further revealed by awarding of two Nobel prizes in economics for nutrition related work in recent years (Robert Fogel and Amartya Sen) and the prominence of food security and nutrition in international discourse related to human rights, human development, health and national development.

The most widely discussed subject in the literature concerning child malnutrition is the correlation between child malnutrition and a variety of socioeconomic characteristics and biological variables. Mosley and Chen (1984) in their model identified the following factors as the causes of child malnutrition. They are: maternal factors, environmental contamination leading to the transmission of infectious agents to children, nutrient availability to the child as well as to the mother during pregnancy, lactation and socio-cultural factors.

The present chapter reviews previous research conducted by scholars on different factors that influence the prevalence of malnutrition in children. In this study, different demographic and socio-economic variables as well as maternal and other factors, which affect child nutritional status, are discussed. The demographic factors include age and sex of the child. The social factors include place of residence; religion and caste of child; and mother's education. The economic factors that influence child malnutrition are: standard of living and mother's work status. Maternal factors responsible for child malnutrition are: birth order of the child and body mass index (BMI) of mother. Other factors which have a bearing on child's nutritional status are exposure to mass media, duration of breastfeeding, child immunisation, infections and diseases etc.

2.1 Demographic Factors

2.1.1 Age of the child

A child's organs and tissues, brain and bones are formed, and intellectual and physical potential is shaped during the period from conception up to three years of age. Since human development proceeds particularly rapidly for the first 18 months of life, the nutritional status of children is of paramount importance for a child's later physical, mental and social development (UNICEF). The children of poor communities who habitually subsist on inadequate diets continuously transits from the stage of normalcy to that of full-fledged clinically manifest malnutrition which generally supervenes before the third year (Gopalan 1989). Children who survive but receive inadequate food in the first five years of life are susceptible to permanent stunting of their physical growth (Bender and Smith 1997). The prevalence of wasting is the greatest among children between 12 and 24 months of age, whereas the prevalence of stunting increases over time up to age of 24 and 36 months and then shows a tendency to level off (Sachdev 1994). Studies by Arnold et al., (2004) regarding Indian children, on the basis of NFHS-3 data show that underweight and stunting are relatively low for children less than six months old, at least twice as high for children age six to eleven months old, and highest of all among the children who are one to two years old. By age three, malnutrition and related disorders are already a serious problem and it is difficult to reverse these disorders completely at later ages.

2.1.2 Sex of the child

Discrimination and violence against women are major causes of malnutrition (UNICEF 1998). Discrimination against girls in feeding and healthcare are often cited as reasons for poor nutrition and higher mortality among girls than boys in many developing countries (Visaria 1987). In India male children are valued higher than the female children and there are evidences of discrimination in respect of food and healthcare. Hence the prevalence of malnutrition is often found higher among girls than boys (Gupta 1986, Geetha and Swaminathan 1996, Gopalan 1995 and Pande 2003). However, most studies based on anthropometric data do not find a higher prevalence of malnutrition girls in

India, as well in other developing countries. According to Haughton (1997), there is no evidence of any gender bias against girls as per his study of child nutrition in Vietnam. Studies by J. Strauss (1991) found no gender effect in Cote d'Ivoire. The study conducted by Gaur et al., (2002) on the nutritional status of Rajput children of Himachal Pradesh shows that the percentage of malnourished girls was relatively less than that of boys. Studies also reveal that stunting and wasting was more among the male children than among the female children of Malto tribals of Bihar (Rajaratnam 1997). Despite the strong son preference that is prevalent in India, there is no evidence that girls are much more malnourished than boys. Girls are slightly more likely than boys to be underweight and stunted, but boys are slightly more likely than girls to be wasted (Arnold et al., 2004). But no concrete reasons for these unexpected findings are suggested (Sommerfelt and Arnold 1998).

In India, the existence of an anti-female bias for wasting in four northern states or territories (Bihar, Chandigarh, Delhi and Rajasthan) and for underweight in one (Orissa) seems to support the idea of differential undernutrition to the detriment of girls (EPW, 2002). Review of 306 child nutrition surveys (developing and transition stage countries) yields that 35 surveys reveal significant sex differentials in the prevalence of wasting by sex. Girls are more affected in nine cases, 40 surveys reveal significant sex differentials in the prevalence of stunting by sex. Girls are more affected in one case, boys in 39 cases. 30 surveys reveal significant sex differential in the prevalence of underweight by sex. Girls are more affected in four cases, boys in 26 cases (EPW, 2002). The statistical evidences tell that, where detectable difference by sex exists, boys usually fare worse than girls by anthropometric indicators. Haddad et al (1996) reviewed 21 studies on male-female differences in anthropometric outcomes. They found small differences in India, with girls often but not always worse off, boys slightly worse off in Africa, and no significant differences in other areas. Sommerfelt and Arnold (1998) after reviewing 41 DHS (demographic and health surveys), noted only small differences between sexes in the prevalence of wasting, stunting, and underweight. Where there is a strong preference for sons, boys will receive preferential treatment in feeding and medical treatment (Rosenberg, 1973; Williamson, 1976).

2.2 Social Factors

2.2.1 Place of Residence

Prevalence of malnutrition is roughly one and half times higher in rural areas than the urban areas (UNICEF 1990). According to Bender and Smith (1997), rural children are more likely to be underweight for their age because they are more likely to be poor. Although urban poverty is a growing phenomenon in the developing world because of rapid urbanisation and other factors, up to 80 per cent of extreme poverty is concentrated in rural areas. In India, levels of malnutrition are much higher in rural areas than in urban areas, but even in urban areas more than one-third of young children are stunted and underweight (Arnold et al., 2004).

An analysis of the situation of the India by UNICEF states that cultural traditions of intra-family distribution of food rooted in rural areas compel women to eat least both in quality and in quantity. This inadequate diet cannot meet the demands of the baby during pregnancy and lactation and thereby depletes her health leading to entrenched deficiencies and ill health. This is the root cause of nutritional deficiency of infant and their deaths in several contexts are resulting out of the nutritional deficiency of the mother (Vankatacharya, 1985).

Ample evidence shows that urban children generally have a better nutritional status than their rural counterparts (Hussain and Lundven 1987; Von Braun et al. 1993; Ruel et al. 1998; Ruel 2001). This is particularly true for linear growth (stunting) and for underweight (low weight-for-age). Using Food and Agricultural Organization of the United Nations (FAO) data for 11 countries, most of which were African, Hussain and Lundven (1987) showed that stunting rates in urban areas were 55-78 percent of those in rural areas. Von Braun et al. (1993) corroborated these findings with United Nations Children's Fund (UNICEF) data sets from 33 countries in Africa, Asia, and the Americas, showing that, on average stunting was 1.6 times greater in rural than in urban areas. Using Demographic and Health Surveys (DHS) from 28 countries conducted between 1990 and 1998, Ruel (2001) also documented the consistently lower prevalence of stunting in urban areas, with wider urban-rural differences in Latin America than Africa

and Asia. Although, typically, wasting is also higher in rural areas, most studies have found very small urban-rural differences. In a few instances, slightly higher wasting in urban areas has been reported (Ruel et al. 1998; Ruel 2001; Von Braun et al. 1993; Hussain and Lundven 1987).

2.2.2 Religion and Caste

Social factors like, religion and caste are regarded to be closely associated with the nutritional status of children. It is observed that prevalence of malnutrition is higher among children of the low caste households than among children of high caste households (singh1989). Studies by Kanungo and Mohanta (2004) show that the tribal children suffer more from malnutrition in comparison with other children, and it is also found to be a leading cause of mortality among children (Rajaratnam et al., 1997). Kanungo and Mohanta's study of child nutritional status by different social groups also revealed that the children belonging to scheduled caste, tribes or other backward classes have relatively high levels of malnutrition according to all the three anthropometric measures. According to a study by Haughten (1997) of Vietnamese children, it is seen that children born into the ethnic minorities are more likely to be stunted. However, Sharrif (1996) found that religion and caste are not significant factors determining the nutritional status of children.

2.2.3 Mother's education

Mother's years of education are often positively associated with improved child health and nutritional status (Behrman, 1990).A lack of access to education and correct information is an important cause of malnutrition. Without information strategies and better and more accessible education programmes, the awareness, skills and behaviours needed to combat malnutrition cannot be developed; therefore improving education for girls and women is vital (UNICEF 1998). Data from Latin America (Behm, 1976-78; Haines and Avery, 1978), Africa (Caldwell, 1979; Farah and Preston, 1982), and Asia (Cochrane, 1980; Cald-well and McDonald, 1981) all show a negative relationship between the extent of maternal education and the level of child mortality, although the amount of education required to produce a significant reduction in mortality varies from

culture to culture. A great deal of attention has been paid to the effect that education of the mother has on child malnutrition and the finding is almost universally positive (Haughton 1997). According to Gopalan (1989), the level of female literacy in the household is often a major determinant of child rearing practice and therefore of the level of child malnutrition in poor households. Education of parents especially mother is an important socio-cultural factor, which determines the nutritional status of children. Studies have found that literate and educated mothers have fewer malnourished children than illiterate mothers (Ramchandran 1989, Sommerfelt and Sewart 1994). Studies by Haughton (1997) on Vietnamese children show that when parents are more educated, their children are likely to be less malnourished. According to Arnold et al., (2004), key NFHS-2 findings on nutrition show that the education of the child's mother has strong negative relationship with malnutrition among children. Children whose mothers are illiterate are more than twice as likely to be stunted and underweight and one and a half times as likely to be wasted as children whose mothers have completed at least a high school level education. A major conclusion of the United Nations report is that in countries where nutrition improvement has lagged behind economic growth, social discrimination against women is behind high levels of illiteracy among women, which is responsible for high child malnutrition rates (UNICEF 1998).

Maternal education is closely related to child health measured either by nutritional status or by infant and child mortality. The effect of father's education on infant and child mortality appears to be about one half that of mother's education (Susan H. Cochrane, Joanne Leslie and Donald J. O'Hara). The Cebu Study Team (1991, 1992) found that mother's education leads to improved waste disposal and higher and higher non-breast milk calorie intake, both of which reduce the incidence of diarrhoea. Maternal education also leads to earlier weaning, which can increase episodes of diarrhoea, but the net effect of maternal education is to reduce the incidence of diarrhoea. Strauss (1990) found in Cote d'Ivoire that mother's education raises child height-for-age and weight-for-height, even after using family fixed effects estimators. Barrera (1990) found that better educated mothers tended to wean their children sooner, but they compensated for this shortened breastfeeding time with better care; overall their children were healthier as measured by higher height-for-age z-scores.

Caldwell (1979) has argued that three factors are of importance in this regard. In ascending order these are (1) a reduction in fatalism in the face of children's ill health; (2) a greater capability in manipulating the world (e.g., in knowing where facilities are, and in securing the attention of doctors and nurses); and (3) a change in the traditional balance of family relationships that shifts the focus of power away from the patriarch and mother-in-law and ensures that a greater share of available resource to children.

Data from Latin America (Behm, 1976-78; Haines and Avery, 1978), Africa (Caldwell, 1979; Farah and Preston, 1982), and Asia (Cochrane, 1980); Caldwell and McDonald, 1981) all show a negative relationship between the extent of maternal education and the level of child mortality, although the amount of education required to produce a significant reduction in mortality varies from culture to culture. In Bangladesh where nutrition is important determinant of health, there is evidence that a link exists between mother's height and the birth weight of the infant and that educated mothers bear heavier infants with a greater chance of survival because of their own greater height and fitness (Chowdhury, 1982).

2.3 Economic Factors

2.3.1 Standard of Living

According to Mosley and Chen (1984) the level of potential exposure to disease and malnutrition can be attributed to the standard of living, which includes housing condition, environment sanitation, personal hygiene, and drinking water. Strauss (1991) in his Cote d'Ivoire study found the effects of water supply and sanitation as well as the income to be fairly important. Arnold et al., (2004) in their study show that among Indian children from households with a low standard of living more than one-quarter of the children are stunted and underweight. A study by Rajaratnam (1990) in rural Tamil Nadu showed that infant mortality is not much related to housing condition (type of house, number of rooms, etc.) but highly related to environmental sanitation (open air defecation adjoining the house, location of cattle shed in or adjoining the house, sullage nuisance around the house, etc.) Esrey et al. (1988) and mertens et al., (1990) found that the presence of clean water supply and sanitary facilities have beneficial effects on child growth and nutrition.

In countries where economic growth has resulted in increased household income and resource access for the poor, the nutritional pay-off has been large. For example, in Indonesia, economic growth from 1976 to 1986 was accompanied by improvements in nutrition (UNICEF 1998). According to Bender and Smith (1997), the type and amount of food people eat are largely determined by economic factors, especially the price of food relative to income. As income rise, people tend to demand larger quantities of food and more variety in their diets, the share of inexpensive starches in the diet falls and the share of animal products, oils, sweeteners, fruits and vegetables rises which increases the nutritional status. Children in wealthy households are less likely to be stunted (Festus A. Ukwuani and Chirayath M. Suchindran, 2002).

2.3.2 Mother's work status

The work status of the mothers also has a bearing on the levels of malnutrition in children. Very high child malnutrition throughout much of South Asia is due to women's low level of employment. The remarkable improvement in child nutrition in Thailand in the last two decades is due to very high literacy, high participation of females in the labour force and a strong place in social and household level decision-making (UNICEF 1998). According to Gupta and Rhode (2004), poor mothers who must work are particularly vulnerable and employment conditions often do not allow young infants to accompany their mothers. Worse yet, the public misconception that bottle-feeding is modern and better must be aggressively countered also results in child malnutrition.

According to Ramchandran (1994), the type of work the women does outside the house determines the impact of such employment on the nutritional status of the women and her children. The rural and urban poor women engaged in manual labour are more vulnerable to malnutrition during pregnancy due to over burden of work. At the same time it is not possible for them to refrain from work because, if they do so, their families would have a still lower economic status and purchasing power. On the other hand, gainful employment of urban women outside the house in jobs requiring only moderate physical activity is associated with improved financial status, increase in purchasing power and standard of living with consequent improvement in nutritional status, increase in

purchasing power and standard of living with consequent improvement in nutritional status.

Wasting among infants increased when mothers did not take them to work. Furthermore, mothers' work reduced stunting in their children, but the expected positive effect of earning cash from work on childhood nutrition was less visible. (Social Science & Medicine, May 2003).

2.4 Maternal Factors

2.4.1 Birth order of the child

Birth order of the child is an important maternal factor, which influences the nutritional status of children. It is often argued that the oldest child is least malnourished and the subsequent children are increasingly poorly provided for. There are a number of plausible explanations. Parents may have less time per child once their families become large. Additional children may stretch the household budget too far and thus negatively affect nutrition status of children. Mothers become older and may become more tired as they have more children and thus cannot so easily find the energy to devote as much attention to late-arriving children. To the extent that there is a quantity-quality trade-off between having a few children and lavishing attention on them and having a lot of children but letting them fend more for themselves (Haughton and Haughton 1997). This study shows that higher parity children are more malnourished, being both more stunted and wasted in Vietnam. Studies by UNICEF (1984), Sommerfelt Stewart (1994) and Rao et al., (1999) have found that malnutrition and infant child mortality is higher among children of higher birth orders (often order four and above).

2.4.2 BMI of Mother

The BMI can be used to asses both thinness and obesity. The BMI is defined as the weight in kilograms divided by height in metr square (kg/m^2). The mean BMI for women in India is 20.3 kg/m^2. Chronic energy deficiency is usually indicated by a BMI of less than 18.5 kg/m2. According to UNICEF (1998), the infants of women who are themselves malnourished and underweight are likely to be small at birth. Growth during

the foetal stage depends on how much weight she gains while she is pregnant as gains in weight are essential for the development of foetal tissues. Rao et al., (1999) studied that mothers with normal stature and had normal newborns more thena those with present and past forms of malnutrition. Very high relative risk of abnormalities was found among the mothers with short stature and low BMI because stunted women are more likely to experience obstructed labour and are thus at greater risk of dying while giving birth. There is also a direct relationship between stunting of the mothers and the occurrence of low birth weights in their offspring. It is observed that with respect to both height and weight, infants who start with the initial handicap of low birth weights in their offspring. It is observed that with respect to both height and weights, infants who start with the initial handicap of low birth weight apparently never fully recover from their initial handicap. Thus low birth weights in infants make a lasting contribution to stunting (Gopalan 1989). Studies conducted by Brennan et al., (2003) show that mother's BMI also has a very powerful effect in the wasting of the child.

2.4.3 Level of Anaemia in Mother

According to UNICEF (1998), since the foetus relies entirely on the mother for nutrients, pregnant women not only need to gain weight but also must maintain an optimal intake of essential nutrients such as iron. Anaemia is the one of the most important of all micronutrient deficiencies in pregnancy. Low dietary intake of iron and foliate and poor bioavailability of iron from Indian diets were identified as factors responsible for iron deficiency and consequent anaemia (Ramchandran 1994). The consequences of anaemia for pregnant women and their new born children are often disastrous. The condition puts women at higher risk of death because of the greater likelihood of haemorrhage in childbirth and their newborns face a high risk of poor growth and development (UNICEF 1998). The provision of iron and folic acid tablets to pregnant women prevent nutritional anaemia (Kanungo and Mohanta 2004). It is also found in many studies that women who availed one or the other antenatal, natal and postnatal services have fewer malnourished children than their counterparts (Ramchandran 1989, Punhani and Mahajan 1989). According to Bulliyya (2002), maternal malnutrition and absence of antenatal care contribute to low birth weight babies. Further Basu (1990) argues that even if the

physical environment is poor, better antenatal and natal care would reduce morbidity and mortality among children. Many countries have adopted policies to ensure that women who seek antenatal care have access to daily iron supplements to help them meet the very high needs of pregnancy and childbirth (UNICEF 1998). The National Anaemia Prophylaxis Programme of Iron and Folic acid tablets distribution to pregnant women and young anaemic children was initiated, to reduce the prevalence of anaemia as a part of National Plan of Action for children on the basis of National Nutritional Policy of 1993 (Sachdev and Choudhary 1994) for preventing malnutrition.

2.4.4 Breastfeeding

Briend et al., (1988) found that breastfeeding improves nutritional status and child survival. It is also found in many studies that longer duration of breastfeeding and initiations of supplementary feeding at age four to six months of the child help improve its nutritional status (Vijaysree and Satyavani 1992). According to UNICEF (1998), breastfeeding perfectly combines the three fundamentals of sound nutrition, namely: food, health and care. Therefore it is an important protection for children because breast milk contains all the nutrients, antibodies, hormones and antioxidants an infant needs to thrive. It plays an important role in promoting the mental and physical development of children. Breastfeed infants not only show better immune responses to immunisations, but their intake of breast milk also protects the mucous membranes that line their gastrointestinal and respiratory tract infections. Thus breastfeed infants have fewer infections and they take a greater interest in their environment and hence learn more than ill infants. Therefore UNICEF and WHO in 1991 introduced the 'Baby-Friendly Hospital Initiative' as an effort to protect, promote and support breastfeeding in maternity hospitals. In India, under National Plan of Action for Children, the Department of Women and Child Development took the initiative of empowering all women to breastfeed their children exclusively for four to six months and continue breastfeeding with complementary food, well into the second year for the promotion of breastfeeding.

2.5 Other Factors

Mosley and Chen (1984) consider the demographic characteristics such as the age of mother at childbirth and birth interval as the important maternal factors influencing the nutritional status of children. Many studies have found that infant and child mortality, and malnutrition, is higher among children born to mothers at age below 18 and at age after 34 years, and among children born with a short birth interval of less than 24 months (UNICEF 1984, Sommerfelt and Stewart 1994). According to Raina (1971) studies highlight that pregnant mothers with better dietary intake are less likely to deliver their babies prematurely and with low birth weight.

Women's educational and social status, national per capita food availability, and access to safe water are important underlying determinants of child nutritional status. Furthermore, a review of situation in Asia has suggested that high prevalence of low birth weight, poor hygiene, inadequate child care and feeding practices, and the low status of women in society are key factors that explain high rates of child malnutrition.

Several studies indicate that inadequate or improper food intake and repeated episodes of infectious diseases adversely affect children's nutritional status (Sommerfelt and Stewart 1994). Lutter et al., (1989) found that proper treatment of acute infectious diseases, especially diarrhoea, has beneficial effects for children's growth and nutritional status. 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 (Sommerfelt and Stewart 1994). They also found that stunting and underweight are more among children who are not vaccinated against childhood diseases than among children who are fully vaccinated.

Mass media-generally identified with print media, film, radio and television - are capable of changing the attitudes and behavioural patterns of the people and have assumed a powerful role in modern society. There is a growing recognition that mass media if appropriately used could bridge the information gap between 'knowledge haves' and 'knowledge have nots' says Shingi, Kaur and Rai (1999). According to Schramn (1964), mass media acts as 'mobility multipliers', spreading favourable attitude for social change.

Children under three years of age who had low birth weight (less than 2.5 kilograms) are much more likely to be malnourished than other children (Arnold et al., 2004). The empowerment of women is of central importance for improving nutrition of both women and children (UNICEF 1998). The study conducted by Smith et al., (2003) shows that higher status of women has a significant, positive effect on children's nutritional status in the three developing regions, namely: South Asia, Sub-Saharan Africa and Latin America and the Caribbean. Vitamin A supplementation has been shown to reduce morbidity (Rose et al., 1995). However, Vijayraghavan et al., (1980) found that the evidence of beneficial effects of vitamin A supplementation on morbidity and mortality in not conclusive.

To sum up, since the intellectual and physical development of children that takes place during the first five years of life is entirely dependent on the nutrition provided during these crucial years, it is necessary to study the nutritional status of children during these five years. The different demographic, socio-economic, maternal and other variables discussed before explain their importance in determining the child nutritional status. The review of literature presented above is used for framing the conceptual framework in the third chapter, which helps in subsequent analysis of the effects of demographic and socio-economic factors on child nutrition in Rajasthan.

CHAPTER 3

Conceptual Framework for Analysis of Child Malnutrition

Conceptual framework is a useful tool for understanding the relationships between the key concepts that are to be examined from the empirical data. In this chapter we develop a conceptual framework for the analysis of the effects of the different demographic and socio-economic variables on the indices of child nutrition namely: underweight, stunting and wasting on the basis of literature review.

Nutrition is a major determinant of health, and the resolution of many nutritional issues of public health concern requires survey data. The clinical features namely protein, energy, malnutrition and other micronutrient deficiencies (Vitamin A, Riboflavin etc.) do not appear till they become severe in nature. In addition to dietary intake methodologies, questionnaire material, hematological tests, and nutritional biochemistries, the assessment of nutritional status requires a series of stature, weight, and other anthropometric dimensions (Sachdev, 1998).

Evaluation of nutritional status is based on the rationale that in a well-nourished population, there is a statistically predictable distribution of children of a given age with respect to height and weight. In any large population, there is variation in height and weight; this variation approximates a normal distribution. Use of a standard reference population as a point of comparison facilitates the examination of differences in the anthropometric status of subgroups in a population and of changes in nutritional status over time. The use of a reference population is based on the empirical finding that well-nourished children in all population groups for which data exist follow very similar growth patterns before puberty. Until 2006 the most commonly used reference population, which was used in NFHS-1 and NFHS-2, was the U.S. National Center for Health Statistics (NCHS) standard, which was recommended at that time by the World Health Organization (Dibley et al., 1987a; 1987b).

3.1 Nutritional Anthropometry

Anthropometric examination is an almost mandatory tool in any research on health and nutritional condition in childhood and the study of nutritional status is of great importance for the understanding of the social well being in a population. Anthropometric values are closely related to nutrition, genetic makeup, environmental characteristics, social and cultural conditions, lifestyle, functional status and health. Anthropometric evaluation is an essential feature of geriatric nutritional evaluation for determining malnutrition, being overweight, obesity, muscular mass loss, fat mass gain and adipose tissue redistribution. Anthropometric indicators are used to evaluate the prognosis of chronic and acute diseases, and to guide medical intervention.

The various nutritional anthropometry measures to assess child growth are weight, height, arm circumference, skin-fold thickness, chest circumference and head circumference. Weight is a measure of total body mass and hence it is sensitive to changes in body fluids, fat, muscle mass, skeleton and other organs. Arm circumference assess the degree of muscle and fat in the mid upper arm area. Skin-fold thickness is an indication of body fat reserves. Height is a measure of the linear body growth i. e. the degree of skeletal development (Gopalan and Chatterjee, 1985). Weight and arm circumference are affected within a short duration of inadequate nutrient intake and ill health. Height, head and chest circumference do not change so rapidly, neither can these decrease in acute nutritional deficiency. Therefore, weight is considered to be a 'sensitive' indicator of nutritional status responsive to acute nutritional deficiency of short duration, while height deficit may be considered to be indicative of chronic nutritional deprivation (Gopalan and Chatterjee, 1985).

Weight and height have been considered to be the most sensitive parameters for assessing nutritional status in children less than five years of age when related to age, weight and height provide the means to study child nutritional status over a period of time. Weight-for-height provide age independent measures and are useful when age in unknown or difficult to estimate (Gopalan and Chatterjee 1985). Waterlow (1977) proposed that weight for height allows one to distinguish between children who have suffered

malnutrition in the past from those who are currently experiencing malnutrition. When malnutrition has been chronic, the child is 'stunted', both is weight-for-age and height-for-age are low, but his weight-for-height may be normal. In acute malnutrition, the height-for-age is appropriate, but the child is 'wasted' or of low weight for both height and age. Thus, weight and height measurements together are useful for understanding the dynamics of malnutrition, distinguishing between current malnutrition and long term or chronic malnutrition. From the four basic parameters, namely: sex, age, weight and height, three common indices can be derived, they are:

1. Height-for-age
2. Weight-for-height
3. Weight-for-age

Height-for-age represents the long-term effects of malnutrition in a population and does not vary according to recent dietary intake. It represents chronic malnutrition. Children whose Z-score is below minus two standard deviations (-2SD) from the median of the reference population are considered stunted for their age and are chronically malnourished. Children whose height-for-age is below minus three standard deviations (-3 SD) from the median of the reference population are considered to be severely chronic.

Weight-for-height index measures body mass in relation to body length and describes current nutritional status. Children whose Z-score is below minus two standard deviations (-2SD) from the median of the reference population are considered thin (wasted) for their height and are acutely malnourished. Wasting represents the failure to receive adequate nutrition in the period immediately preceding the survey and may be the result of inadequate food intake or a recent episode of illness causing loss of weight and the onset of malnutrition. Children whose weight-for-height is below minus three standard deviations (-3 SD) from the median of the reference population are considered to be severely wasted.

Weight-for-age is a composite index of height-for-age and weight-for-height. It takes into account both acute and chronic malnutrition. Children whose weight-for-age is below minus two standard deviations from the median of the reference population are

classified as underweight. Children whose weight-for-age is below minus three standard deviations (-3 SD) from the median of the reference population are considered to be severely underweight.

The 'Harvard Standards' of weight-for-age and height-for-age obtained from a study of well nourished Caucasian children in Boston in the 1930s as well as the studies of the growth of healthy children from the United Kingdom were the most frequently used reference standards. In 1966, the Harvard growth curves were widely disseminated by the WHO as the international growth reference. During the next decade, dissatisfaction with the limitation of the Harvard and other available reference data and the desire for a more contemporary reference led the United States' (US) National Centre for Health Statistics (NCHS) and the Centres for Disease Control (CDC) to collect data on weight, height, arm circumference, skin-fold thickness and head circumference on a large economically and ethnically heterogeneous US child population. The NCHS constructed a set of smoothed percentile distributions for attained weight, height and head circumference from birth to 18 years and this NCHS reference data are now recommended for by WHO.

The new WHO growth standard adopts a perspective approach, describing how healthy children should grow. The new standard is based on children around the world (Brazil, Ghana, India, Norway, Omen, and the United States) who are raised in healthy environments, whose mothers do not smoke, and who are fed with recommended feeding practices (exclusive breastfeeding for the first six months and appropriate complementary feeding from 6 to 23 months). The WHO growth standard identifies breastfed child as the normative model for growth and development standards, depicts normal early childhood growth under environment conditions, and can be used to assess children regardless of ethnicity, socioeconomic status, and type of feeding.

3.2 Standard Deviation Classification of Malnutrition

The classification is based upon the cut-off points recommended by the WHO in 1997. According to this cut-off point, prevalence of moderate malnutrition and severe malnutrition is defined as the proportion of children below-2 standard deviation (SD) and -3SD of the median value of the NCHS reference population respectively. Unlike Gomez

and IAP classifications, which take into account only weight-for-age index, the standard deviation classification takes into account only weight-for-age index, the standard deviation classification takes into account all the three indices of malnutrition namely: weight-for-age, height-for-age and weight-for-height.

Weight-for-Height (Wasted):

-2SD percentage below international reference population is considered as wasted whereas -3SD percentage below international reference population is considered as severely wasted. 2SD percentage above international reference population is considered as obese.

Weight-for-Age (Underweight):

-2SD percentage below international reference population is considered as underweight whereas -3SD percentage below international reference population is considered as severely underweight. 2SD percentage above international reference population is considered as obese.

Height-for-Age (Stunted):

-2SD percentage below international reference population is considered as stunted whereas -3SD percentage below international reference population is considered as severely stunted.

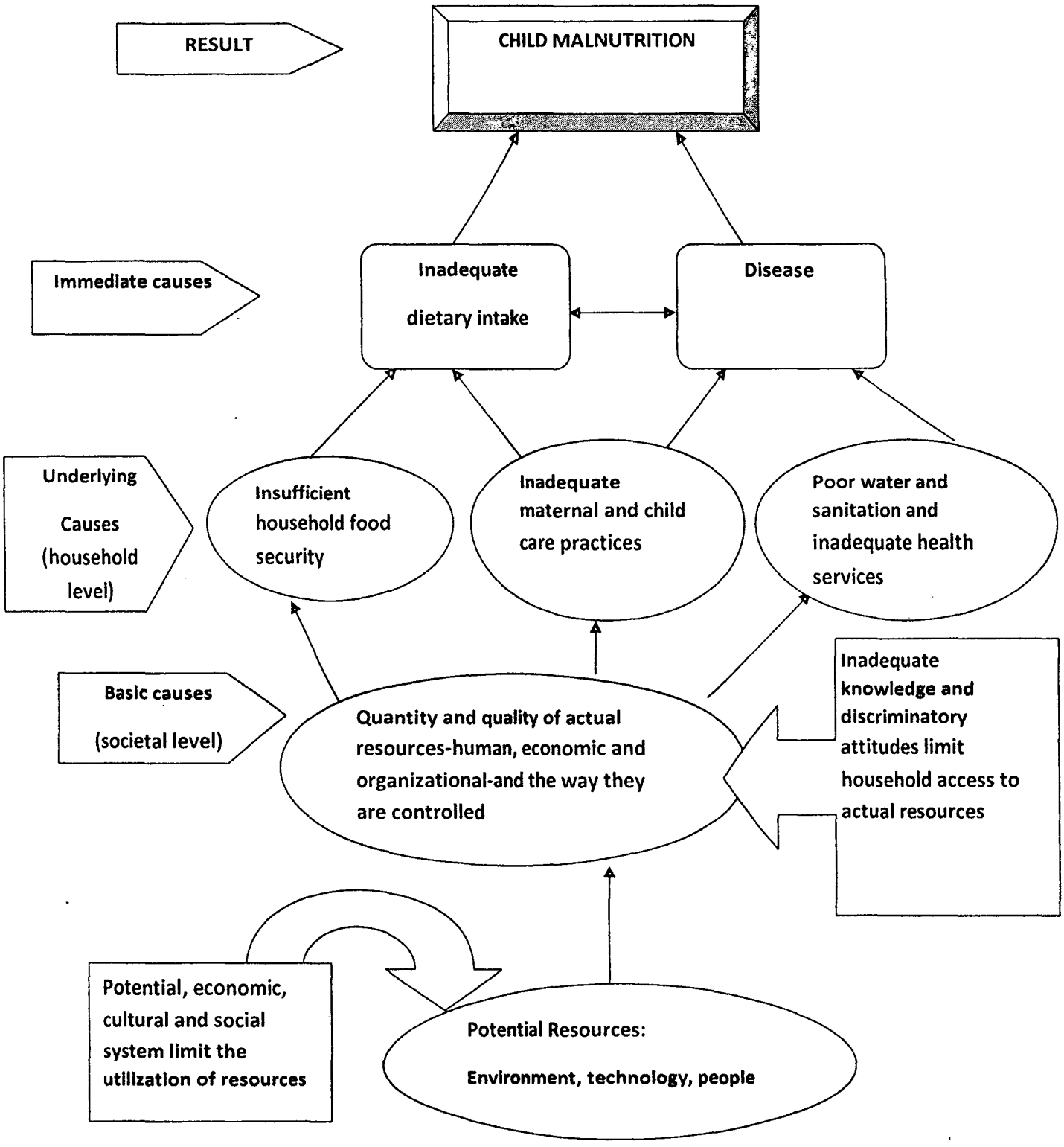
The reason behind using the standard deviation classifications is that it is now widely used to assess the nutritional status because each index is expressed in standard deviation units from the median of the international reference population adopted by the WHO. Moreover, standard deviation classifications have distinct statistical advantages since these reflect the reference distribution and are comparable, across ages and across indicators (WHO 1986, Waterlow et al., 1977, Dibley et al., 1987). Even the cut-off point of -2SD and -3SD is the same for all the three indices (Nigam 2003). The wide gap is a matter of great concern and even raises ethical considerations of depriving large number of severely malnourished children of the benefits of supplementary food (Nigam 2003). Thus the standard deviation data on the nutritional status are chosen to study the

prevalence of malnutrition and classify malnourished children from the children in Tamil Nadu and Madhya Pradesh.

3.3 Conceptual Framework

The conceptual framework as shown in figure 3.1 on the causes of child malnutrition was developed in 1990 as a part of UNICEF Nutrition Strategy. The framework shows that causes of malnutrition are multi sectoral, embracing food, health and caring practices. They are classified as immediate (individual level), underlying

Conceptual framework for the analysis of effects of demographic and socio-economic factors on child malnutrition.



Conceptual framework of the causes of child malnutrition, UNICEF, 1998.

(household or family level) and basic (societal level), whereby factors at one level influence other levels. The two most significant immediate causes of malnutrition are: 1) inadequate dietary and 2) illness. The interplay of these causes tends to create a '**vicious cycle of malnutrition**'. Three underlying causes that lead to immediate causes are:

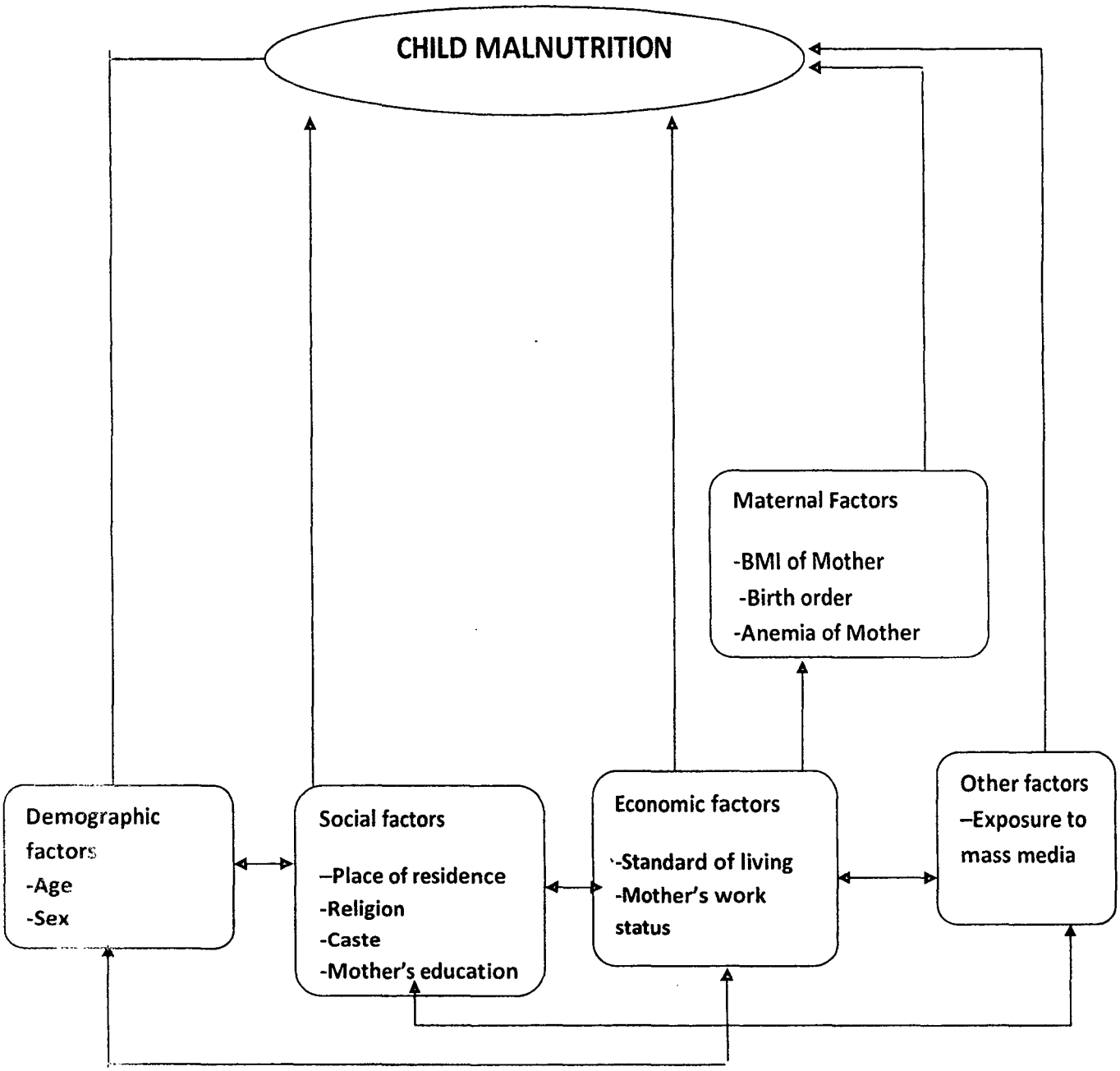
1) In adequate access to food in a household.

2) Insufficient health services and an unhealthy environment.

3) Inadequate care for children.

Inadequate access to food in a household food security, which is defined as sustainable access to safe food of sufficient quality and quantity including energy, protein and micronutrients to ensure adequate intake and a healthy life for all members of the family. Insufficient health services and an unhealthy environment are determined by the accessibility of health services, safe water and sanitation. An essential element of good health is access to curative and preventive health services, safe water and sanitation. An essential element of good health is access to curative and preventive health services that are affordable and of good quality. In terms of healthy environment should be ready access to safe water supply and proper sanitation and hygienic way of handling food as well as hygienic conditions in and around homes for the prevention of childhood diarrhea and other infectious diseases. Care of the children includes proper feeding of the child i.e. exclusive breastfeeding for the first six months and complementary food (solid and liquid) should be introduced along with breast milk since the age of six months, complete immunizations, emotional support and cognitive stimulation. The basic causes of malnutrition are: no rights of women, the political and economic system that determines how income and assets are distributed and the ideologies and policies that govern the social sector. The framework is used at national, district and local levels to help plan effective actions to improve nutrition. It serves as a guide in assessing and analyzing the causes of the nutrition problem and helps in identifying the most appropriate mixture of actions (UNICEF 1998).

Fig. 3.2 A Conceptual framework for the analysis of the effects of the demographic and socio-economic factors on child malnutrition



On the basis of the above mentioned conceptual framework as proposed by UNICEF, we present a conceptual framework (as shown in fig. 3.2) to suit the requirements of our study for explaining the causes of child malnutrition in Rajasthan. The causes of child malnutrition are classified into different factors namely: demographic, social, economic, maternal factors, anemia, and other factors. Demographic factors include: age and sex of the child. Place of residence, religion and caste of the child and mother's education are the different social factors included in the analysis. Standard of living and mother's work status are considered to be the important economic factors responsible for child malnutrition. Maternal factors include the BMI of mother and the birth order of the child, anemia of mother. Other factor includes exposure to mass media. It is seen that all factors individually and in inter-relation with each other influence the nutritional status of children under five years of age. It is evident from the framework that demographic, social and economic factors have direct impact on child nutrition. Antenatal care received by the mothers is influenced by social, economic and other factor like exposure to mass media which affects child nutrition. Economic factors like standard of living and mother's work status influences the maternal factors like BMI of mother and birth order of child, which in turn affect child nutritional status.

3.4 Research Questions

To analyze the effects of demographic and socio-economic determinants on the prevalence of child malnutrition following research questions had been formulated based on literature review:

1. Prevalence of child malnutrition is found higher in rural areas than urban areas.
2. Children of higher birth order are likely to be more malnourished.
3. Prevalence of child malnutrition becomes higher with lower Body Mass Index (BMI) of mother.
4. Prevalence of malnutrition is found higher in socially backward classes.
5. The level of child malnutrition is inversely related to standard of living i.e. the poorest section will have highest prevalence of child malnutrition.

6. The anaemic condition of mother affects the nutritional status of the child, the higher the level of anaemia in mother the poorer the condition of nutrition of her child.
7. Higher level of Mothers' education leads to better conditions of nutrition of children.

3.5 Source of Data

The data for the study are used mainly from NFHS-3, also data from NFHS-1, NFHS-2 and Census-2001 are used. To assess nutritional status, NFHS-3 included an anthropometric component, in which all children under five years of age were weighed and measured. National Family health Surveys (NFHS) is conducted by International Institute of Population Sciences (IIPS). NFHS-3 was conducted in 2004-06 in Rajasthan. In previous NFHS surveys, anthropometric measurements were restricted to children born to women interviewed with the Women's Questionnaire. However, the data from those surveys do not represent all children, since they exclude children whose mothers were not in the household (either because they did not live there or because they had died), children whose mothers were not eligible for the individual interview (i.e., they were under age 15 or age 50 and over), and children whose mothers did not complete an individual interview. To overcome these biases, NFHS-3 included height and weight measurements for all children born in the five years preceding the survey who were listed in the Household Questionnaire.

3.6 Selection of Variables

Identification of the casual relationships among the different variables of any study is an essential concern of an investigation. A casual relationship between the two variables exists only when one of them may logically be considered as the cause of the other. Thus, for analyzing the data, two sets of variable are chosen. They are: 1) Dependent Variable. 2) Independent Variable.

The independent variable is typically the variable representing the value being manipulated or changed and the dependent variable is the observed result of the

independent variable being manipulated. Thus the variations in dependent variable may be explained in terms of the variations in the independent variable.

3.7.1 Dependent Variables

Dependent variables or the effects of nutritional status are based on the three indices of child malnutrition namely: weight-for-age, height-for-age and weight-for-height that measures whether a child is stunted, underweight or wasted (i.e. whether child is two or three standard deviations below the median of the international reference population in terms of weight-for-age, height-for-age and weight-for-height). These variables are dependent on the effects of demographic and socio-economic variables. In this study, children below two and three standard deviations and above two standard deviations are taken into malnourished category.

Dependent Variable	Category
Weight-for-Height	Not Wasted Wasted Severely Wasted
Height-for-Age	Not Underweight Underweight Severely Underweight
Weight-for-Age	Not Stunted Stunted Severely Stunted

Note: 'Severely Wasted, Severely Underweight and Severely Stunted categories are not taken for Binary Logistic Regression'

3.7.2 Independent Variables

An independent variable is that variable which is presumed to affect or determine a dependent variable. The independent variables or the causes of child nutritional status are the different demographic and socio-economic variables on which the indices of child malnutrition depend. The demographic variables considered in the analysis include age and sex of child. The social variable include place of residence, religion and caste of child and mother's education. The economic variable includes standard of living and mother's work status. Maternal factor include, birth order and of the child, Birth Interval (preceding), Breastfeeding status, BMI of the mother, whether mother is anemic. Other

variable like exposure to mass media is also included in the analysis of prevalence child malnutrition.

Independent Variable	Category
BMI of Mother	Underweight
	Normal
	Overweight
Mother's Work Status	Not Working
	Working
Breastfeeding	Within half hour
	After half hour
Birth Interval	<36 months
	36 months & above
Education Attainment of Mother	No education
	Incompleted sec.
	Complete sec. & higher
Birth Order	Upto 2
	3 & above
Age of Child	<12 months
	12-35 months
	>35 months
Anaemia of Mother	Severe
	Mild/Moderate
	Not Anemic
Religion	Hindu
	Muslim
	Others
Exposure to Mass Media	No
	Yes
Standard of Living Index	Low
	Medium
	High
Type of caste or tribe	General
	SC
	ST
	OBC
Type of place of residence	Urban
	Rural
Sex of child	Male
	Female

3.7 Methodology

The following methodologies are adopted for the analysis:

- Cross tabulation
- Binary logistics

1. Cross tabulation of the dependent and independent variables are prepared to find out the percentages of the demographic and socio-economic variables.
2. Binary logistic regression or simply logistic regression is applied to a dichotomous dependent variable, where the dependent variable is the odds of the event of interest occurring. Logistic regression determines the effect of a set of variables on the probability as well as the effect of the individual variables. In this case, all the three dependent variables namely: weight-for-age, height-for-age and weight-for-height have dichotomous values and thus binary logistic is the model of choice.

The general logistic model expresses a qualitative dependent variable as a function of several independent variables, both qualitative and quantitative.

Let P = 1 (Normal)

P = 2 (if children are malnourished i.e. underweight, stunted or wasted)

Thus, malnutrition i.e. underweight, stunted and wasted (P) is a dichotomous dependent variable reflecting binary choices. Let us assume that underweight, stunting and wasting depends on a set of economic, socio-cultural and demographic characteristics to be represented by a vector. The basic form of a logistic function is:

$P= 1/ (1+e^{-Z})$

Or, $1-P = 1/ (1+e^{Z})$

Or, $P/1-P = e^{Z}$

Log (P/1-P) – Z

Where, P= estimated probability (the probability of underweight, stunted and wasted)

Z = independent variable

e = the base of natural logarithm (e=2.7183)

The independent variable has the largest effect on P when P= 0.5 and P becomes smaller in absolute magnitude as P approaches 0 to 1.00.

In case, if we use multivariate logistic function involving 'k' independent variables, like, X_1, X_2, X_3.....X_a, the relationship can be written as:

$$\text{Log } \{P/1-P\} = b_0 + b_1x_1 + b_2x_2 + b_3x_3 \ldots\ldots b_kx_k$$

The coefficient b_1 represents the additive effect of one unit change in independent variable x_1 on the logistics odds of malnutrition i.e. underweight, stunted and wasted.

The quantity e^b is called the odds ratio that represents the multiplicative effect on one unit change in the independent variable x_1 on the odds of underweight, stunted and wasted. The odds ratio interpreted as 'e^b' {Exp (B)} is more readily understandable as a measure of effect. This represents proportional increase (if greater than 1.0) or decrease (if less than 1.0) for odds of event occurring (i.e. underweight, stunted and wasted) for unit change in corresponding independent variable.

CHAPTER 4

Analysis of Child Malnutrition in Rajasthan

The aim of chapter is to analyse the prevalence of malnutrition in children of Rajasthan. The chapter also analyzes the effect of demographic and socio-economic background on the nutritional condition of children in the state. For the analysis chapter is divided in five parts. First part explains the percentage distribution of dependent variables to give an initial view of the status of nutrition of children in the state. Second part shows the distribution of background characteristics of the state. Third section of study deals with the analysis of cross-section tabulation and explains prevalence of malnutrition in children according to their background characteristics. Fourth part of chapter analyses of effect of independent variables on dependent variables i.e. it explains how the demographic and socio-economic variables did affects the prevalence of wasting, underweight and stunting. The last section of chapter summarises the chapter.

4.1 Levels of Child Malnutrition in Rajasthan

Table 4.1 Percentage Distribution of Dependent Variable in Rajasthan

Dependent Variable	Category	Percent	Numbers
Weight-for-Height	Not Wasted	77.7	1356
	Wasted	22.3	389
	Severely Wasted	7.3	128
Height-for-Age	Not Underweight	59.0	1029
	Underweight	41.0	716
	Severely Underweight	15.6	272
Weight-for-Age	Not Stunted	53.1	927
	Stunted	46.9	818
	Severely Stunted	23.3	408

Source : Computed from raw data, IIPS, 2007.

22.3 percent children of Rajasthan are wasted whereas 77.7 percent children are not wasted. 7.3 percent children of Rajasthan are severely wasted. Prevalence of underweight is high as 59 percent children are underweight and 41 percent children are normal i.e. not

underweight. 15.6 percent children are severely underweight. More than half (53.1 percent) children of Rajasthan are found stunted whereas 46.9 percent children are not stunted. Nearby one-fourth (23.3 percent) children are severely stunted in Rajasthan.

4.2 Background of Study Area

"A healthy mother can give birth to healthy child", with this phrase the BMI of mother to be notice is very important. In Rajasthan there are 56percent females which are of normal weight, 39.7 percent are underweight and 4.3 percent are overweight. Looking at Mother's work status working mothers in Rajasthan are 54.8 percent and 45.2 percent mothers are not working. Regular breastfeeding is very important for the health of child, so it is an important indicator to be noted here. Children who are breastfed within half hour of their birth are 13.2 percent and children who are breastfed after half hour of their birth are 84.8 percent. Birth interval is the time period between two children to a woman, and it must not be very less, which can be dangerous for the child and mother health. For better child mother health, birth interval must be from at least 36 months. In the state, 49.5percent women keep interval up to 36 months, but more than 36 months interval is maintained only by 24.1percent women. Phule propagated through his organization, the Satya Sodhak Samaj, that "for want of education intellect deteriorated, for want of intellect morality decayed, for want of morality progress stopped, for want of progress health vanished, all their sorrows sprung from illiteracy." By this statement we can consider that how important education among women is. In the state the share of females who attained the education up to secondary or higher level is merely 4.1percent, which is really a matter to think. 69.9percent mothers are with no education and only 26 percent mothers have incomplete secondary education attainment. As education is not only necessary pre condition for behavioural and attitudinal changes in regard to the population question, but also an essential input for modernization, economic growth and self reliant development of economy. It is female literacy which has suffered the most from the faulty process of development. Two children for a mother are considered as standard as they could be fed and cared properly by a family (couple). 48.8 percent children are of birth order up to two and 51.2 percent children of birth order three and above. Health of mother is very important for the child health, and

Table 4.2 Percentage distribution of children aged 0-59 months by independent variables, India, 2005-06

INDEPENDENT VARIABLE	CATEGORY	NUMBER	PERCENT
BMI of Mother	Underweight	824	39.7
	Normal	1161	56.0
	Overweight	88	4.3
Mother's Work Status	Not Working	937	45.2
	Working	1136	54.8
Breastfeeding	Within half hour	274	13.2
	After half hour	1747	84.8
Birth Interval	upto 36 months	1026	49.5
	>36 months	499	24.1
Education Attainment Of Mother	No education	1448	69.9
	Incomplete secondary	539	26.0
	Completed sec. & higher	85	4.1
Birth Order	Upto 2	1012	48.8
	3 & above	1062	51.2
Age Of Child	<12 months	439	21.2
	12-35 months	691	33.3
	>35 months	756	36.5
Anaemia Of Mother	severe	60	2.9
	mild/moderate	1152	55.6
	not anemic	848	40.9
Religion	hindu	1816	87.6
	muslim	241	11.6
	others	17	.8
Exposure to Mass Media	No	1240	59.8
	Yes	634	30.6
Standard Of Living Index	Low	608	29.3
	Medium	641	30.9
	High	614	29.6
Type Of Caste Or tribe	SC	462	22.3
	ST	307	14.8
	OBC	947	45.7
	General	357	17.2
Type Of Place Of Residence	Urban	425	20.5
	Rural	1649	79.5
Sex of child	Male	1105	53.3
	Female	968	46.7

Source : Computed from raw data, IIPS, 2007.

anaemic mother will rarely give birth to healthy child. In the state, mild or moderate anaemia is found in 55.6 percent mothers and 2.9 percent mothers are severely anaemic. Children up to twelve months are tend to be healthier than children of age more than twelve months. 21.2 percent children are of age less than twelve months, 33.3 percent children are of 12 to 35 months and 36.5 children are of age more than 35 months. Out of surveyed child sample, 87.6percent are Hindus and 11.6percent are Muslims and .8 percent children are of other religion. Exposure to mass media played very crucial role in the awareness of mothers towards health of child. But in the state only 30.6percent mothers has the exposure of mass media and 59.8 percent mothers are not exposed to mass media. Standard of living index is composed of the facilities (vehicle, utensils, type of house, electronic and electrical items etc.) used by a household. 29.3 percent children are living in low standard of living, 30.9 percent children are living in medium standard of living and 29.6 percent children are living in high standard of living. Out of the total surveyed sample, the share of children of Scheduled Castes is 22.3percent, Scheduled Tribe is 14.8percent, OBCs is 45.7percent and Generals is 17.2percent. About four-fifth (79.5 percent) of children of Rajasthan are living in rural areas 20.5 percent children living in urban areas. Child sex ratio is also not favourable to females and 53.3percent children are male while only 46.7percent children are females.

4.3 Prevalence of Malnutrition in Children According to Their Background Characteristics

4.3.1 Prevalence of Stunting in Children of Rajasthan

Prevalence of stunting in children of underweight and normal mothers is almost at same levels. 44 percent children of mothers having normal body mass index and 45 percent children of underweight mothers are stunted. Nearby one-fourth children of normal and underweight mothers are severely stunted. Children of overweight mothers are found little bit healthier as 35 percent children of overweight mothers are stunted whereas nearby 13 percent children of overweight mothers are severely stunted. Children of overweight mothers are less stunted than children of normal and underweight mothers.

Nearby 46 percent children of working mothers are stunted whereas 26 percent children are severely stunted of working mothers. On other hand 42 percent children of Not Working mothers are stunted and nearby 20 percent children of not working mothers are severely stunted. Prevalence of stunting was found higher in children of working mothers.

Children who are breastfed within half hour and after half hour are stunted at same level as nearby 44 percent children are stunted in both types of feeding practices. Also 23 percent children are severely stunted who are breastfed after half hour and 25 percent children are found severely stunted who are breastfed within half hour of their birth. No significant impact was found of breastfeeding practices as the prevalence of stunting is almost at same levels in the children who are breastfed within half hour and after half hour.

Prevalence of stunting in children whose birth interval is less than 36 months is 47 percent and the prevalence of stunting in children whose birth interval is 36 months & above is 44 percent. Nearby 25 percent children are severely stunted whose birth interval is less than 36 months and 24 percent children are severely stunted whose birth interval is 36 months and above. Although there is little difference but prevalence of stunting is less in the children whose birth interval is 36 months or above.

Almost half (nearby 50 percent) children are stunted and more than one-fourth (28 percent) children are severely stunted whose mothers are not educated. 34 percent children are stunted and 15 percent children are severely stunted whose mothers are educated up to incomplete secondary levels. On other hand nearby 13 percent children are stunted and two percent children are severely stunted whose mothers have completed secondary level or higher educated. Level of education attainment is having high impact on prevalence of stunting. The prevalence of stunting falls with increasing education attainment. Very low level of stunting is found in the children of mothers who have completed their secondary and are higher educated in comparison of not educated mothers.

Table 4.3 Percentage distribution of stunted children under five years of age in Rajasthan, NFHS-3, 2005-06

Background Characteristic		Height-for-age Z-score		
		-3	-2	TOTAL
BMI of Mother	Underweight	23.50	45.40	685
	Normal	24.10	44.00	989
	Overweight	12.70	35.20	71
Mother's Work Status	Not Working	19.80	42.10	779
	Working	26.20	45.80	966
Breastfeeding	Within half hour	25.30	43.80	233
	After half hour	23.10	44.40	1487
Birth Interval	<36 months	25.40	47.10	856
	36 months & above	24.10	44.00	432
Education Attainment of Mother	No education	27.70	49.70	1202
	Incompleted sec.	15.10	34.50	469
	Complete sec. & higher	2.00	12.70	75
Birth Order	Upto 2	19.80	40.00	848
	3 & above	26.60	48.00	897
Age of Child	<12 months	7.30	21.60	385
	12-35 months	28.00	51.10	649
	>35 months	27.70	49.90	711
Anaemia of Mother	Severe	31.30	54.20	48
	Mild/Moderate	23.00	44.50	976
	Not Anemic	23.40	44.10	712
Religion	Hindu	23.20	43.70	1529
	Muslim	25.00	47.50	200
	Others	11.80	41.20	17
Exposure to Mass Media	No	28.00	48.90	1040
	Yes	15.10	35.90	544
Standard of Living Index	Low	32.50	53.60	507
	Medium	25.30	45.80	537
	High	13.40	34.30	531
Type of caste or tribe	General	24.70	48.40	372
	SC	31.70	49.10	259
	ST	22.00	42.70	805
	OBC	18.40	38.70	310
Type of place of residence	Urban	14.40	34.90	361
	Rural	25.70	46.60	1386
Sex of child	Male	23.70	44.70	932
	Female	22.90	43.40	813

Source : Computed from raw data, IIPS, 2007.

More than one-fourth (26 percent) children are severely stunted and nearly half (48 percent) children are stunted whose birth order is three or above. Forty percent Children of Birth Order up to two are stunted and nearby twenty percent children are severely stunted whose birth order is up to two. Prevalence of stunting in children whose birth order is up to two is low than the children of higher (three and above) birth orders.

Prevalence of stunting in children less than 12 months is 21 percent whereas seven percent children up to 12 months are severely malnourished. More than half (51 percent) children of 12 to 35 months are stunted whereas more than one-fourth (28 percent) children are severely stunted in this category. Children of above 35 months are also stunted at same levels as about half of them are stunted and 28 percent of them are severely stunted. Children below 12 months are less stunted than children of 12 months and above.

44 percent children of mild/moderate and not anemic mothers are stunted and 23 percent are severely stunted. More than half (54 percent) children of severely anemic mothers are stunted whereas 31 percent children are severely stunted whose mothers are severely anemic. Prevalence of stunting in children whose mothers are severely anemic is higher than children of moderate/mild anemic and not anemic mothers.

Nearby half (48 percent) Muslim children are stunted and one-fourth Muslim children are severely stunted. 23 percent children are stunted and 44 percent children are severely stunted in Hindus. 41 percent children of others are stunted whereas 12 percent children of others are severely stunted. Muslim children are more stunted than Hindu children.

Half children (49 percent) are stunted whose household is not exposed to mass media whereas 28 percent children are severely stunted whose household is not exposed to mass media. Prevalence of stunting is 36 percent in the children whose household is exposed to mass media and 15 percent children are severely stunted of this category. Prevalence of stunting is higher in the children whose household is not exposed to mass media than the children whose household is exposed to mass media.

More than half (54 percent) children are stunted and 32 percent children are severely stunted who falls in low standard of living. One-fourth children are severely stunted in

medium standard of living whereas 46 percent children are stunted in this category. 34 percent children are stunted in high standard of living and 13 percent children are severely stunted in this category. The prevalence of stunting in children increases with decreasing in standard of living index i.e. the highest prevalence of stunting is found in low standard of living and lowest prevalence of stunting is found in high standard of living.

Prevalence of stunting is found highest the children of schedule tribes followed by schedule caste and OBC children. General category children have lowest prevalence of stunting. 49 percent ST children are stunted and 32 percent ST children are severely stunted. 48 percent SC children are stunted and nearly one-fourth SC children are severely stunted. 43 percent OBC children are stunted whereas 22 percent OBC children are severely stunted. 39 percent General category children are stunted and 18 percent General category children are severely stunted.

Prevalence of stunting in urban children (35 percent) is lower than that of rural children (46 percent). Also one-fourth children are severely stunted from rural areas and fourteen percent children from urban background are severely stunted. Prevalence of stunting is higher in children of rural background than children of urban background.

45 percent male children are stunted whereas 24 percent male children are severely stunted. Nearby 43 percent female children are stunted and 23 percent female children are severely stunted. Although little difference but prevalence of stunting is higher in male children than female children.

4.3.2 Prevalence of Underweight in Children of Rajasthan

43 percent children of underweight mothers and 39 percent children of normal mothers are underweight. 16 percent children of underweight and normal mothers are severely underweight. 34 percent children of overweight mothers are underweight whereas 5.6 percent children of overweight mothers are severely underweight. 0.3 percent children of underweight mothers and 0.4 percent children of normal mothers are obese (above+2z score). Prevalence of underweight is lower in children of overweight mothers than underweight and normal mothers.

Children of working women are (43 percent) having higher prevalence of underweight than children of not working women (37.5 percent). Prevalence of Severe underweight is also high in children of working women (16 percent) than children of not working mothers (15 percent). Children of working women are having higher prevalence of underweight than children of not working women.

Prevalence of underweight is almost at same levels in children whose birth interval is up to 36 months and above 36 months (43 percent). 0.5 percent children whose birth interval is more than 36 months are obese.

Children who are breastfed within half hour of birth (38 percent) are having less prevalence of underweight than children who are breastfed after half hour of birth (41 percent). 12.5 percent children who are breastfed within half hour of birth are severely underweight whereas 16 percent children who are breastfed after half hour of birth are severely underweight. Children who are breastfed after half hour of birth are having higher prevalence of underweight than the children who are breastfed within half hour of birth.

46.5 percent children of not educated mothers are underweight and 18 percent children of not educated mothers are severely underweight. 29.6 percent children of mothers having incomplete secondary education attainment are underweight whereas 9.6 children of this category are severely underweight. 16 percent children of mothers having completed secondary and higher education attainment are underweight whereas 9.3 children are severely underweight in this category. 1.3 percent children of mothers having completed secondary and higher education attainment are found obese. Higher prevalence of underweight is found in children of not educated mothers than children of mothers having incomplete secondary, complete secondary & higher education attainment but on other hand prevalence of obesity in children of mothers having complete secondary & higher education attainment is higher than the children of not educated mothers.

Higher prevalence of underweight is found in children whose birth order is three and above (45.6 percent) than the children whose birth order is one and two (35.5 percent). 18 percent children whose birth order is three and above are severely underweight whereas 13 percent children whose birth order is up to two are severely

Table 4.4 Percentage distribution of underweight children under five years of age in Rajasthan, NFHS-3, 2005-06

Background Characteristic		Weight-for-age			
		Z-score			
		-3	-2	2	TOTAL
BMI of Mother	Underweight	16.00	43.4	0.3	686
	Normal	15.9	39.3	0.4	988
	Overweight	5.6	33.8	*	71
Mother's Work Status	Not Working	14.8	37.5	0.4	779
	Working	16.3	43.3	0.3	966
Breastfeeding	Within half hour	12.5	37.9	0.4	232
	After half hour	15.9	41.2	0.3	1486
Birth Interval	<36 months	16.8	42.5	0.2	855
	36 months & above	17.3	43.4	0.5	433
Education Attainment of Mother	No education	18.3	46.5	0.3	1202
	Incompleted sec.	9.6	29.6	0.2	469
	Complete sec. & higher	9.3	16	1.3	75
Birth Order	Upto 2	12.9	35.5	0.4	847
	3 & above	18.1	45.6	0.3	897
Age of Child	<12 months	7.6	25.6	1	384
	12-35 months	17.6	44.3	0.3	649
	>35 months	18	45.7	0.3	712
Anaemia of Mother	Severe	14.6	50	*	48
	Mild/Moderate	15	40.1	0.4	975
	Not Anemic	16.3	40.8	0.3	713
Religion	Hindu	14.8	40.4	0.5	1530
	Muslim	20.6	42.71	*	199
	Others	22.2	38.9	*	18
Exposure to Mass Media	No	18.4	46.4	0.3	1041
	Yes	11.8	32.6	0.6	544
Standard of Living Index	Low	22.9	54.3	0.4	506
	Medium	16	39.5	0.6	536
	High	9.8	32	0.2	531
Type of caste or tribe	General	17.2	45.6	0.5	373
	SC	20.9	46.5	0.4	258
	ST	12.2	37.5	0.1	806
	OBC	17.8	38.5	0.6	309
Type of place of residence	Urban	11.4	31.7	*	360
	Rural	16.7	43	0.5	1386
Sex of child	Male	14.7	41.6	0.5	932
	Female	16.5	39.6	0.1	814

Source : Computed from raw data, IIPS, 2007.

* No children was found in this category

underweight. Prevalence of underweight is found higher in children whose birth order is three and above than the children whose birth order is one or two.

Nearby 45 percent children are underweight and 18 percent children are severely underweight who are of age 12-35 months or above 35 months. 25.6 percent children are underweight and 7.6 percent children are severely underweight who are of age under 12 months. Also one percent children under 12 months are found obese. Children under 12 months are having low prevalence of underweight than children of 12 to 35 months and children above 35 months.

Half children of severely anemic mothers are underweight and 14.6 percent children of severely anemic mothers are severely underweight. Nearby 40 percent children of moderate/mild anemic and not anemic mothers are underweight. Prevalence of underweight is higher in children of severely anemic mothers than the children of mild/moderate anemic and not anemic mothers.

Muslim children (42.7 percent) are having high prevalence of underweight than Hindu children (40.4 percent) and children of others (39 percent). Almost 15 percent Hindu children are severely underweight whereas 20.6 percent Muslim children are severely underweight. Muslim children are having higher prevalence of underweight than children of Hindus.

Children whose household is exposed to mass media (32.6 percent) are having higher prevalence of underweight than children whose household is not exposed to mass media (46.4 percent). 18.4 percent children are severely underweight whose household is not exposed to mass media and about 12 percent children are severely underweight whose household in exposed to mass media. Children of households which are exposed to mass media are found less underweight than children of households which are not exposed to mass media.

54.3 percent children having low standard of living, 39.5 percent children belonging to medium standard of living and 32 percent children belonging to high standard of living are underweight. Whereas, 23 percent children belonging to low standard of living, 16 percent children belonging to medium standard of living and 10 percent children

belonging to high standard of living are severely underweight. Prevalence of underweight is highest in children belonging to low standard of living and prevalence of underweight is lowest in children belonging to high standard of living.

46.5 percent ST children and 45.6 percent SC children are underweight and 21 percent ST children and 17 percent children are severely underweight. 38.5 percent General children and 37.5 OBC children are underweight, and 12 percent OBC children and 18 percent general children are severely underweight. Prevalence of underweight is found higher in ST/SC children than OBC and general children.

Prevalence of underweight is higher in rural children (43 percent) than urban children (32 percent). 16.7 percent rural children and 11.4 percent urban children are severely underweight. Rural children are more malnourished (underweight) than urban children.

Male children (41.6 percent) are higher affected with underweight then female children (39.6 percent). 14.7 percent male children 16.5 percent female children are severely underweight. Male children are more malnourished (underweight) than female children.

4.3.3 Prevalence of Wasting in Children of Rajasthan

Prevalence of wasting in children of underweight and normal mothers is almost at same levels. 28 percent children of mothers having normal body mass index and 29 percent children of underweight mothers are wasted. Nearby seven percent children of normal and underweight mothers are severely wasted. 2.4 percent children of normal mothers are also found obese. Children of overweight mothers are found little bit healthier as 15 percent children of overweight mothers are wasted whereas nearby 5.6 percent children of overweight mothers are severely wasted. Children of overweight mothers are less wasted than children of normal and underweight mothers.

2.3 percent children of not working mothers are obese. 27.7 percent children of working mothers are wasted whereas 7 percent children are severely wasted of working mothers. On other hand 28.2 percent children of Not Working mothers are wasted and nearby 7.6 percent children of not working mothers are severely wasted. Prevalence of wasting was found little higher in children of not working mothers than children of working mothers.

Three percent children are found obese who are breastfed within half hour of their birth. Children who are breastfed within half hour and after half hour are wasted at same level as nearby 28 percent children are wasted in both types of breastfeeding practices. Also 7.5 percent children are severely wasted who are breastfed after half hour and 6.4 percent children are found severely wasted who are breastfed within half hour of their birth. No significant impact was found of breastfeeding practices as the prevalence of wasting is almost at same levels in the children who are breastfed within half hour and after half hour.

Prevalence of wasting in children whose birth interval is less than 36 months is 28.5 percent and the prevalence of wasting in children whose birth interval is 36 months & above is 31.3 percent. Eight percent children are severely wasted in both categories whose birth interval is less than 36 months and whose birth interval is 36 months and above. Prevalence of wasting is higher in the children whose birth interval is 36 months or above than children whose birth interval is less than 36 months.

29 percent children are wasted and 7.6 percent children are severely wasted whose mothers are not educated. 26 percent children are wasted and 6 percent children are severely wasted whose mothers are educated up to incomplete secondary levels. On other hand 25 percent children are wasted and ten percent children are severely wasted whose mothers have completed secondary level or higher educated. 2.3 percent children are obese whose mothers have incomplete secondary level education whereas 2.6 percent children are obese whose mothers have complete secondary and higher level of education attainment. The prevalence of wasting falls with increasing education attainment. Low levels of wasting are found in the children of mothers who have completed their secondary and are higher educated in comparison of not educated mothers.

More than one-fourth (25.3 percent) children are wasted and 6 percent children are severely wasted whose birth order is up to two. 30.4 percent Children of Birth Order three and above are wasted and nearby 8.5 percent children are severely wasted whose birth order is three and above. 2.5 percent children are obese whose birth order is one

Table 4.5 Percentage distribution of wasting children under five years of age in Rajasthan, NFHS-3, 2005-06

Background Characteristic		Weight-for-height			
		Z-score			
		-3	-2	2	TOTAL
BMI of Mother	Underweight	7	29	0.7	685
	Normal	7.6	28	2.4	988
	Overweight	5.6	15.4		71
Mother's Work Status	Not Working	7.6	28.2	2.3	778
	Working	7	27.7	1.1	967
Breastfeeding	Within half hour	6.4	28.3	3	233
	After half hour	7.5	27.9	1.4	1487
Birth Interval	<36 months	8	28.5	1.3	855
	36 months & above	7.9	31.3	1.4	433
Education Attainment of Mother	No education	7.6	29.1	1.3	1201
	Incompleted sec.	6.2	25.8	2.3	469
	Complete sec. & higher	10.5	24.9	2.6	76
Birth Order	Upto 2	6	25.3	2.5	847
	3 & above	8.5	30.4	0.9	898
Age of Child	<12 months	7.8	32	3.4	385
	12-35 months	6.8	28.7	1.1	649
	>35 months	7.4	24.9	1.3	712
Anaemia of Mother	Severe	4.3	32	2.1	47
	Mild/Moderate	7.6	28.7	1.6	975
	Not Anemic	7.3	27	1.5	712
Religion	Hindu	6.8	26.9	1.8	1529
	Muslim	10.5	35.5	1	200
	Others	16.7	39		18
Exposure to Mass Media	No	7.1	28.3	1.3	1040
	Yes	7.7	27.9	1.8	544
Standard of Living Index	Low	8.9	33.2	0.8	506
	Medium	5.2	24.2	2	538
	High	8.1	28.2	1.7	532
Type of caste or tribe	General	7.5	29.5	0.5	372
	SC	7.7	34.7	0.8	259
	ST	5.1	21.6	2	805
	OBC	12.3	36.3	2.9	309
Type of place of residence	Urban	8.9	30	1.4	361
	Rural	6.9	27.4	1.7	1386
Sex of child	Male	7.4	28.4	2	933
	Female	7.1	27.2	1.2	813

Source : Computed from raw data, IIPS, 2007.

and two. Prevalence of wasting in children whose birth order is up to two is low than the children of higher (three and above) birth orders.

Prevalence of wasting in children less than 12 months is 32 percent whereas 7.8 percent children up to 12 months are severely malnourished. More than one-fourth (28.7 percent) children of 12 to 35 months are wasted whereas 6.8 percent children are severely wasted in this category. Nearby one-fourth Children of above 35 months are wasted and 7.4 percent children are severely wasted who are above 35 months. Children below 12 months are highest wasted and children above 35 months are lowest wasted.

28.7 percent children of mild/moderate and 27 percent children of not anemic mothers are wasted and about seven percent children of mild/moderate and not anemic mothers are severely wasted. 32 percent children of severely anemic mothers are wasted whereas 4.3 percent children are severely wasted whose mothers are severely anemic. Also two percent children of severely anemic mothers are obese. Prevalence of wasting in children whose mothers are severely anemic is higher than children of moderate/mild anemic and not anemic mothers.

Prevalence of wasting is higher in Muslim children (35.5 percent) than Hindu children (27 percent). 10.5 percent Muslim children and 6.8 percent Hindu children are severely wasted. Muslim children are more wasted than Hindu children.

There is almost negligible impact of exposure to mass media on prevalence of wasting. Nearby 28 percent children are wasted whose household is exposed and not exposed to mass media. 7.7 percent children whose household is exposed to mass media and 7.1 percent children whose household in not exposed to mass media are severely wasted.

About 33 percent children are wasted and 9 percent children are severely wasted who falls in low standard of living. Nearby One-fourth children are wasted in medium standard of living whereas 5 percent children are severely wasted in this category. 28 percent children are wasted in high standard of living and 8 percent children are severely wasted in this category. 1.7 percent children falling in high standard of living and two percent children falling in medium standard of living are obese. The prevalence of

wasting is highest in children of low standard of living and lowest in medium standard of living.

Prevalence of wasting is found highest in general category children followed by ST and SC children. OBC children have lowest prevalence of wasting. Nearby 35 percent ST children are wasted and 7.7 percent ST children are severely wasted. 29.5 percent SC children are wasted and 7.5 percent SC children are severely wasted. 21.6 percent OBC children are wasted whereas 5.1 percent OBC children are severely wasted. 36 percent General category children are wasted and 12 percent General category children are severely wasted.

Prevalence of wasting in urban children (30 percent) is higher than that of rural children (27.4 percent). Also 7 percent children are severely wasted from rural areas and 9 percent children from urban background are severely wasted. Prevalence of wasting is higher in children of urban background than children of rural background.

28.4 percent male children are wasted whereas 27.2 percent female children are wasted. 7 percent female children are wasted and 7.4 percent male children are severely wasted. Also 2 percent male children are obese whereas 1.2 female children are obese. Although little difference but prevalence of wasting is higher in male children than female children.

3.4 Effect of Demographic and Socio-Economic Variables on Child Malnutrition in Rajasthan

4.4.1 Effect of Independent Variables on Stunting

Body mass Index has high significant impact on stunting of children. Controlling all other factors, children of normal mothers are 5 percent less likely and children of overweight mothers are 22 percent less likely to be stunted than children of underweight mothers.

Mother's work status has high significant affect on stunting of children. Controlling all other factors, Children of working mothers are 1.06 times more likely to be stunted than children of not working mothers.

Table 4.6 Odds ratios from logistic regression analysis of the likelihood of stunting in children under age five years, Rajasthan, 2005-06

Predictor Variables		Height-for-age	
		exp (b)	sig.
BMI of Mother	Underweight ®		
	Normal	.955	.713
	Overweight	.785	.476
Mother's Work Status	Not Working ®		
	Working	1.065	.634
Breastfeeding	Within half hour ®		
	After half hour	1.023	.897
Birth Interval	<36 months ®		
	36 months & above	.878	.306
Education Attainment of Mother	No education ®		
	Incompleted sec.	.627	.004
	Completed sec. & higher	.091	.000
Birth Order	Upto 2 ®		
	3 & above	1.212	.773
Age of Child	<12 months ®		
	12-35 months	3.475	.000
	>35 months	2.948	.000
Anaemia of Mother	Severe ®		
	Mild/Moderate	.660	.275
	Not Anemic	.724	.404
Religion	Hindu ®		
	Muslim	1.367	.121
	Others	5.443	.035
Exposure to Mass Media	No ®		
	Yes	1.224	.294
Standard of Living Index	Low ®		
	Medium	.803	.154
	High	.651	.047
Type of caste or tribe	General ®		
	SC	1.479	.012
	ST	1.696	.002
	OBC	1.185	.210
Type of place of residence	Urban ®		
	Rural	1.587	.000
Sex of child	Male ®		
	Female	.931	.551

® = Reference Category

Source : Computed from raw data, IIPS, 2007.

Breastfeeding practice has highly significant effect on stunting of children. Controlling all other factors, children who are breastfed after half hour of their birth are 1.02 times more likely to be stunted than the children who are breastfed within half hour of their birth.

Birth spacing has high significant impact on stunting of children. Controlling all other factors, children whose birth interval is 36 months & above are 13 percent less likely to be stunted than children whose birth interval is less than 36 months.

Education attainment of mother has significant impact on stunting of children. Controlling all other factors, children of mothers who have incomplete secondary education attainment are 38 percent less likely to be stunted and children of mothers who have completed secondary and higher education attainment are 91 percent less likely to be stunted than children of not educated mothers.

Birth Order of children has highly significant effect on stunting of children. Controlling all other factors, children of birth order three and above are 1.21 times more likely to be stunted than children of birth order up to two.

Age of child has significant impact on stunting of children. Controlling all other factors, children of age 12 to 35 months are 3.4 times more likely and children above 35 months are 2.9 times more likely to be stunted than children of age less than 12 months.

Status of Anemia of mother has high significant impact on stunting of children. Controlling all other factors, Children of mild/moderate anemic mothers are 34 percent and children of not anemic mothers are 28 percent less likely to be stunted than children of severely anemic mothers.

Religion significantly impacts stunting of children. Controlling all other factors, Muslim children are 1.36 times and other children are 5.4 times more likely to be stunted than Hindu children.

Household's exposure to mass media significantly affects child stunting. Controlling all other factors, children whose household is exposed to mass media are four percent less likely to be stunted than children of whose household is not exposed to mass media.

Living standard significantly affects stunting of children. Controlling all other factors, children belonging to medium standard of living household are 20 percent and children belonging to high standard of living household are 35 percent less likely to be stunted than children belonging to low standard of living household.

Significant impact of type of caste or tribe on children on stunting is found. Controlling all other factors, children belonging to SC's are 1.4 times, ST children are 1.7 times and OBC children are 1.18 times more likely to be stunted than general category children.

Type of place or residence has highly significant impact on stunting of children. Controlling all other factors, rural children are 1.6 times more likely to be stunted than urban children.

Sex of child is also highly significant to impact child stunting. Controlling all other factors, female children are 7 percent less likely to be stunted than male children.

4.4.2 Effect of Independent Variables on Underweight

Body mass Index has high significant impact on underweight of children. Controlling all other factors, children of normal mothers are 13 percent less likely and children of overweight mothers are 22 percent less likely to be underweight than children of underweight mothers.

Mother's work status has high significant affect on underweight of children. Controlling all other factors, Children of working mothers are 1.2 times more likely to be underweight than children of not working mothers.

Breastfeeding practice significantly affects underweight of children. Controlling all other factors, children who are breastfed after half hour of their birth are 1.1 times more likely to be underweight than the children who are breastfed within half hour of their birth.

Birth spacing has a positive impact on underweight of children. Controlling all other factors, children whose birth interval is 36 months & above are one percent less likely to be underweight than children whose birth interval is less than 36 months.

Table 4.7 Odds ratios from logistic regression analysis of the likelihood of underweight in children under age five years, Rajasthan, 2005-06

Predictor Variables		Weight-for-age	
		exp (b)	sig.
BMI of Mother	Underweight ®		
	Normal	.870	.263
	Overweight	.883	.714
Mother's Work Status	Not Working ®		
	Working	1.223	.128
Breastfeeding	Within half hour ®		
	After half hour	1.145	.454
Birth Interval	<36 months ®		
	36 months & above	.999	.994
Education Attainment of Mother	No education ®		
	Incompleted sec.	.528	.000
	Completed sec. & higher	.123	.001
Birth Order	Upto 2 ®		
	3 & above	1.004	.976
Age of Child	<12 months ®		
	12-35 months	2.053	.000
	>35 months	1.969	.000
Anaemia of Mother	Severe ®		
	Mild/moderate	.743	.422
	Not anemic	.817	.589
Religion	Hindu ®		
	Muslim	1.005	.979
	Others	3.383	.098
Exposure to Mass Media	No ®		
	Yes	.643	.544
Standard of Living Index	Low ®		
	Medium	.583	.000
	High	.572	.010
Type of caste or tribe	General ®		
	SC	1.330	.067
	ST	1.373	.064
	OBC	.937	.636
Type of place of residence	Urban ®		
	Rural	1.663	.000
Sex of child	Male ®		
	Female	.901	.285

® = Reference Category

Source : Computed from raw data, IIPS, 2007.

Education attainment of mother has significant impact on underweight of children. Controlling all other factors, children of mothers who have incomplete secondary education attainment are 48 percent less likely to be underweight and children of mothers who have completed secondary and higher education attainment are 88 percent less likely to be underweight than children of not educated mothers.

Birth Order of children significantly affects underweight of children. Controlling all other factors, children of birth order three and above are 1.004 times more likely to be underweight than children of birth order up to two.

Age of child has significant impact on underweight of children. Controlling all other factors, children of age 12 to 35 months are 2.05 times more likely and children above 35 months are 1.9 times more likely to be underweight than children of age less than 12 months.

Status of Anemia of mother has high significant impact on underweight of children. Controlling all other factors, Children of mild/moderate anemic mothers are 26 percent and children of not anemic mothers are 19 percent less likely to be underweight than children of severely anemic mothers.

Impact of religion on underweight of children is highly significant. Controlling all other factors, Muslim children are 1.005 times more likely to be underweight than Hindu children and other children are 3.3 times more likely to be underweight than Hindu children.

Household's exposure to mass media significantly affects child underweight. Controlling all other factors, children whose household is exposed to mass media are 36 percent less likely to be underweight than children of whose household is not exposed to mass media.

Standard of living has a positive impact on underweight of children. Controlling all other factors, children belonging to medium standard of living household are 42 percent and children belonging to high standard of living household are 13 percent less likely to be underweight than children belonging to low standard of living household.

Significant impact of type of caste or tribe on children on underweight is found. Controlling all other factors, children belonging to SC's and ST's are 1.3 times more likely to be underweight than the general category children. OBC children are seven percent less likely to be underweight than general category children.

Type of place or residence has significant impact on underweight of children. Controlling all other factors, rural children are 1.66 times more likely to be underweight than urban children.

Sex of child is also significantly impact child underweight. Controlling all other factors, female children are 9 percent less likely to be underweight than male children.

4.4.3 Impact of Independent Variables on Wasting

Body mass Index has high significant impact on wasting of children. Controlling all other factors, children of normal mothers are 5 percent less likely and children of overweight mothers are 53 percent less likely to be wasted than children of underweight mothers.

Mother's work status has high significant affect on wasting of children. Controlling all other factors, Children of working mothers are four percent less likely to be wasted than children of not working mothers.

Breastfeeding practice significantly affects wasting of children. Controlling all other factors, children who are breastfed after half hour of their birth are 16 percent less likely to be wasted than the children who are breastfed within half hour of their birth.

Birth spacing has high significant impact on wasting of children. Controlling all other factors, children whose birth interval is 36 months & above are 1.09 times more likely to be wasted than children whose birth interval is less than 36 months.

Education attainment of mother has high significant impact on wasting of children. Controlling all other factors, children of mothers who have incomplete secondary education attainment are five percent less likely to be wasted and children of mothers who have completed secondary and higher education attainment are 36 percent less likely to be wasted than children of not educated mothers.

Table 4.8 Odds ratios from logistic regression analysis of the likelihood of wasting in children under age five years, Rajasthan, 2005-06

Predictor Variables		Weight-for-height	
		exp (b)	sig.
BMI of Mother	Underweight®		
	Normal	.959	.768
	Overweight	.478	.134
Mother's Work Status	Not Working®		
	Working	.967	.593
Breastfeeding	Within half hour ®		
	After half hour	.842	.294
Birth Interval	<36 months ®		
	36 months & above	1.098	.521
Education Attainment of Mother	No education ®		
	Incompleted sec.	.951	.699
	Completed sec. & higher	.644	.172
Birth Order	Upto 2 ®		
	3 & above	1.047	.687
Age of Child	<12 months ®		
	12-35 months	.739	.090
	>35 months	.564	.002
Anaemia of Mother	Severe ®		
	Mild/moderate	.683	.239
	Not anemic	.623	.149
Religion	Hindu ®		
	Muslim	1.359	.177
	Others	.919	.918
Exposure to Mass Media	No ®		
	Yes	.969	.807
Standard of Living Index	Low ®		
	Medium	.877	.466
	High	.863	.561
Type of caste or tribe	General ®		
	SC	1.297	.162
	ST	1.033	.088
	OBC	1.256	.201
Type of place of residence	Urban ®		
	Rural	1.073	.753
Sex of child	Male ®		
	Female	.915	.523

® = Reference Category

Source : Computed from raw data, IIPS, 2007.

Birth Order of children significantly affects wasting of children. Controlling all other factors, children of birth order three and above are 1.04 times more likely to be wasted than children of birth order up to two.

Age of child has significant impact on wasting of children. Controlling all other factors, children of age 12 to 35 months are 27 percent less likely and children above 35 months are 44 percent less likely to be wasted than children of age less than 12 months.

Status of Anemia of mother has high significant impact on wasting of children. Controlling all other factors, Children of mild/moderate anemic mothers are 32 percent and children of not anemic mothers are 38 percent less likely to be wasted than children of severely anemic mothers.

Impact of religion on wasting of children is highly significant. Controlling all other factors, Muslim children are 1.3 times more likely to be wasted than Hindu children and other children are nine percent less likely to be wasted than Hindu children.

Household's exposure to mass media significantly affects child wasting. Controlling all other factors, children whose household is exposed to mass media are four percent less likely to be wasted than children of whose household is not exposed to mass media.

Standard of living has a positive impact on wasting of children. Controlling all other factors, children belonging to medium standard of living household are 13 percent and children belonging to high standard of living household are 14 percent less likely to be wasted than children belonging to low standard of living household.

There is significant impact of type of caste or tribe on children on wasting. Controlling all other factors, children belonging to SC's are 1.3 times, ST children are 1.03 times and OBC children are 1.25 times more likely to be wasted than general category children.

Type of place or residence has highly significant impact on wasting of children. Controlling all other factors, rural children are 1.07 times more likely to be wasted than urban children.

Sex of child is also highly significant to impact child wasting. Controlling all other factors, female children are 9 percent less likely to be wasted than male children.

4.5 Summary of findings

The results shows that children of Rajasthan found better on weight for height conditions but the main prevalence of malnutrition is found due to retarded growth of height which is sign of long term insufficient food intake. Among socio-economic conditions standard of living index and, type of place of residence and caste or tribe found most affective. Very low variation for child malnutrition among children of different religion was found and almost negligible difference was found between both sexes. Children of high standard of living were found in better condition of nutrition than children of poor and poorest section. Highest prevalence of malnutrition was found among children of schedule tribes followed by schedule castes. Children of urban residence were found in better nutritional conditions than children of rural residence. Mother's health had a direct effect on nutritional condition of children. Children of underweight, uneducated and severe anaemic mothers were found highly malnourished whereas low prevalence of child malnutrition was found in high educated, not anaemic and overweight mothers. Children of lower birth orders were found in better position of nutrition than the children of higher birth orders. Children less than twelve months are found in better position of nutrition than children of higher ages. Children aged 36-59 months were found worst malnourished.

CHAPTER 5

Conclusion

High level of malnutrition among children is a major problem in every part of India. It should also be mentioned in this context that malnutrition among children mostly occurs during the first two years of life, which remains virtually irreversible after that because more than 90 percent of the brain actually develops during the first two years of life (Gupta and Rhode 2004). Therefore malnutrition during the early years of life impairs cognitive development, intelligence, strength, energy and productivity of the children, which results in less productivity, physical stamina and endurance in adult life. Most of the malnourished children fail to achieve their genetically destined potential in physical growth and bodily dimensions. In addition, such malnourished children may also suffer from various disorders related to the deficiency of various nutrients, which in turn affects their risk of morbidity and mortality in later years of life. Thus if we have to ensure the quality of future human resource of the country, we have to turn our attention to the children of today as malnutrition among children under three years of age can be a major obstacle in the future development process. It is observed that by improving child nutritional status, the children grow up to be healthy adults and thus become human resources who help in raising the productivity which in turn leads to economic growth. The economic growth of the country leads to poverty reduction and increase in investment in social sector which in turn raises child nutritional status and helps in further development and progress of the country.

In September 2000, the world leaders representing 189 countries adopted United Nations Millennium Declaration, calling for stronger global efforts to reduce poverty and improve health. Reducing child mortality was one of the goals of the MDG's in Rajasthan and to reduce child mortality, reduction of child malnutrition by two-third during 1990-2015. No doubt, Rajasthan had made a good progress and reduction of child malnutrition was observed in three National Family Health Surveys but to complete the target of reduction of child malnutrition by two-third from 1990 level, state need to focus on food, health and education infrastructure.

Impact of independent variables on stunting was found on large scale. Body mass index has a crucial role in determining the child health. Children of overweight mothers are less stunted than children of normal and underweight mothers. Prevalence of underweight is lower in children of overweight mothers than underweight and normal mothers. Children of overweight mothers are less wasted than children of normal and underweight mothers. Children of overweight mothers were found less malnourished than children of underweight and normal BMI mothers.

Work status of mother also determines prevalence of child malnutrition. Prevalence of stunting was found higher in children of working mothers. Children of working women are having higher prevalence of underweight than children of not working women. Prevalence of wasting was found little higher in children of not working mothers than children of working mothers. Conclusively Prevalence of underweight and stunting was found higher in children of working mothers whereas prevalence of wasting was found higher in children of not working mothers.

Significant impact of breastfeeding practices on prevalence of underweight was found whereas according to results little or no impact of breastfeeding was found on wasting and stunting in children in Rajasthan. The prevalence of stunting is almost at same levels in the children who are breastfed within half hour and after half hour. Children who are breastfed after half hour of birth are having higher prevalence of underweight than the children who are breastfed within half hour of birth.

Children born after the gap of 36 months or above preceding a child tends to be less malnourished than the children having birth interval less than 36 months. Although there is little difference but prevalence of stunting is less in the children whose birth interval is 36 months or above. Prevalence of wasting is higher in the children whose birth interval is 36 months or above than children whose birth interval is less than 36 months.

Level of education attainment is having high impact on prevalence of child malnutrition in Rajasthan. The prevalence of child malnutrition falls with increasing levels of education attainment. Very low level of stunting is found in the children of mothers who have completed their secondary and are higher educated in comparison of not educated

mothers. Higher prevalence of underweight is found in children of not educated mothers than children of mothers having incomplete secondary, complete secondary & higher education attainment but on other hand prevalence of obesity in children of mothers having complete secondary & higher education attainment is higher than the children of not educated mothers. The prevalence of wasting falls with increasing education attainment. Low levels of wasting are found in the children of mothers who have completed their secondary and are higher educated in comparison of not educated mothers.

First two children of a mother are tending to found healthier than children of higher birth orders. Prevalence of stunting in children whose birth order is up to two is low than the children of higher (three and above) birth orders. Prevalence of underweight is found higher in children whose birth order is three and above than the children whose birth order is one or two. Prevalence of wasting in children whose birth order is up to two is low than the children of higher (three and above) birth orders.

Prevalence of malnutrition in children in first twelve months of their birth is lower than the later age i.e. up to 59 months. Children below 12 months are less stunted than children of 12 months and above. Children under 12 months are having low prevalence of underweight than children of 12 to 35 months and children above 35 months. Children below 12 months are highest wasted and children above 35 months are lowest wasted. Prevalence of underweight and stunting is lower and wasting is higher in children of age below 12 months than children of age 12-59 months.

Malnutrition is highly prevalent in children of severely anemic mothers. Prevalence of stunting in children whose mothers are severely anemic is higher than children of moderate/mild anemic and not anemic mothers. Prevalence of underweight is higher in children of severely anemic mothers than the children of mild/moderate anemic and not anemic mothers. Prevalence of wasting in children whose mothers are severely anemic is higher than children of moderate/mild anemic and not anemic mothers.

Muslim children are more stunted than Hindu children. Muslim children are having higher prevalence of underweight than children of Hindus. Muslim children are more

wasted than Hindu children. Muslim children were found more malnourished than Hindu children.

Prevalence of stunting is higher in the children whose household is not exposed to mass media. Children of households which are exposed to mass media are found less underweight than children of households which are not exposed to mass media. Prevalence of malnutrition was higher in children whose household was not exposed to mass media than the children whose household is exposed to mass media.

Children of low standard living index were found more malnourished than children of medium and high standard of living. The prevalence of stunting in children increases with decreasing in standard of living index i.e. the highest prevalence of stunting is found in low standard of living and lowest prevalence of stunting is found in high standard of living. There is almost negligible impact of exposure to mass media on prevalence of wasting. Prevalence of underweight is highest in children belonging to low standard of living and prevalence of underweight is lowest in children belonging to high standard of living. The prevalence of wasting is highest in children of low standard of living and lowest in medium standard of living.

General and OBC category children were found healthier than ST and SC children. Prevalence of stunting is found highest in the children of schedule tribes followed by schedule caste and OBC children. General category children have lowest prevalence of stunting. Prevalence of underweight is found higher in ST/SC children than OBC and general children. Prevalence of wasting is found highest in general category children followed by ST and SC children. OBC children have lowest prevalence of wasting.

Prevalence of stunting is higher in children of rural background than children of urban background. Rural children are more malnourished (underweight) than urban children. Prevalence of wasting is higher in children of urban background than children of rural background.

Little difference was found in prevalence of malnutrition in male and female children. Male children are found more malnourished than female children. Although little difference but prevalence of stunting is higher in male children than female children.

Male children are more malnourished (underweight) than female children. Although little difference but prevalence of wasting is higher in male children than female children.

Most developing countries have experienced important decreases in child mortality rates over three decades. As greater numbers of children survive, it becomes critical to pay closer attention to the strong relationship between nutritional status and children's ability to achieve optimal physical growth and psychological development. Impaired growth and development in children can affect the rest of their lives and compromise academic performance and the ability to achieve optimal physical growth and development in children can affect the rest of their lives and compromise academic performance and the ability to contribute to society. Investment in interventions aimed at improving physical growth and mental development in children can be expected not only to decrease the prevalence of stunting but also to prevent its negative functional consequences throughout the life cycle. There is a great need to focus the attention of policy-makers on the nutritional status of children as one of the main indicators of development and as a precondition for the socio-economic advancement of societies in the long term. Good nutrition during pregnancy ensures a healthier baby. WHO recommends exclusive breastfeeding for six months, introducing age-appropriate and safe complementary foods at six months, and continuing breastfeeding for up to two years or beyond. About 20% of deaths among children under-five worldwide could be avoided if these feeding guidelines are followed. Appropriate feeding decreases rates of stunting and obesity and stimulates intellectual development in young children.

Conclusively certain sections of children like ST/SC children, Muslim children, children belonging to low standard of living and rural areas should be focussed. Also mothers who are not educated, severe anaemic and having lower Body Mass Index should given be more focus in order to bring the levels of child malnutrition low. Also there is need for the programmes which could aggressively campaign for right food habits and implementation of family planning programme in the state. Reproductive child health should be given more focus in order to bringing Rajasthan's maternal and child health in good state.

BIBLIOGRAPHY

- Agarwal, K. N. et al., 1991. *Growth performance of affluent Indian children (under-fives): Growth standards for Indian children.* New Delhi: **Nutrition Foundation of India.**
- Ahmed, T. and Ahmed, A. M. S. (2006) " *Undernutrition in late infancy and early childhood (6-24 Months) and associated factors: Bangladesh Experience,"* **Nutrition Foundation of India:** 26-31
- Alderman, Harold et al., 2001. *"Child health and school enrolment" A longitudinal analysis,"* **Journal of Human Resources** 36(1): 185-204.
- Anthony, Grace Maria et al., 2001. *"Suitability of HDI for assessing health and nutritional status,"* **Economic and Political Weekly** 36(31): 2976-2979.
- Arnold, Fred, Parveen Nangia and Umesh Kapil. 2004. *"Indicators of nutrition for women and children: Current status and recommendations,:* **Economic and Political Weekly** *39(7): 664-670.*
- Bairagi, R. 1986. *"Food crisis, nutrition, and female children in rural Bangladesh,"* **Population and Development Review** 12: 307-315
- Barkley J, Newton C, Maitland K. (2005). *Severe malnutrition assessment in children in rural Kenya*, JAMA, 294: 2577.
- Basu, A. M. 1989. *"Is discrimination in food really necessary for explaining sex differentials in childhood morality?"* **Population Studies 43: 193-210.**
- Bender, Williams and Margaret Smith. 1997. *"Population, food and nutrition,"* **Population Bulletin** 51(4): 2-48.
- Bhende, A.A. and Kanitkar, T. 2006. *Principles of Population Studies.* New Delhi, Himalaya Publishing House.
- Bhuiya, A., S. Zimicki and S. D'Souza. 1986. *"Socio- economic differentials in child nutrition and morbidity in a rural area of Bangladesh,"* **Journal of Tropical Paediatrics** 32: 17-23.

- Bishnoi P, Sehgal K, Kwatra A (2004), *Anthropometric measurements of preschool children as efectedted by socioeconomic factors.* Asia Pacific Journal Clinic Nutrition; 13 (Suppl.): S132.
- Blossner M, De Onis M, Uauy R (2006), *Estimating stunting from underweight survey data. In: Bose K edt. Culture, Nutrition, Health and Disease.* J Hum Ecol. (Special Issue no. 14), Chapter 20. Delhi : Kamal Raj Enterprise.
- Bobby J, Rebello A, Kullu P, Raj VD. *Prevalence of malnutrition in rural Karnataka, South India: a comparison of anthropometric indicators.* Journal Population Health and Nutrition, 2002;20:239-44.
- Botha, M.E. 1989. *"Theory Development in Perspective: The role of Cenceptual Frameworks and Models in Theory Development",* **Journal of Advanced Nursing** 14(1): 49-55.
- Brennan, Lance, John McDonald and Ralph Shlomiwitz. 2003. *"A statistical study of malnutrition: The puzzle of wasting,"* **Demography India** 32(2): 161-169.
- Bryk AS, Raudenbush SW. Hierarchical linear models: applications and data analysis methods. Newbury Park, CA, Sage Inc., 1992.
- Caldwell, J.C. 1986. *"Routes to low mortality in poor countries",* Population and Development Review 12(2): 171-219.
- Chandana, R.C. 2002. *"Geography of Population: Concepts, Determinants and Patterns,"* New Delhi, Kalyani Publishers.
- Chatterjee, and Saha S, (2008), *A study on knowledge and practice of mothers regarding infant feeding and nutritional status of under-five children attending immunization clinic of a medical college.* Internet Journal: Nutrition and Wellness, vol. 5, no.1.
- Desai, S. and D. Jain. 1994. *"Maternal employment and changes in family dynamics: The Social context of women's work in rural South India,"* **Population and Development Review** 20: 115-136.
- Desai, S. and S. Alva. 1998. *"Maternal education and child health: Is there a strong causal relationship?"* **Demography** 35:71-81
- Devadas, R. P. 1993. *"Nutritional challenges India faces today",* Indian Journal of Nutrition and Dietetics, 30: 271- 278

- Dubey, O.P., and Shyama Koley. 1997. *"Food and nutrition in Samanpur village, Sagar district, Madhya Pradesh: An empirical study,"* **Geographical Review of India** 59(1): 82-86.
- EDHS (2005). *"Nutritional Status and Anemia levels,"*: 169-187.
- Ei- Ghorab, M. And Gabr M. 1994. *"Communication and Nutrition Education"* in Margaret, R. B. And Mamdough, G. (ed.) *Nutrition in the Nineties: Policy Issues,* Delhi, Oxford University Press*: Pp. 125-138..*
- *Fourth report on the world nutrition situation.* Geneva, United Nations Administrative Committee on Coordination/ Sub-Committee on Nutrition, 2000.
- Frongillo EA, de Onis M, Hanson KMP. *Socioeconomic and demographic factors are associated with worldwide patterns of stunting and wasting of children.* Journal of Nutrition, 1997, 127: 2302–2309.
- Geetha, S., and Mudhura Swaminathan. 1996. *"Nutritional status of slum children in Mumbai: A socio economic survey,"* **Economic and Political Weekly** 31(4): 896-906.
- Glewive, Paul et al., 2001. *"Early childhood nutrition and academic achievement: A longitudinal analysis,"* **Journal of public economics** 81(3): 345-368.
- Glick, peter, and David E. Sahn. 1998. *"Maternal labour supply and child nutrition in West Africa,"* **Oxford Bulletin of Economics and Statistics** 60(33): 325-355.
- Gopalan, C. 1984. *Nutrition and healthcare- Problems and policies.* Special Publication Series. New Delhi: Nutrition Foundation of India.
- Gopalan, C. 1987. *"Heights of populations- An index of their nutrition and socio-economic development,"* **Bulletin of Nutrition Foundation of India** 8:1-5.
- Gopalan, c. 1989. *Nutrition, health and national development.* Special Publication Series 4. New Delhi: Nutrition Foundation of India.
- Gopalan, C. 1995. *"Towards food and nutrition security,"* **Economic and Political Weekly** 30(52): A 134- A141.
- Government of India. 1993. *National Nutrition Policy.* Department of Women and Child Development: Ministry of Human Resource Development.

- Gupta, Arun and Jon E. Rohde. 2004. *"Infant and young child undernutrition: Where lies the solution?"* **Economic and Political Weekly** 39(49): 5213-5216.
- Handa, Sudhanshu. 1999. *"Maternal education and child health,"* **Economic Development and Cultural Change** 47(2): 421-439.
- Haq, E. 2007. *Sociology of Population in India,* New Delhi, Macmillan India Ltd.
- Haughton, Dominique and Jonathan Haughton, 1997. *"Explaining child nutrition in Vietnam,"* **Economic Development and Cultural Change** 45(3): 541-546.
- Howard, D. Leathers and Phillips Foster. 2005: *World Food Problem,* New Delhi, Lynne Rienner Publishers.
- International Institute for Population Sciences, 2000. *National Family Health Survey-2,* India, 1989-99. Mumbai.
- International Institute for Population Sciences, 2007. *National Family Health Survey-3,* India, 2004-06. Mumbai.
- Jean- Gerard Pelletier. 1993. *Children in the Tropics, Severe Malnutrition: A Global Approach,* No. 208-209.
- Jilliffe, D.B. 1966. *The assessment of the nutritional status of the community",* World Health Organization.
- Kanungo, Jyotirmayee and Dibya Lochan Mohanta. 2004. *"Reproductive and child healthcare status of different social groups of India: An investigation into NFHs-2,"* **Man in India** 84(1-2): 15-31
- Kaur G, Sing Kang H, Singal P and Sing SP. (2005). *Nutritional status : Anthropometric perspective of preschool children.* Anthropologist. 7(2) : 99-103.
- Khader, Vijaya. 1999. *"Impact of women's supplementary income on family's nutritional status,"* **Indian Journal of Social Work** 60(3): 368-378.
- Klasen, Stephan. 1996. *"Nutrition, health and mortality in Sub- Saharan Africa: Is there a gender bias?"* **Journal of Development Studies** 32(6): 919-932.
- Kumari S, (2005) *Nutritional status of scheduled caste pre-school children.* Indian Journal on Public Health 49: 258-259.
- Lee RD, Nieman DC (2003), *Nutritional Assessment.* New York: McGraw Hill.

- Lohman, T.G., A.F. Roche, and R. Martorell. *Anthropometric Standardization Reference Manual.* Chicago: Human Kinetics Books, 1988.
- Mahapatra A, Geddam JJ, Marai N, Murmu B, Mallick G, Bulliyya G, Acharya AS, Satyanarayana K (2000) *Nutritional status of preschool children in the drought affected Kalahandi district of Orissa.* Indian J Med Res 111: 90-94.
- Man WDC et al. *Nutritional status of children admitted to hospital with different diseases and its relationship to outcome in the Gambia, West Africa.* Tropical Medicine and International Health, 1998, 3: 1–9.
- Marins VMR, and Almeida RMVR. (2002), *Under-nutrition prevalence and social determinants in children aged 0-59 months.* Niterol, Brazil. Ann. Hum.Biol. 29 : 609-618.
- Martin-Prevel Y, Delpeuch F, Trassac P, Massamba JP, Adoua-Oyila G, Couderet K and TrecheS. (2000), *Determinants in the nutritional status of young children and there mothers in Brazzaville, Congo, following the 1994 devaluation of the CFA franc.* Bull WHO 78 : 108-118.
- Martorell R et al. Obesity in Latin American women and children. *Journal of Nutrition*, 1998, 128: 1464–1473.
- Maytt M, Khara T and Collins S. (2006). *A review of methods to detect cases of severely malnourished children in the community for their admission into community – best therapeutic care programs. Food and Nutrition Bulletin,* Vol.27, NO.3 (supplement), S7-S23, The United Nations University.
- Mishra B and Mishra S. (2007). *Nutritional anthropometry and preschool child feeding practices in working mothers of central Orissa.* Stud. Home. Comm. Sci., 1 (2): 139-144.
- Mishra, V. K., S. Lahiri and N. Y. Luther. 1999. *"Child nutrition in India,"* **National Family Health Survey Subject Reports.** Number 14. Mumbai, India: International Institute of Population Sciences.
- Mosley, W. Henry and Lincoln C. Chen. 1984. *"Child survival: Strategies for research,"* **Population and Development Review** 10: 25-48.

- Navaneetham, K. And Jose, S. 2005. *"Poverty, Malnutrition and Morality in South Asia: A review of Issues and Options"*, Centre for Development Studies, Trivandrum:1-21.
- Nigam, A.K. 2003. *"Determining grades of malnutrition in children: Standard deviation classification and the alternative,"* **Demography of India** 32(1): 137-139.
- *Nutrition in pregnancy and lactation (Geneva:* W.H.O., 1965)
- *Nutrition, health and child development.* Washington, DC, Pan American Health Organization, 1998 (PAHO Scientific Publication No. 566).
- Osmani, S.R. and A. Bhargava. 1998. *"Health and nutrition in Asia,"* **Asian Development Review** 16(1): 31-71.
- **Pande, Rohini P. 2003.** ***"Selective gender differences in childhood nutrition and immunisation in rural India: The role of siblings,"*** **Demography** 40(3): 395-418.
- Pelletier D, Frongillo EA, Habicht JP. Epidemiologic evidence for a potentiating effect of malnutrition on child mortality. *American Journal of Public Health*, 1993, 83: 1130–1133.
- Pelletier DL et al. The effects of malnutrition on child mortality in developing countries. *Bulletin of the World Health Organization*, 1995, 73: 443–448.
- Pelletier DL., 1994 *The relationship between child anthropometry and mortality in developing countries: implications for policy, programs and future research.* Internet Journal: Nutrition and Wellness, 1994; 124:2047-812.
- *Physical status: the use and interpretation of anthropometry.* Geneva, World Health Organization, 1995 (WHO Technical Report Series, No. 854).
- Pollitt E et al. Early supplementary feeding and cognition. *Monographs of the Society for Research in Child Development*, 1993, 58: 1–99.
- Quisumbing, Agnes R. 2003. *"Food aid and child nutrition in rural Ethiopia,"* **World Development** 31(7): 1309-1324.
- Radhakrishna, R. Rao, K. Hanumantha, C. Ravi and B. S. Reddy. 2004. *"Chronic poverty and malnutrition in 1990s,"* **Economic and Political weekly** 39: 3121-3130.
- Raj, H. 2003. *Fundamentals of Demography: population studies with special reference to India,* Delhi, Surjeet Publications.

- Rajaram S, Sunil TS, Zottarelli LK (2003), *Analysis of childhood malnutrition in Kerala and Goa.* J Biosoc Sci 35: 335-351.
- Rajaratnam, Abel et al., 1997. *"Maternal and child health practices and nutritional status of Malto tribes in Bihar,"* **Man in India** 77(1): 29-34.
- Ramachandran, K. 2006. *"Nutrition Monitoring and Surveillance,"* **Nutrition Foundation of India Bulletin** 27(1): 4-7
- Ramachandran, P. 2007. *"Poverty nutrition linkages"*, Indian J Med Res 126: 249-261.
- Reddy, Vinodini, N. Pralhad Rao, J. Gowrinath Sastry and K. Kashinath. 1993. *Nutrition trends in India.* Hyderabad: National Institute of Nutrition.
- Ruel, Marie T. et al., 1999. *"Good care practices can mitigate the negative effects of poverty and low maternal school on children's nutritional status: Evidence from Accra,"* **World Development** 27(11): 1993-2009.
- Sachdev, H. P.S. 1995. *"Assessing child malnutrition,"* Nutrition Foundation of India Bulletin.
- Sachdev, H. P.S. and Panna Choudhury. (ed.). 1994. *Nutrition in children-Developing country concerns.* New Delhi: Cambridge Press.
- Sachdeva HPS (1995), *Assessing child mal-nutrition : some basic issues.* Bulletin of the Nutrition Foundation of India.
- *SAS/STAT software: changes and enhancements through release 6.12.* Cary, NC, SAS Institute Inc., 1997.
- Schroeder DG, Brown KH. Nutritional status as a predictor of child survival: summarizing the association and quantifying its global impact. *Bulletin of the World Health Organization,* 1994, 72: 569–579.
- Scrimshaw(1996), *Nutrition and Health from Womb to Tomb,* Nutrition Today, 31.
- Shields, Patricia and Hassan Tajalli. 2006. *"Intermediate Theory: The missing link in successful Student Scholarship,"* Journal of Public Affairs Education 12(3): 313-334.
- Smith LC, Haddad L. *Explaining child malnutrition in developing countries: a cross-country analysis.* Washington, DC, International Food Policy Research Institute, 1999 (Food Consumption and Nutrition Division, Discussion Paper No. 60).

- Smith, Lisa C. Usha Ramakrishnan, Aida Ndiaye, Lawrence Haddad and Reynaldo Marborell. 2003. *The Importance of Women's Status on Child Nutrition in Developing Countries.* Washington D.C: International Food Policy Research Institute.
- Smyth, R. 2004. *Exploring the usefulness of a conceptual framework as research tool: A researcher's reflections,"* Issues in Educational Research 14: 1-11.
- Social Development Index. 2006. *Indian Social Development Report,* Council for Social Development, New York, Oxford University Press.
- Sommerfelt, A. E. and M.K. Stewart. 1984. *Children's nutritional status. DHS Comparative Studies.* Number 12. Calverton, Maryland: Macro International, Demographic and Health Surveys.
- SPSS Inc. *Advanced Statistical Analysis Using SPSS.* Chicago.
- Spurr GB, Barac-Nieto M, Maksud MG. Productivity and maximal oxygen consumption in sugar cane cutters. *American Journal of Clinical Nutrition*, 1977, 30: 316–321.
- *State of the world's children.* New York, United Nation Children's Fund, 2000.
- Steven, A. 2004. *"Maternal nutrition knowledge and the demand for micronutrient rich foods: Evidence from Indonesia,"* **Journal of Development Studies** 40(6): 82-125.
- *Third report on the world nutrition situation.* Geneva, United Nations Administrative Committee on Coordination/ Sub-Committee on Nutrition, 1997.
- Thomas, Andrian G. 2002. *Malnutrition in childhood- A growing concern, Nutrition and Health-2.* Antwerp- Apeldoorn: Grant Publishers and the Authors.
- Tomkins A, Watson F. *Malnutrition and infection: a review.* Geneva, United Nations Administrative Committee on Coordination/Subcommittee on Nutrition, 1989 (ACC/SCN State-of-the-art Series, Nutrition Policy Discussion Paper No. 5).
- UNICEF. 1984. *The state of the world's children.* New York: Oxford University Press.
- UNICEF. 1997. *Child malnutrition: Progress towards the World Summit for children goal.* Statistics and Monitoring Section Report. New York: Oxford University Press.
- UNICEF. 1998. *The state of the world's children.* New York: Oxford University Press.

- Vaidyanathan, A. 2002. *"Issues in health and nutrition,"* **Indian Economic Journal** 50(2): 35-42.
- Visweswara, Rao K. 1999. *"Nutritional status of newborns and the associated factors,"* **Man in India** 79(1-2): 101-109.
- Wagstaff, A. and N. Watanabe. 2000. *Socioeconomic inequalities in child malnutrition in the developing world.* Washington D.C: World Bank. At http://econ.worldbank.org/1189.pdf
- World Health Organisation. 1986. *"Use and interpretation of anthropometric indicators of nutritional status,"* **Bulletin WHO** 64:929-941.
- World Health Organisation. 2005. *Improving Maternal, Newborn and Child Health in South East Asia Region,* New Delhi..
- World Health Organization (1986), Use *and interpretation of anthropometric indications of nutritional status.* Bull. WHO. 64 : 921-941.
- World Health Organization (1995), Physical Status: The *Use and Interpretation of Anthropometry*: Technical Report Series no. 854. Geneva: World Health Organization.
- *World population prospects.* The 1996 revision. New York, United Nations, 1998.
- Yadav RJ, Singh P (1999), *Nutritional status and dietary intake in tribal children of Bihar.* Indian Pediatr 36: 37-42.