CHILD NUTRITION IN INDIA: A COMPARATIVE STUDY OF TAMIL NADU AND MADHYA PRADESH ON THE BASIS OF NFHS-2

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Dedicated to:

My Beloved Grandfather

Late Annada Prasad Mandal

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J F Kennedy

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Swati Mondal

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CHAPTER 1

INTRODUCTION

A healthy citizen is an asset to the nation. A state of well-being contributes to raise national productivity and improve many social indicators of better living. 'Health is Wealth', is the age-old saying. 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 the opportunities available in the environment' (WHO 1946). 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 of the levels of nutrition, standards of living and the improvements of public health 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 the individual who enjoys a full, rich and wholesome life must have an adequate amount of wholesome food.

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).

Malnutrition is one of the prime causes of morbidity and mortality among young children (Rajaretnam 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 years 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 (Rajaretnam 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).

1.1 SCENARIO OF MALNUTRITION

Malnutrition has long been recognised as a consequence of poverty and are more prevalent in the developing regions of the world. However, malnutrition shows substantial differences even across the developing regions. 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 has the lowest rate and number of malnourished children (Smith and Haddad 2000).

In India, the overall nutritional status of young children is far from satisfactory. According to Swaminathan (1979), a review of studies conducted during the 1960s and 1970s 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 per cent of the children in Kerala and 70 per cent children in Orissa are malnourished (Gopalan 1995). However, by mid 1980s the severe forms of malnutrition related diseases as mentioned above declined. The National Family Health Survey-1 (NFHS-1) of 1992-93 showed that over 50 per cent of the children of age 0-47 months are malnourished and 25 per cent are severely malnourished. NFHS-2 of 1998-99 estimates that nearly half of the children under three years of age in India are

Fig. 1.1 Distribution of underweight children under three years of age by state, NFHS–2, 1998-99

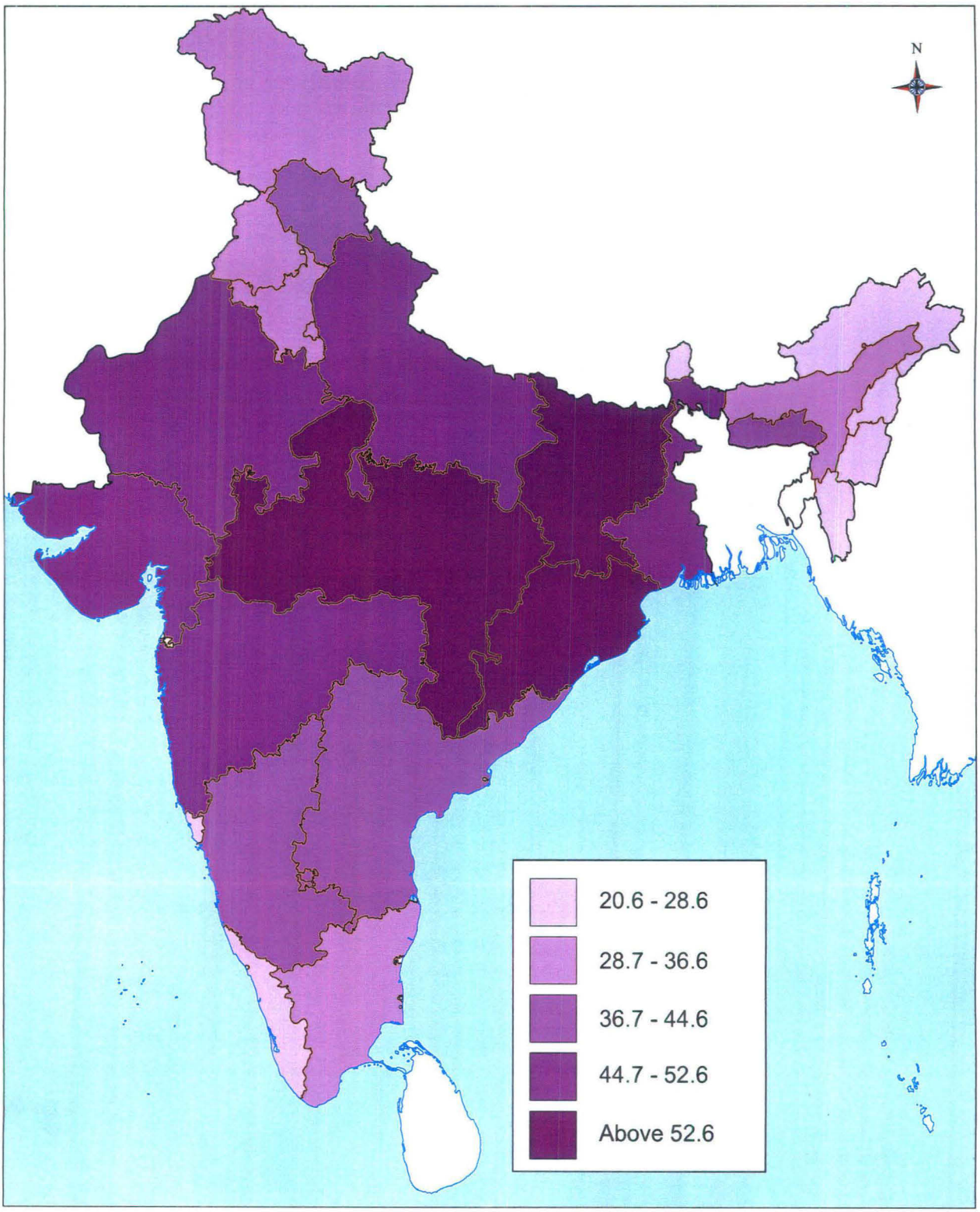


Fig. 1.2 Distribution of stunted children under three years of age by state, NFHS–2, 1998-99

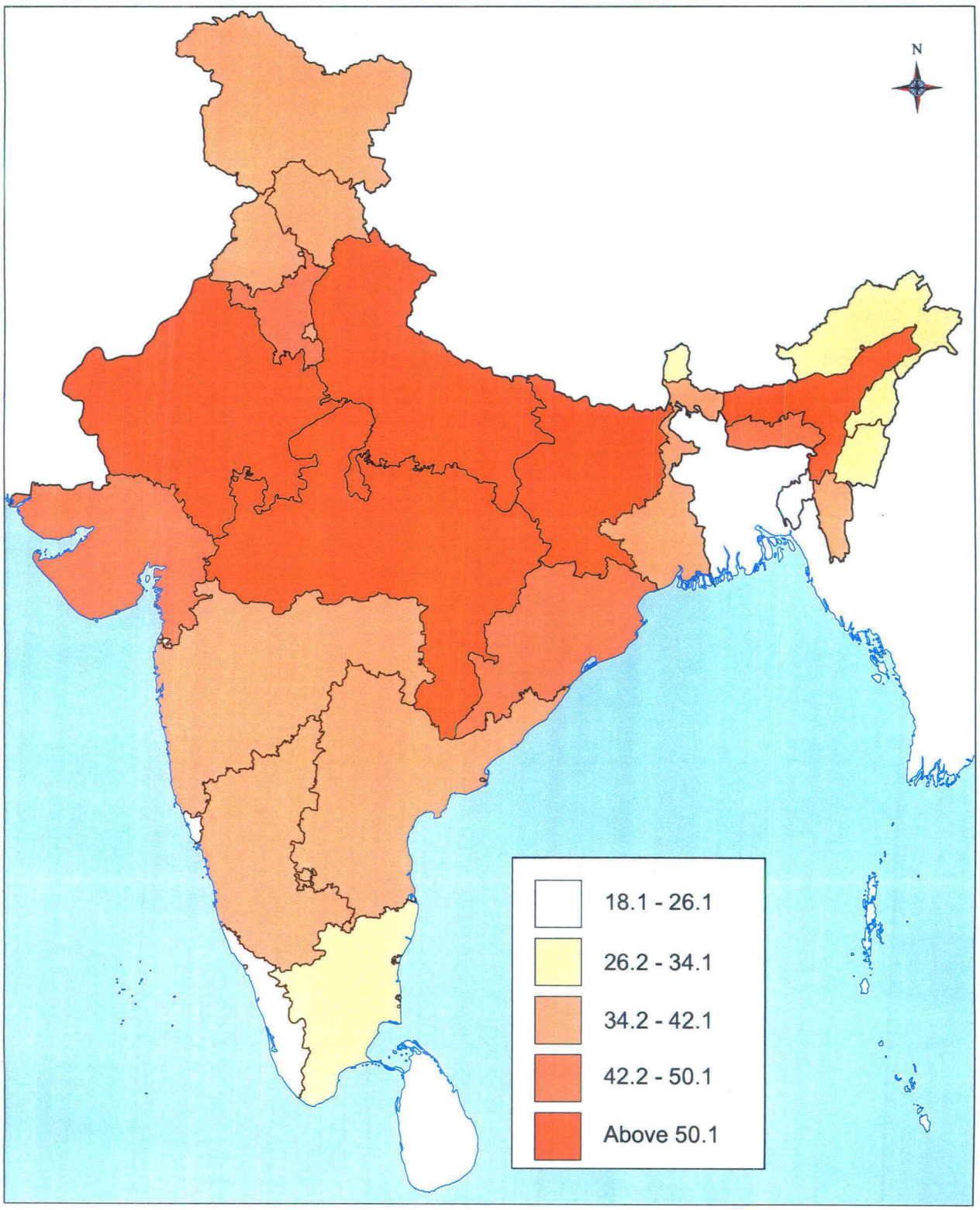
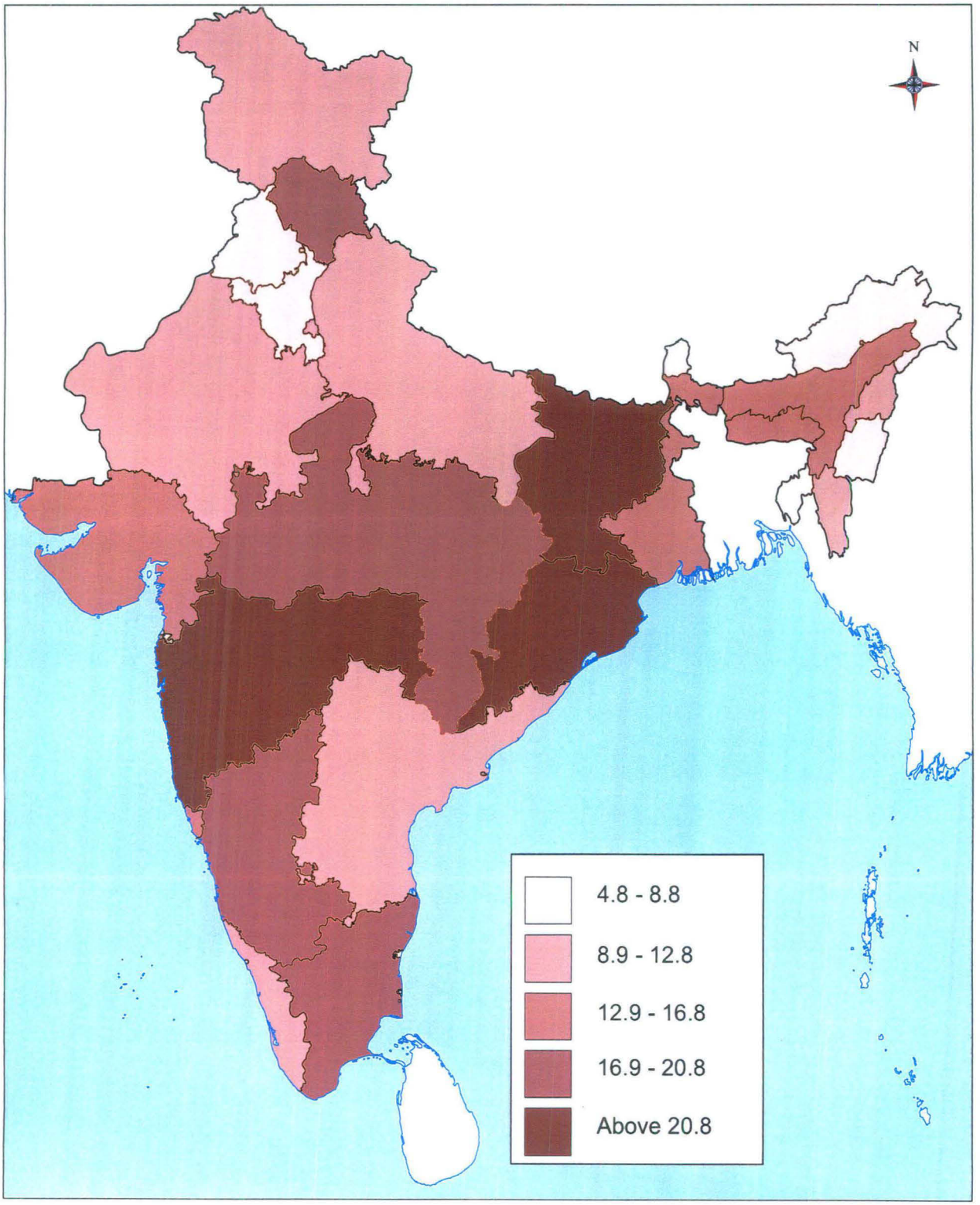


Fig. 1.3 Distribution of wasted children under three years of age by state, NFHS–2, 1998-99



underweight (47 per cent) and stunted (46 per cent) and one in six children are wasted (16 per cent). 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-2 found only one country with a higher level of underweight children than India (Niger), 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'Ivoire, Mali, Niger and Cambodia). Comparison between NFHS-1 and NFHS-2 estimates shows some improvement in nutritional status (e.g., the percentage of underweight children decreased from 52 per cent to 47 per cent), but continuing high levels of malnutrition are still a matter of serious concern (Arnold et al., 2004).

Malnutrition among children is a major problem in almost all part of India. From NFHS-2, 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 (fig. 1.1). 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. Figure 1.2 shows that more than half of the children under three years of age in Bihar, Madhya Pradesh, Uttar Pradesh, Rajasthan and Assam are stunted. Stunting among children is also high in Orissa, Gujarat, Haryana and Maghalaya. The lowest percentages of stunted children under three years of age are found in Goa and Kerala. The geographical pattern of wasting among children as presented in figure 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 percentages of malnourished children than Chennai or

Mumbai (Arnold et al., 2004). It should be mentioned in this context that the maps showing the distribution of underweight, stunted and wasted children under three years of age by state are done with the help of choroplething method i.e. by subtracting the lowest value from the highest value and then dividing it by the number of classes. Therefore the values shown in the index are not equal for the three cases.

1.2 CAUSES OF MALNUTRITION

Malnutrition 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 are 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 nutrition, 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 for children's growth and nutritional status. Brown et al., (1982) and Sommerfelt and Stewart (1994), found that inadequate and improper food intake and repeated episodes of infectious diseases adversely affect children's nutritional status. Research conducted by Briend et al., (1988) reveals that breastfeeding improves 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 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.

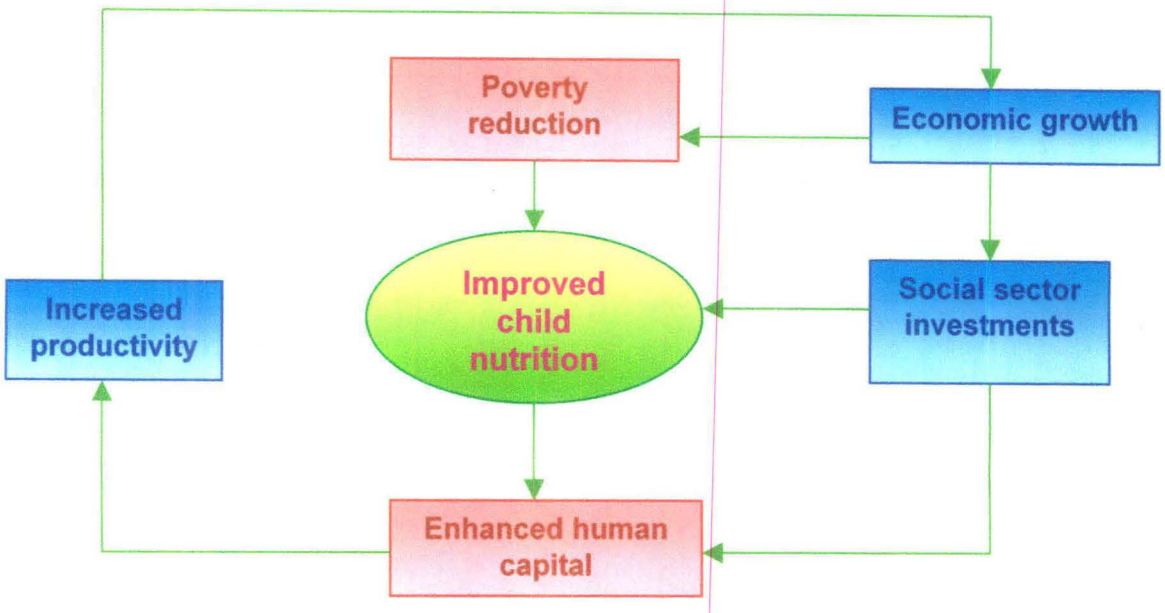
Child malnutrition is measured on the basis of height-for-age, weight-for-age and weight-for-height. The calculation of these three indices of child malnutrition are expressed in terms of standard deviation units and are compared with an international reference population as recommended by the World Health Organisation (WHO). Children who fall more than two standard deviations below the reference median are considered to be 'malnourished' and those who fall more than three standard deviations below the reference median are considered to be 'severely malnourished'. The details of the measurement of child malnutrition will be dealt in the third chapter.

High levels of malnutrition among children are 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 per cent 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 result 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.

Figure 1.4 shows how improved child nutrition leads to future development of the country. It is observed that by improving child nutritional status, the children grows 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. Poverty reduction and social sector investment in turn raise child nutritional status and helps in further development and progress of the country.

Fig. 1.4 Improved nutrition leads to future development of the country (adopted from UNICEF 1998)



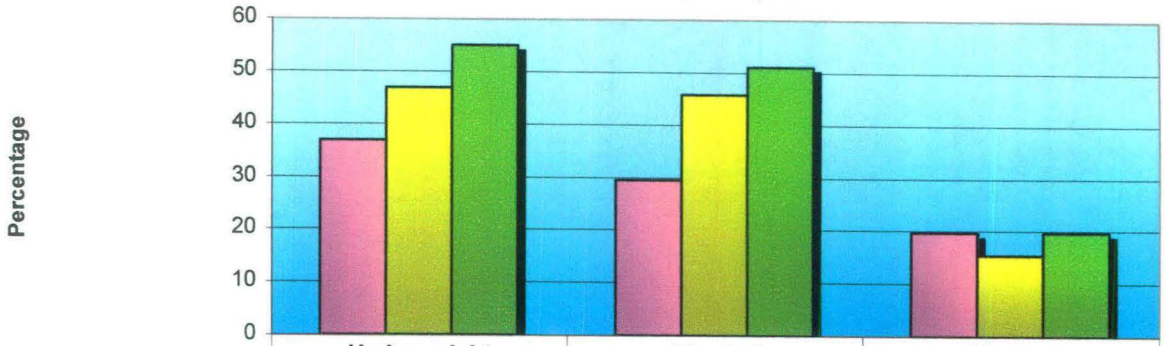
From the above discussion, it is clear that the role of nutrition is important for healthy development of children. We, however, have limited understanding of the various demographic and socio-economic variables that influence child nutrition. As mentioned before, some studies have been conducted in India but regional variations have not been given as much attention as it deserves. In this study, we examine, child nutrition in two states of India –Tamil Nadu and Madhya Pradesh – to understand the differences that are present in the relationship between child nutrition and demographic and socio-economic variables.

1.3 AREA OF STUDY

Child nutrition in terms of wasting, stunting and underweight will be studied with particular reference to Tamil Nadu and Madhya Pradesh. The NFHS-2 data on percentage of children under three years of age classified as malnourished on the basis of the three anthropometric indices of nutritional status namely, weight-for-age, height-for-age, and weight-for-height, for the different states of India shows that Tamil Nadu has high nutritional status next only to Kerala, but Kerala is not taken as the study area as almost all the children have high nutritional status. In the weight-for-age index, 36.7 per cent of the children in Tamil Nadu are underweight and 10.6 per cent are severely underweight. The height-for-age index shows that 29.4 per cent of the children are stunted and 12.0 per cent are severely stunted. The weight-for-height index shows that 19.9 per cent of the children are wasted and only 3.8 per cent are s verely wasted. Thus the low values of the variables show high nutritional status of Tamil Nadu in the country.

Tamil Nadu is one of India's economically and industrially developed states. Although it continues to be predominantly an agricultural state, Tamil Nadu's economy has been changing rapidly into an industrial economy. Canals, tanks and wells extensively irrigate agricultural land. Important natural resources include lignite, crude petroleum and natural gas. Tamil Nadu has good public transport system with more than 90 per cent of villages covered by metalled roads. Most of the villages in the state have been electrified. The state also has very good health infrastructure in both rural and urban areas. As per the Relative Infrastructure Development Index, Tamil Nadu ranks third among the 17 major states of India (Centre for Monitoring Indian Economy, 1997). According to 2001 census, it is one of the most urbanised states in the country. Except for Kerala, Tamil Nadu recorded the lowest population growth rate of 11.2 per cent in 1991-2001 among all the states and union territories in India. It is also one of the

Fig. 1.5 Percentage of children under three years of age classified as underweight, stunted and wasted in Tamil Nadu, Madhya Pradesh and India, 1998-99.



	Underweight	Stunted	Wasted
Tamil Nadu	36.7	29.4	19.9
India	47	45.5	15.5
Madhya Pradesh	55.1	51	19.8

Source: IIPS (2000)

educationally more advanced states in the country having a literacy rate of 73 per cent among the population age seven and above (2001 census). According to Sample Registration System (1998), fertility in Tamil Nadu has declined to 19.2 per 1000 population and the total fertility rate is 2.0 children per woman. The infant mortality rate is 53 per 1000 live births and the crude death rate is 8.5 per 1000 population.

On the other hand, Madhya Pradesh has 55.1 per cent underweight and 24.3 per cent severely underweight children. In the height-for-age index, 51.0 per cent children under three years of age are stunted and 28.3 per cent are severely stunted. The weight-for-height index shows that 19.8 per cent children in the state are wasted and 4.3 per cent are severely wasted. Thus the high value of the data shows low nutritional status in the state. Although it is evident from the data that the nutritional status of Madhya Pradesh is slightly better than that of Bihar, but in overall comparison, both the states – Madhya Pradesh and Bihar – rank in the lower levels of nutritional status in the country. But Madhya Pradesh

is selected for the study area because data pertaining to Madhya Pradesh shows that the percentage of children in the weight-for-age index is higher than that of Bihar, which means that both chronic and acute malnutrition are common in the state.

Agriculture is the mainstay of the economy of Madhya Pradesh. Industrialisation in the state is confined to selected pockets surrounding the state's metropolitan towns. Despite industrial advances, there is little diffusion of development to rural and remote areas. According to 1991 census, the literacy rate for population age seven and above was 44.0 per cent. In demographic indicators too, Madhya Pradesh performs poorly in comparison to most other states. According to Sample Registration System (1998), the crude birth rate was 30.7 per 1000 population and the total fertility rate was 4.0 children per woman. In the same period, Madhya Pradesh had the highest crude death rate and infant mortality rate in the country.

Thus the states of Tamil Nadu and Madhya Pradesh are chosen as the study area for examining the different demographic and socio-economic factors that have resulted in high nutritional status in Tamil Nadu and low nutritional status in Madhya Pradesh.

1.4 OBJECTIVES

The objectives of the study is to assess the following:

- To study how the different demographic and socio-economic factors affect child nutritional status namely underweight, stunting and wasting in Tamil Nadu.

- To see how the different demographic and socio-economic factors affect child nutritional status in Madhya Pradesh in terms of underweight, stunting and wasting.

- To compare the different demographic and socio-economic factors that play important role in determining the child nutritional status in a state that has better nutritional status and the other state having worse nutritional status.

1.5 ORGANISATION OF THE STUDY

The study of the effects of the different demographic and socio-economic factors on the child nutritional status in Tamil Nadu and Madhya Pradesh is spread over five chapters. A review of literature is presented in the second chapter. Chapter three develops the conceptual framework for the analysis on the basis of literature review and thereby derives the research questions. This chapter also describes the selection of different dependent and independent variables and the data and methodology adopted. Chapter four examines in detail the analytical results of the effects of the demographic and socio-economic factors on child nutritional status namely on underweight, stunting and wasting. It also brings out a comparative study between Tamil Nadu and Madhya Pradesh. The fifth chapter concludes the study by suggesting certain policy implications that the government could pursue for improving the nutritional status in children under three years of age through various programmes.

CHAPTER 2

REVIEW OF LITERATURE

The present chapter reviews previous research conducted by the scholars on different factors that influence child nutrition. Mosley and Chen (1984) in their model identified the following factors as the causes of child malnutrition. They are: maternal factors, environmental contamination to the transmission of infectious agents to children, nutrient availability to the child as well as to the mother during pregnancy and lactation and socio-cultural factors. In this study, a brief review of the 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 the 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. Antenatal care includes, whether mother received iron and folic acid tablets and tetanus injections during pregnancy. Other factors include exposure to mass media, duration of breastfeeding, child immunisation, infections and diseases etc.

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 1998). The children of the 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 the 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-2 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 and highest of all among 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.

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 poorer 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 among girls in India, as well as 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 the 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 this unexpected finding are suggested (Sommerfelt and Arnold 1998).

PLACE OF RESIDENCE

Prevalence of malnutrition is roughly one and a half times higher in rural areas than 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).

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 the high caste households (Singh 1989). 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, scheduled tribes or other backward classes have relatively high levels of malnutrition according to all the three anthropometric measures. According to a study by Haughton (1997) of Vietnamese children, it is

seen that children born into the ethnic minorities are more likely to be stunted. However, Shariff (1996) found that religion and caste are not significant factors determining the nutritional status of children.

MOTHER'S EDUCATION

A lack of access to education and correct information is a 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). A great deal of attention has been paid to the effect that education of the mother has on child nutrition 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 nutrition 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 (Ramachandran 1989, Sommerfelt and Stewart 1994). Studies by Haughton (1997) on Vietnamese children show that when parents are more educated, their children are less likely to be malnourished. According to Arnold et al., (2004), key NFHS-2 findings on nutrition show that the education of the child's mother has a 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 than children whose mothers have completed at least a high school 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 common. In Pakistan, for example, widespread discrimination against women is behind high levels of illiteracy among women, which is responsible for high levels of child malnutrition rates (UNICEF 1998).

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 include housing condition, environmental 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 Indian children from households with a low standard of living are about twice as likely as children from households with a high standard of living to be malnourished. Even in households with a high standard of living, however, more than one-quarter of the children are stunted and underweight. A study by Rajaretnam (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 incomes 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 rise which increases the nutritional status.

MOTHER'S WORK STATUS

The work status of the mothers indicates 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 Rohde (2004), poor mothers who must work are particularly vulnerable and employment conditions often do not allow young infants to accompany mothers. Worse yet, the public misconception that bottle-feeding is modern and better must be more aggressively countered as it results in child malnutrition. According to Ramachandran (1994), the type of work the women does outside the house determines the impact of such employment on the health and 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.

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 the least malnourished and that 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. 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 and Stewart (1994) and Rao et al., (1999) have found that malnutrition and infant and child mortality is higher among children of higher birth orders (often order four and above).

BMI OF MOTHER

The BMI can be used to assess both thinness and obesity. The BMI is defined as the weight in kilograms divided by height in metre 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/m^2. 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 well nourished a woman was before pregnancy, as well as 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 BMI had normal newborns more than 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 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.

ANTENATAL CARE

Iron and folic acid tablets and tetanus injections received by the mother during pregnancy are the two variables considered under antenatal care. 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 one of the most important of all micronutrient deficiencies in pregnancy. Low dietary intake of iron and folate and poor bioavailability of iron from Indian diets were identified as factors responsible for iron and folate deficiency and consequent anaemia (Ramachandran 1994). The consequences of anaemia for pregnant women and their newborn 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 (Ramachandran 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 Nutrition Policy of 1993 (Sachdev and Choudhury 1994) for preventing malnutrition.

According to Luther (1998), children of mothers who received two or more tetanus injections when they were pregnant have a significantly lower prevalence of stunting than children whose mothers did not receive tetanus injections during pregnancy. Controlling for the other predictor variables substantially reduces this effect, but it remains statistically significant. This finding is consistent with earlier evidence from NFHS that a mother having two or more tetanus injections during pregnancy is a good proxy for the mother's health-seeking behaviour for her children.

EXPOSURE TO MASS MEDIA

Mass media – generally identified with print media, film, radio and television – are capable of changing the attitudes and behavioral 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 Schramm (1964), mass media acts as 'mobility multipliers', spreading favourable attitude for social change. Modern western ideas about consumer values, control over one's life and non-familiar roles of women could be communicated through the media and influence people even in rural settings and with little education (Westoff and Bankole, 1997).

'Entertainment education' is another recent approach to confront health issues through mass media. Entertainment education is purposively designing and implementing media message both to entertain and educate in order to increase audience member's knowledge about an educational issue, thereby creating favourable attitudes and change overt behaviour (UNFPA 2002). Population Media Centre (PMC) is involved in a new two year community radio project to promote education and information about HIV/AIDS, women's status, and reproductive and child health through local FM and community radio. The project involving five Asian countries and six countries in Africa aims to increase

collaboration among local FM radios and NGOs, which addresses health, education, youth issues preventing HIV/AIDS and women's reproductive rights and health in both rural and urban areas (Ghosh 2004).

Exposure to mass media has shown to have substantial effects on people's attitudes and behaviour in India. Rao and Mishra (1998), studied the 'Knowledge and use of oral rehydration therapy for childhood diarrhoea in India: Effects of exposure to mass media'. The analysis indicates that mother's exposure to electronic mass media increases awareness and use of oral rehydration therapy. In 1998, as part of a series of television health promotion messages developed by Centre for Communication Health and Environment's (CCHE) media training programme in Punjab, the Public Service Announcements (PSA) addressed visiting doctors during pregnancy, tetanus toxoid injections, breastfeeding and oral rehydration. PSAs have the potential to reach many more viewers than regular programmes and to make a reinforcing and long lasting impact because it could be used repeatedly and frequently in various parts of the broadcast schedule. In July 2000, CCHE tested the impact of four maternal and child health PSA's on childbearing women in South India. The research concluded that exposure to a specific PSA predisposes women to adopt the behaviour promoted in the programme.

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 (Vijayasree 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. Breastfed 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 tracts, thus shielding them against diarrhoea and upper respiratory tract infections. Thus breastfed 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 the 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.

OTHER FACTORS

Mosley and Chen (1984) consider the demographic characteristics such as the age of the 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.

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.

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 women's status 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 (Ross et al., 1995). However, Vijayaraghavan et al., (1990) found that the evidence of beneficial effects of vitamin A supplementation on morbidity and mortality in children is not conclusive.

To sum up, since the intellectual and physical development of children that takes place during the first three years of life is entirely dependent on the nutrition provided during these crucial years, it is necessary to study the nutritional status of children under three years of age. The different demographic, socio-economic, maternal and other variables discussed before explain their importance in determining the child nutritional status. The duration of breastfeeding, although an important variable and discussed here, is not considered in the later chapters for framing the concepts and in the analysis since the Indian mothers adopt universal breastfeeding. 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 the demographic and socio-economic factors on child nutrition in Tamil Nadu and Madhya Pradesh.

CHAPTER 3

CONCEPTUAL FRAMEWORK FOR ANALYSING CHILD NUTRITION IN TAMIL NADU AND MADHYA PRADESH

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.

Nutritional status of children can be evaluated under three categories, namely: clinical, biochemical and anthropometric. The clinical features namely protein energy malnutrition and other micronutrient deficiencies (vitamin A, riboflavin etc.) do not appear till they become severe in nature. Moreover, the biochemical parameters have to be obtained from the blood sample and when taken from large-scale surveys make the task cumbersome. Thus for practical purposes anthropometry is the most useful parameter for assessing the nutritional status of children in the country (Sachdev 1998).

Inadequate food and infections are the two factors that cause growth deficits in developing countries. Infections influence body size and growth through their effect on metabolism and nutrition. Therefore, the use of anthropometry is the most logical method of nutritional assessment for children (Sachdev 1998).

3.1 NUTRITIONAL ANTHROPOMETRY

The various nutritional anthropometric 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 is 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 his 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:

- Weight-for-age
- Height-for-age

- Weight-for-height

Weight-for-age

The term weight-for-age represents the weight of the observed child with that of a median reference child of the same age and sex. It is a composite measure of chronic and acute malnutrition.

Height-for-age

The term height-for-age represents the height of the observed child with that of a median reference child of the same age and sex. It examines linear growth retardation and is an indicator of chronic malnutrition.

Weight-for-height

The term weight-for-height compares the weight with the height of the observed child with that of a median reference child of the same age and sex. This index reflects acute malnutrition.

The words 'reference' and 'standard' – as mentioned above – are often used interchangeably, but a 'reference' is referred to as neutral, which carry no value judgements and act simply as a yardstick for making comparisons. On the other hand, the word 'standard' refers to a target or level that ought to be met (Sachdev 1998). A child's growth data are usually compared with that of a 'reference' population to facilitate evaluation of his nutritional status. The observation that well nourished children in developing countries grow in much the same way as their counterparts in the developed world has led to the use of a single international growth standard for all (Gopalan 1985).

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 use by WHO.

3.2 CLASSIFICATION OF MALNUTRITION

Prevalence of malnutrition in a population is described in terms of the percentage of individuals below a specific cut-off point, such as certain per cent of the mean/median, or a percentile or standard deviation (SD) in terms of z-scores (Nigam 2003). Malnutrition is also classified separately on the basis of the above mentioned specific cut-off points for three different indices, namely, weight-for-age, height-for-age and weight-for-height. The three different classifications of malnutrition are discussed below.

i) Gomez classification

Gomez's classification of malnutrition was the first one to be proposed from Mexico on the basis of prognostication studies from hospitalisation. Gomez et al., (1956) recognised three grades of malnutrition on the basis of weight-for-age index based on the percentage median of the NCHS standard, namely:

WEIGHT- FOR- AGE (PER CENT MEDIAN OF THE NCHS STANDARD)	NUTRITIONAL GRADE
90 and above	Normal
75 - 90	Mild malnutrition
60 - 75	Moderate malnutrition
Less than 60	Severe malnutrition

ii) Indian Academy of Pediatrics (IAP) classification

The Nutrition Sub-Committee of the Indian Academy of Pediatrics in 1972 proposed the popularly known IAP classification, which is also based on the weight-for-age index. It classifies malnutrition into the following classes:

WEIGHT- FOR- AGE (PER CENT MEDIAN OF NCHS STANDARD)	NUTRITIONAL GRADE
80 and above	Normal
70 - 80	Grade 1 malnutrition
60 - 70	Grade 2 malnutrition
50 - 60	Grade 3 malnutrition
Less than 50	Grade 4 malnutrition

iii) Standard Deviation classification

This classification is based upon the cut-off points recommended by 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 all the three indices of malnutrition namely: weight-for-age, height-for-age and weight-for-height.

- **Weight-for-age:**

PERCENTAGE BELOW INTERNATIONAL REFERENCE POPULATION MEDIAN	NUTRITIONAL GRADE
-2SD	Underweight
-3SD	Severely underweight

- **Height-for-age:**

PERCENTAGE BELOW INTERNATIONAL REFERENCE POPULATION MEDIAN	NUTRITIONAL GRADE
-2SD	Stunted
-3SD	Severely stunted

- **Weight-for-height:**

PERCENTAGE BELOW INTERNATIONAL REFERENCE POPULATION MEDIAN	NUTRITIONAL GRADE
-2SD	Wasted
-3SD	Severely wasted

The rationale for 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). On the other hand, Gomez and IAP classifications, which used Harvard reference, are no longer recognised as an international reference (Sachdev 1998). The cut-off points as recommended by Gomez or IAP classifications may not be strictly valid, as they are not given by age and sex. Sachdev (1995) pointed out that this discrepancy cannot be simply eliminated by adjusting one or the other cut-off points, as the coefficient of measurement variation changes with age.

Moreover, irrespective of IAP classification's arbitrary nature as already discussed, it also underestimates severely malnourished children. While IAP classification fixes 60 per cent of median standard weight as the cut-off point for severe malnutrition, research in India shows it should actually be 67 per cent of the median weight based upon standard deviation classification. This 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

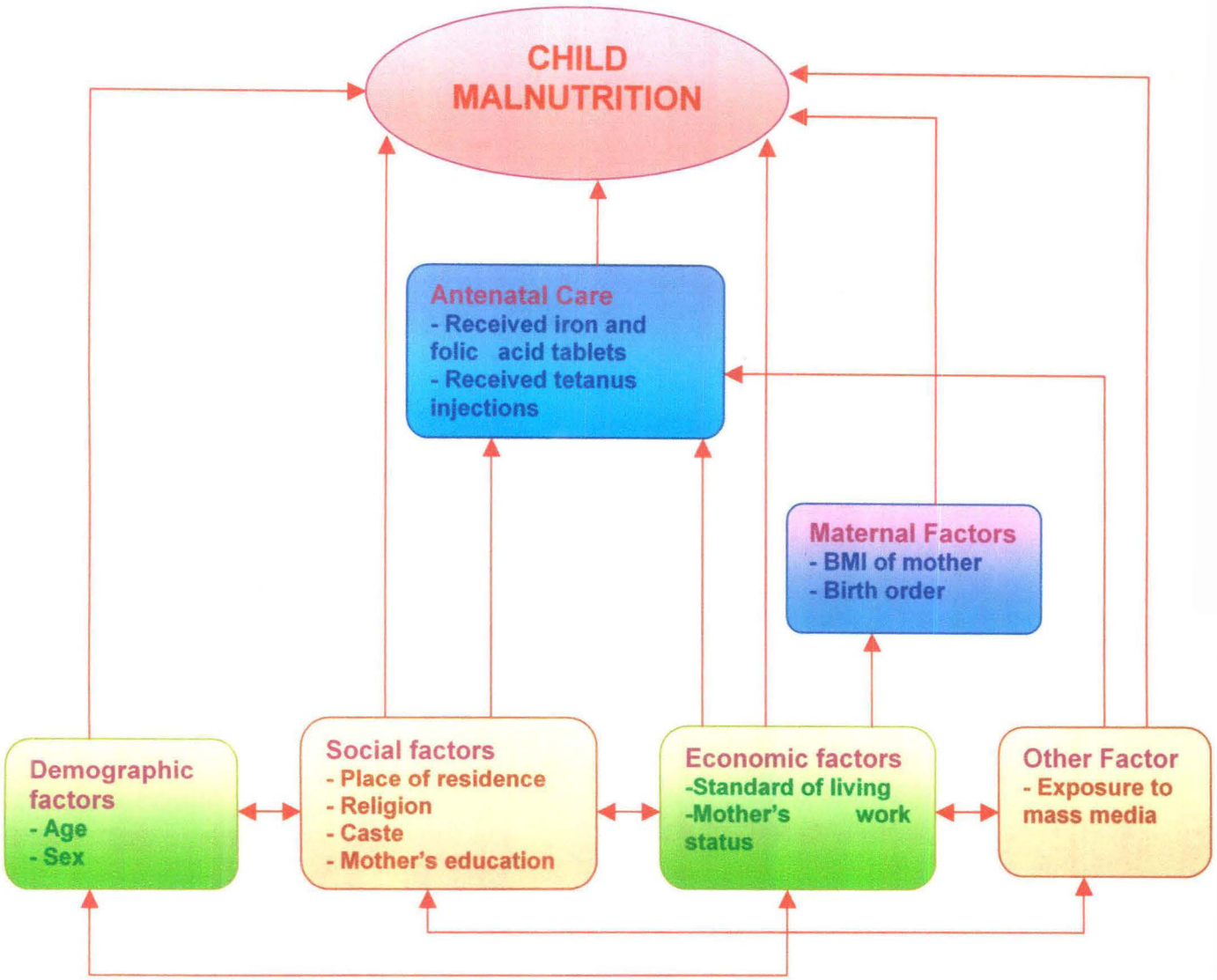
The conceptual framework as shown in figure 3.1 on the causes of child malnutrition was developed in 1990 as a part of UNICEF Nutrition Strategy. The framework shows that causes of malnutrition are multi sectoral, embracing food, health and caring practices. They are also classified as immediate (individual level), underlying (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 intake and 2) illness. The interplay of these two causes tends to create a 'vicious cycle of malnutrition'. Three underlying causes that lead to immediate causes are: 1) inadequate access to food in a household, 2) insufficient health services and an unhealthy environment, and 3) inadequate care for children. Inadequate access to food in a household is determined by 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 is 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 that are affordable and of good quality. In terms of

Fig. 3.1 Conceptual framework of the causes of child malnutrition, according to UNICEF, 1998

healthy environment there 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 diarrhoea and other infectious diseases. Care for 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 immunisations, 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. This 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 analysing the causes of the nutrition problem and helps in identifying the most appropriate mixture of actions (UNICEF 1998).

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 Tamil Nadu and Madhya Pradesh. The causes of child malnutrition are classified into different factors namely: demographic, social, economic, maternal factors, antenatal care and other factor. 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, and the antenatal care include whether mother received iron and folic acid tablets and tetanus injections during pregnancy. Other factor includes exposure to mass media. It is seen that all the factors individually and in inter-relation with each other influence the nutritional status of children under three 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

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



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 the child, which in turn affect child nutritional status. The details of these variables are already discussed in the second chapter.

3.4 RESEARCH QUESTIONS

Based on the literature survey, the following research questions have been formulated to understand the effect of the demographic and socio-economic variables on child nutritional status namely: underweight, stunting and wasting.

1. Children in the age group of 12-23 months are more malnourished than children in the age group of less than 12 months.
2. The higher standard of living of the children enhances the nutritional status of the children.
3. Mothers with normal BMI have fewer malnourished children than mothers with low BMI.
4. Mother's education plays an important role in determining the nutritional well-being of their children, i.e. mothers with higher levels of education have less number of malnourished children than illiterate mothers.
5. Sex of the child, does not have any impact on the nutritional status of the children.

3.5 SOURCE OF DATA

This study uses secondary data from the second round of NFHS-2 for the states of Tamil Nadu and Madhya Pradesh. The second round of NFHS conducted in 1998-99 by the International Institute for Population Sciences (IIPS), Mumbai, under the directive of the Ministry of Health and Family Welfare and financially supported by United States Agency for International Development (USAID)

UNICEF, provides information on fertility, family planning, infant and child mortality, reproductive health, child health, nutrition of women and children, and quality of health and family welfare services. The NFHS-2 national sample covers more than 99 per cent of India's population living in 26 states that existed at the time of the survey. It does not cover the union territories. NFHS-2 is a household sample survey with an overall sample size of 90,303 ever-married women in the age group of 15-49 years living in 92,486 households. Three types of questionnaires were used in NFHS-2 namely: the Village Questionnaire, the Household Questionnaire and the Woman's Questionnaire, which also included data pertaining to the children. In this study, data from the kids file in the Woman's Questionnaire are taken for the analysis.

In Tamil Nadu, NFHS-2 field staff collected information from 5281 households between 8 March 1999 and 7 June 1999 and interviewed 4676 eligible women in these households. In addition, the survey collected information on 1359 children born to eligible women in the three years preceding the survey. The questionnaires in Tamil Nadu were bilingual with questions both in Tamil and English.

In Madhya Pradesh, NFHS-2 field staff collected information from 6749 households between 26 November 1998 and 24 April 1999, and interviewed 6941 eligible women in these households. In addition, the survey collected information on 2837 children born to eligible women in the three years preceding the survey. The questionnaires canvassed in Madhya Pradesh were bilingual with questions both in Hindi and English. Here Madhya Pradesh comprised of both the states of Madhya Pradesh as well as Chattisgarh. For both the states one health investigator on each survey team measured the height and weight of eligible women and young children for assessing the nutritional status and took blood samples for examining the prevalence of anaemia (IIPS 2000).

3.6 SELECTION OF VARIABLES

Identification of the causal relationships among the different variables of any study is an essential concern of an investigation. A causal relationship between the two variables exists only when one of them may logically be considered as the cause of the other. Thus, for analysing the data, two sets of variables are chosen. They are:

- Dependent variable
- Independent variable

The factor which is supposed the be the effect is known as the dependent variable and the factor which is supposed to be the cause is known as the independent variable. Thus the variations in dependent variable may be explained in terms of the variations in the independent variable.

3.6.a Dependent Variable

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 the 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 are clubbed together to determine underweight, stunted and wasted. The dependent variables selected from the NFHS-2 individual level kids data file are suitably categorised and their recoded form are as follows:

SL. NO	NAME OF THE OLD VARIABLE	NAME OF THE NEW VARIABLE	CATEGORIES OF THE NEW VARIABLE
1	Wt/A Standard Deviation	Weight-for-age	1. Normal 2. Underweight
2	Ht/A Standard Deviation	Height-for-age	1. Normal 2. Stunted
3	Wt/Ht Standard Deviation	Weight-for-height	1. Normal 2. Wasted

On the basis of the standard deviation values of weight-for-age, height-for-age and weight-for-height indices as available from NFHS-2 data, the dependent variables are categorised into the following classes for the states of Tamil Nadu and Madhya Pradesh.

Tamil Nadu: In the weight-for-age index, the standard deviation values range between 575 to -573. Therefore, the standard deviation values between 575 to -199 are referred to as 'normal' and between -200 to -573 are referred to as 'underweight'. In the height-for-age index, the values range between 564 to -582. The values between 564 to -199 and -200 to -582 are referred to as 'normal' and 'stunted' respectively. The values in the weight-for-height index vary between 589 to -395. They are classified as 'normal' and 'wasted' on the basis of the values ranging between 589 to -199 and -200 to -395 respectively.

Madhya Pradesh: In the weight-for-age index, the values ranging between 549 to -199 and -200 to -596 are referred to as 'normal' and 'underweight' respectively. The values between 584 to -199 and between -200 to -596 are referred to as 'normal' and 'stunted' respectively in the height-for-age index. In the weight-for-height index, the values ranging between 457 to -199 are referred to as 'normal' and that between -200 to -398 are referred to as 'wasted'.

3.6.b Independent 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 of the child and sex of the child. The social variables include place of residence, religion and caste of the child and mother's education. The economic variables include,

standard of living and mother's work status. Maternal factors include, birth order of the child, BMI of the mother, whether mother received iron and folic acid tablets and tetanus injections during pregnancy. Other variable like, exposure to mass media is also included in the analysis of child nutrition. The independent variables selected from the NFHS-2 individual level kids data file are suitably categorised and their recoded form are as follows:

SL. NO.	NAME OF THE OLD VARIABLE	NAME OF THE NEW VARIABLE	CATEGORIES OF THE NEW VARIABLE
1	Current age of child	Age of the child	1. Less than 12 months 2. 12-23 months 3. 24-35 months
2	Sex of the child	Sex of the child	1. Male 2. Female
3	Type of place of residence	Place of residence	1. Rural 2. Urban
4	Religion	Religion	1. Hindu 2. Others
5	Ethnicity	Caste	1. General 2. SC/ST
6	Highest level of education	Mother's education	1. Illiterate 2. Literate primary 3. Literate secondary and higher
7	Household standard of living	Standard of living	1. Low 2. Medium 3. High
8	Respondent's occupation	Mother's work status	1. Non-working 2. Working
9	Birth order number	Birth order of the child	1. 1-2 2. 3 and above
10	BMI of respondent	BMI of mother	1. Low 2. Normal
11	Given iron and folic tablets during pregnancy	Mother received iron and folic acid tablets during pregnancy	1. No 2. Yes
12	Given tetanus injections during pregnancy	Mother received tetanus injections during pregnancy	1. No 2. Yes
13	Watches TV every week	Exposure to mass media	1. Not exposed 2. Exposed

For categorising the BMI of mother, the cut-off point is taken as 1850 gm/m^2. The values ranging between 1262 gm/m^2 to 1849 gm/m^2 are referred to as 'low BMI' and those ranging between 1850 gm/m^2 to 4314 gm/m^2 are referred to as 'normal BMI'

3.7 METHODOLOGY

Once the variables – dependent and independent – are chosen and suitably recoded to meet the need of the analysis, SPSS 10.0 (Software Package in Social Sciences) is used for the analysis of the research problem. The following methodologies are adopted for the analysis:

1. Cross tabulation
2. Chi-square
3. Binary logistics

Cross tabulation of the dependent and independent variables are prepared to find out the percentages of the demographic and socio-economic variables.

Pearson's chi-square is calculated to show the statistical association between the dependent and independent variables.

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

P = 1 (normal)

Thus, mainutrition 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:

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

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

The quantity e^b is called the odds ratio that represent 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.

In the analysis, Multiple Classification Analysis or MCA is adopted to estimate both the unadjusted and adjusted effects of each of the 13 independent variables on underweight, stunting and wasting. Unadjusted refers to the values that are based on logistic regression that incorporates one independent variable at a time, therefore the unadjusted values do not incorporate controls for any other independent variables. On the other hand, the adjusted values are based on the complete model including all independent variables simultaneously and therefore they are statistically controlled by holding them constant at their mean values.

Having discussed the conceptual framework for the analysis, data to be used and the methodology to be followed in this chapter, we will present a detailed analysis of the effects of the demographic and socio-economic factors on the child nutritional status in Tamil Nadu and Madhya Pradesh in the next chapter.

CHAPTER 4

ANALYSIS OF CHILD NUTRITION IN TAMIL NADU AND MADHYA PRADESH

The main objective of this chapter is to analyse the effect of the demographic and socio-economic variables on the nutritional status in terms of underweight, stunting and wasting for children who are born three years before the NFHS-2 survey in the two selected states of Tamil Nadu and Madhya Pradesh. In order to do so, this chapter has been divided into four sections. The first section of this chapter deals with the background of the study area and analyses the percentage distribution of the dependent variables i.e. underweight, stunted and wasted. The second section shows the association between the dependent and the independent variables for Tamil Nadu and Madhya Pradesh. Cross-tabulations with chi-square and its significant values are shown in order to understand the nature of association between the variables. This analysis also attempts to bring out a comparative study of the associations among the variables in the two selected states. The third section of this chapter analyses the effect of demographic and socio-economic variables on underweight, stunting and wasting with the help of multivariate logistic regression models. The fourth section summarises the whole chapter.

4.1 BACKGROUND OF THE STUDY AREA

Before analysing the nutritional status of the study area in this chapter, we present the demographic and socio-economic characteristics of Tamil Nadu and Madhya Pradesh as per the NFHS-2 survey of 1998-99.

Tamil Nadu

The state of Tamil Nadu, the seat of Dravidian culture and tradition, was a part of the Madras Presidency during the period of the British rule in India. After India

attained independence, the state of Madras was formed during the reorganisation of the states on linguistic basis in 1956. In 1969, Madras state was renamed Tamil Nadu. The state with an area of 130,058 square kilometres has the sixth largest population among the states of India. Chennai is the capital city of Tamil Nadu.

The demographic characteristics according to the NFHS-2 (1998-99) results as presented in table 4.1 show that out of the total 1175 children under three years of age, 32.9 per cent are less than 12 months old, while 33.6 per cent and 33.5 per cent are in the age group of 12-23 months and 24-35 months respectively. Out of these under three years of age children, 52.5 per cent are males and the rest 47.5 per cent are females.

The social variables chosen for the analysis show that 55.6 per cent of the people in the state belong to the rural areas whereas 44.4 per cent belong to the urban areas. The majority of the people are Hindus (86.1 per cent), followed by 13.9 per cent population belonging to other religious backgrounds. The ethnic distribution of population shows that 75.0 per cent belong to the general caste while the scheduled caste and scheduled tribe (SC/ST) together constitute 25.0 per cent of the total population. The levels of female education in the state show that 50.3 per cent of the mothers have education above secondary and higher secondary level and 27.1 per cent of the mothers have education up to primary levels. Out of the total mothers in the state, 22.6 per cent are illiterate. Thus the high level of female education in the state shows that the mothers are aware of the well-being of their children.

The economic characteristics in terms of household standard of living shows that 36.6 per cent of the surveyed population have low standard of living while 47.7 per cent and 15.7 per cent of the households have medium and high standard of living respectively. Mothers work status is low in the state. Among the mothers 31.7 per cent are working and 68.3 per cent are non-working.

The independent variables classified as maternal factors show that 78.3 per cent children are in the birth order of one and two and 21.7 per cent are in the birth order of three and above. This shows that on an average the couples have two children. It is also seen that 29.5 per cent of the mothers have low BMI and 70.5 per cent have normal BMI.

Antenatal care shows that 93.8 per cent of the mothers received iron and folic acid tablets during pregnancy while only 6.2 per cent of the mothers did not receive any in the state. Similarly, 97.8 per cent of the mothers received tetanus injections during pregnancy while only 2.2 per cent did not receive tetanus injections during pregnancy. Thus, it is seen that antenatal care services are almost universal in the state with a few exceptions.

Other factor like, exposure to mass media is high: 66.0 per cent of the population is exposed to mass media while 34.0 per cent are not exposed.

Madhya Pradesh

Madhya Pradesh, as the name implies, is located at the geographical centre of India with Bhopal as the state capital. The state shares its border with seven states namely: Maharashtra, Gujarat, Rajasthan, Uttar Pradesh, Bihar, Orissa and Andhra Pradesh. Spread over 443 thousand square kilometres, Madhya Pradesh is the largest Indian state in terms of area and accounts for 14 per cent of India's landmass and 8 per cent of India's population. The state is grouped into seven geopolitical regions namely: Central, Chattisgarh, Malwa Plateau, Northern, South Central, South Western and Vindhya.

The demographic characteristics of Madhya Pradesh as per NFHS-2 survey of 1998-99 presented in table 4.1 shows that out of the total 2165 children under three years of age, 35.8 per cent are in the age group of less than 12 months and 32.1 per cent each belong to the age group of 12-23 months and 24-35 months

respectively. Out of these under three years of age children, 50.9 per cent are males and 49.1 per cent are females.

Table 4.1 Percentage distribution of independent variables in Tamil Nadu and Madhya Pradesh, NFHS-2, 1998-99.

INDEPENDENT VARIABLE	CATEGORY	TAMIL NADU		MADHYA PRADESH	
		Percentage	Number	Percentage	Number
Age of the child	Less than12 months	32.9	419	35.8	914
	12-23 months	33.6	429	32.1	820
	24-35 months	33.5	427	32.1	818
Sex of the child	Male	52.5	706	50.9	1473
	Female	47.5	639	49.1	1423
Place of residence	Rural	55.6	748	77.6	2246
	Urban	44.4	597	22.4	650
Religion	Hindu	86.1	1156	91.9	2662
	Others	13.9	187	80.1	234
Caste	General	75.0	1008	60.2	1744
	SC/ST	25.0	336	39.8	1151
Mother's education	Illiterate	22.6	304	62.0	1794
	Literate primary	27.1	364	19.0	549
	Literate secondary and higher	50.3	677	19.0	551
Standard of living	Low	36.6	486	36.6	1056
	Medium	47.7	633	48.1	1389
	High	15.7	208	15.3	443
Mother's work status	Non-working	68.3	919	49.0	1419
	Working	31.7	426	51.0	1477
Birth order of the child	1-2	78.3	1053	46.5	1347
	3 and above	21.7	292	53.5	1549
BMI of mother	Low	29.5	391	38.0	1057
	Normal	70.5	935	62.0	1722
Mother received iron and folic acid tablets during pregnancy	No	6.2	83	51.5	1485
	Yes	93.8	1262	48.5	1399
Mother received tetanus injections during pregnancy	No	2.2	29	30.6	883
	Yes	97.8	1316	69.4	2883
Exposure to mass media	Not exposed	34.0	457	60.2	1742
	Exposed	66.0	888	39.8	1153

Source: IIPS (2000)

The social characteristics shows that 77.6 per cent of the under three years of age children resides in the rural areas as against 22.4 per cent of the children

living in the urban areas. The majority (91.9 per cent) of the children in the state are Hindus and only 8.1 per cent belong to other religious backgrounds. According to ethnic background, 60.2 per cent children belong to the general caste and 39.8 per cent belong to scheduled caste and scheduled tribes. In contrast to Tamil Nadu, where mother's education is very high, Madhya Pradesh is a poor performer. A majority (62.0 per cent) of the mothers are illiterate. Only 19.0 per cent of the mothers have attained education up to primary level and another 19.0 per cent have attained education above secondary and higher secondary level.

The economic characteristics show that most of the households (48.1 per cent) of Madhya Pradesh have medium standard of living. Out of the total children, 36.6 per cent belongs to households having low standard of living and 15.3 per cent belongs to households having high standard of living. The state has a high percentage of working mothers. More than half (51.0 per cent) of the mothers are working while 49.0 per cent mothers are non-working.

The maternal factors related to child nutrition shows that 46.5 per cent of the children are in the birth order of one and two while 53.5 per cent children are in the birth order of three and above. The study also shows that 38.0 per cent of the mothers have low BMI as compared with 62.0 per cent mothers having normal BMI.

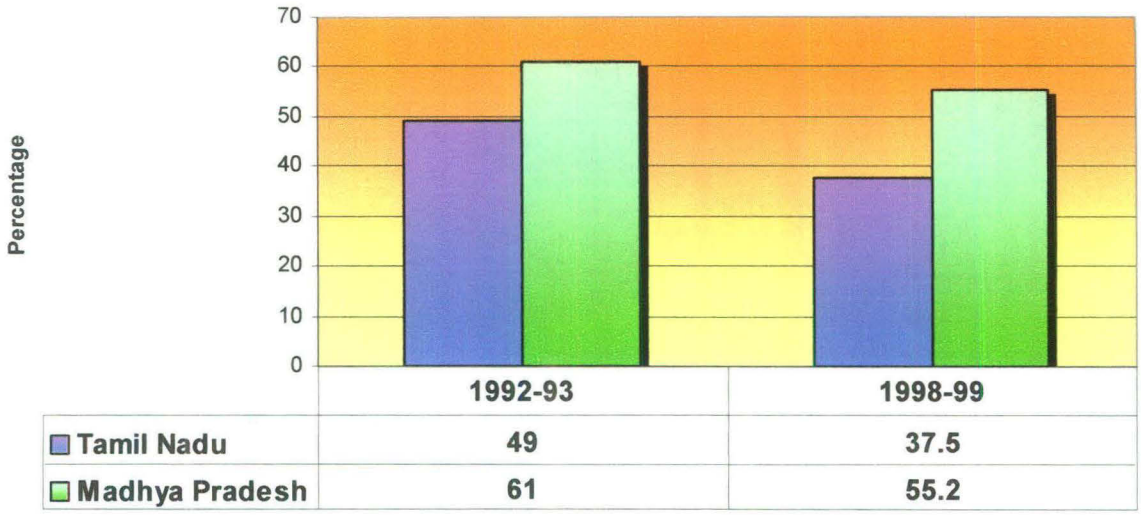
Antenatal care shows that only 48.5 per cent of the mothers received iron and folic acid tablets during pregnancy while a majority of 51.5 per cent mothers did not receive iron and folic acid tablets during pregnancy. Moreover, 69.4 per cent of the mothers received tetanus injections during pregnancy and 30.6 per cent of the mothers did not receive tetanus injections during pregnancy.

Data on exposure to mass media shows that majority of 60.2 per cent parents are not exposed to mass media and only 39.8 per cent are exposed to mass media.

Levels of malnutrition in the study area

Tamil Nadu: The three indices of malnutrition are classified into two types i.e. normal and underweight, stunted or wasted according to weight-for-age, height-for-age and weight-for-height respectively. The values ranging below -2SD are taken as the cut-off points for classifying malnutrition as underweight, stunted and wasted in the weight-for-age, height-for-age and weight-for-height index respectively for 1175 children in Tamil Nadu.

Fig. 4.1 Comparison between NFHS-1 and NFHS-2 of underweight children in Tamil Nadu and Madhya Pradesh



	1992-93	1998-99
Tamil Nadu	49	37.5
Madhya Pradesh	61	55.2

Note: Data on children's height is not available for 1992-93 as their height was not measured in Tamil Nadu and Madhya Pradesh. Therefore it is not represented graphically.

Table 4.2 shows that in the weight-for-age index, 62.5 per cent under three years of age children are normal while 37.5 per cent are underweight. In the height-for-age index, 30.9 per cent children are stunted as compared with 69.1 per cent normal children. Wasting is comparatively less in the state. 19.1 per cent children are wasted as compared with 80.9 per cent normal children.

From table 4.2, it is clear that although Tamil Nadu is one of the least malnourished states in the country, but still within the state, the percentage of underweight children are quite high as compared with stunted and wasted children. Higher percentage of underweight children in the state shows that malnutrition in both chronic and acute form is prevalent among the children.

Table 4.2 Percentage distribution of underweight, stunted and wasted children in comparison with normal children in Tamil Nadu and Madhya Pradesh, NFHS-2, 1998-99.

DEPENDENT VARIABLE	CATEGORY	TAMIL NADU		MADHYA PRADESH	
		Percentage	Number	Percentage	Number
Weight-for-age	Underweight	37.5	441	55.2	1194
	Normal	62.5	734	44.8	971
Height-for-age	Stunted	30.9	363	50.7	1098
	Normal	69.1	812	49.3	1067
Weight-for-height	Wasted	19.1	225	19.9	431
	Normal	80.9	950	80.1	1737

Source: IIPS (2000)

Madhya Pradesh: From table 4.2, it is evident that out of 2165 children surveyed by NFHS-2 only 44.8 per cent children are normal in the weight-for-age index as against 55.2 per cent underweight children. It is also seen that 50.7 per cent children are stunted in comparison with 49.3 per cent normal children. Compared with underweight and stunted children, the percentage of wasted children is less. Only 19.9 per cent children are wasted while 80.1 per cent are normal.

The analysis shows that the majority of the children in the state are underweight. The classification of malnutrition in the weight-for-age index is a composite measure of chronic and acute malnutrition. This shows that both chronic and acute malnutrition is prevalent in Madhya Pradesh.

The comparison of the three indices of malnutrition shows that the percentage of underweight children is higher in both Tamil Nadu and Madhya Pradesh than stunted and wasted children. This means that although the levels of underweight

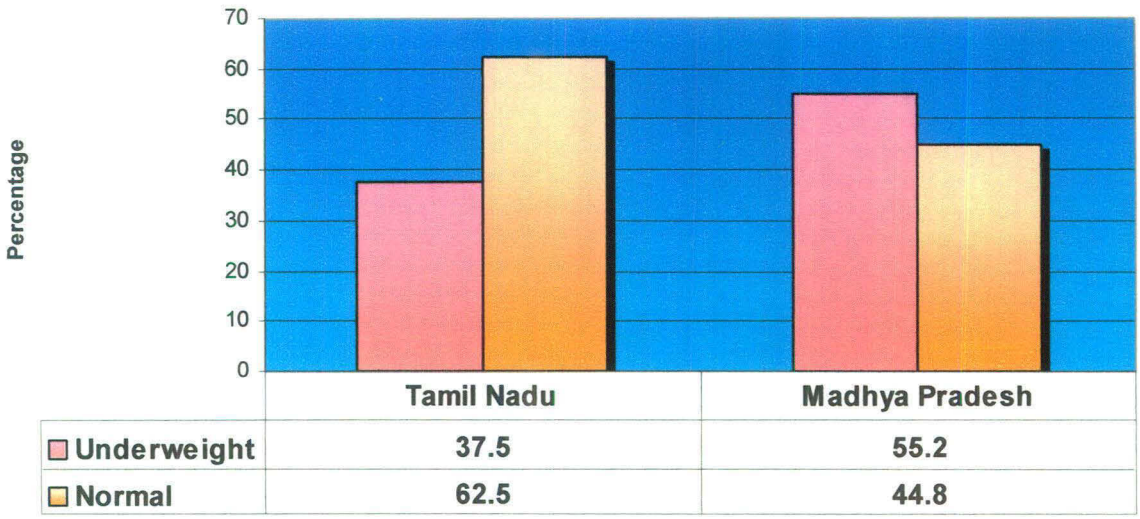
children are far less in Tamil Nadu than in Madhya Pradesh, but both the states suffer from chronic and acute malnutrition.

4.2 ASSOCIATION BETWEEN THE DEPENDENT AND THE INDEPENDENT VARIABLES: A COMPARATIVE STUDY OF TAMIL NADU AND MADHYA PRADESH

4.2.a Association between underweight and the independent variables

The graph below gives us a comparative view of the distribution of underweight children below three years of age in Tamil Nadu and Madhya Pradesh.

Fig. 4.2 Percentage of underweight and normal children in Tamil Nadu and Madhya Pradesh, NFHS-2, 1998-99



	Tamil Nadu	Madhya Pradesh
Underweight	37.5	55.2
Normal	62.5	44.8

Table 4.3 shows the percentage of underweight children below three years of age among the different categories of the respective demographic and socio-economic variables for Tamil Nadu and Madhya Pradesh. The prevalence of underweight is higher for all the independent variables studied for Madhya Pradesh than for Tamil Nadu.

Table 4.3 Percentage distribution of underweight children under three years of age in Tamil Nadu and Madhya Pradesh, NFHS-2, 1998-99

INDEPENDENT VARIABLE	CATEGORY	TAMIL NADU		MADHYA PRADESH	
		Percentage	Number	Percentage	Number
Age of the child	Less than 12 months	19.8	76	32.4	243
	12-23 months	47.9	190	67.2	466
	24-35 months	44.3	175	67.3	485
Pearson chi-square (sig.)		76.897 (.000)		241.520 (.000)	
Sex of the child	Male	36.2	225	52.7	585
	Female	39.0	216	57.8	609
Pearson chi-square (sig.)		.949 (.330)		5.743 (.017)	
Place of residence	Rural	38.8	254	58.6	970
	Urban	35.9	187	43.9	224
Pearson chi-square (sig.)		1.073 (.300)		34.007 (.000)	
Religion	Hindu	37.9	380	55.8	1108
	Others	35.3	60	47.5	176
Pearson chi-square (sig.)		.417 (.519)		4.656 (.031)	
Caste	General	33.6	295	51.8	698
	SC/ST	49.2	146	60.6	495
Pearson chi-square (sig.)		22.788 (.000)		15.807 (.000)	
Mother's education	Illiterate	50.0	129	60.7	789
	Literate primary	42.9	137	56.7	232
	Literate secondary and higher	29.3	175	37.8	172
Pearson chi-square (sig.)		38.530 (.000)		72.175 (.000)	
Standard of living	Low	48.6	205	61.3	460
	Medium	36.6	204	58.0	605
	High	14.4	26*	34.5	126
Pearson chi-square (sig.)				77.844 (.000)	
Mother's work status	Non-working	34.4	279	48.4	525
	Working	44.6	162	61.9	669
Pearson chi-square (sig.)		11.282 (.001)		39.617 (.000)	
Birth order of the child	1-2	35.7	327	51.6	512
	3 and above	44.0	114	58.2	682
Pearson chi-square (sig.)		5.957 (.015)		9.554 (.002)	
BMI of mother	Low	51.0	179	60.8	513
	Normal	31.8	262	51.4	675
Pearson chi-square (sig.)		38.524 (.000)		18.242 (.000)	
Mother received iron and folic acid tablets during pregnancy	No	35.3	24*	57.9	610
	Yes	37.7	417	52.5	584
Pearson chi-square (sig.)				6.404 (.011)	
Mother received tetanus injections during pregnancy	No	45.5	10*	60.8	358
	Yes	37.4	431	53.0	836
Pearson chi-square (sig.)				10.372 (.001)	
Exposure to mass media	Not exposed	44.1	176	61.6	774
	Exposed	34.1	265	46.3	420
Pearson chi-square (sig.)		11.151 (.001)		50.021 (.000)	

Source: IIPS (2000)

Note:
Chi-square is not given for variables marked (*) as the number of cases is low.

The demographic factor like age of the child shows that out of the total children less than 12 months old, 19.8 per cent children are underweight in Tamil Nadu, while in Madhya Pradesh it stands at a high of 32.4 per cent. Similarly, out of the total children in the age group of 12-23 months and 24-35 months, 47.9 per cent and 44.3 per cent children are underweight respectively in Tamil Nadu, as against 67.2 per cent and 67.3 per cent underweight children among the age groups of 12-23 months and 24-35 months respectively in Madhya Pradesh. The chi-square shows a strong association between the ages of the child and underweight which is significant at less than one per cent level of significance for both Tamil Nadu and Madhya Pradesh.

In terms of the sex of the child, the percentage of underweight children is also more in Madhya Pradesh as compared with Tamil Nadu. In Tamil Nadu, among the male and female children, 36.2 per cent and 39.0 per cent are underweight respectively, the percentage of underweight among the males and females are 52.7 per cent and 57.8 per cent respectively in Madhya Pradesh. Not much difference in underweight is observed between male and female children for both the states. The chi-square shows weak association only in Madhya Pradesh.

The prevalence of underweight is high in the rural areas as compared with the urban areas for both the states although the level of underweight is higher in Madhya Pradesh than in Tamil Nadu. In Tamil Nadu and Madhya Pradesh, 38.8 per cent and 58.6 per cent underweight children reside in the rural areas respectively as against 35.9 per cent and 43.9 per cent of the underweight children residing in the urban areas of Tamil Nadu and Madhya Pradesh respectively. The chi-square shows a strong association only in Madhya Pradesh.

The data shows that underweight is higher among the Hindu children than among the children belonging to other religious backgrounds for both the states. In Tamil Nadu, 37.9 per cent Hindu children are underweight as against 35.3 per cent underweight children belonging to other religious communities. In Madhya

Pradesh, 55.8 per cent Hindu children and 47.5 per cent children belonging to other religions are underweight. However, chi-square shows weak association only in Madhya Pradesh.

Underweight is low for the general caste children as compared with the children belonging to scheduled caste and tribes. While 33.6 per cent and 51.8 per cent general caste children are underweight in Tamil Nadu and Madhya Pradesh respectively, the percentage of underweight scheduled caste and tribe children are a high of 49.2 per cent in Tamil Nadu and 60.6 per cent in Madhya Pradesh. The chi-square shows a strong association between the caste of the child and the child being underweight. This means that underweight is more among children belonging to scheduled caste and scheduled tribe families than among the children belonging to the general caste.

The effect of mother's education on the levels of nutrition shows that 50.0 per cent underweight children in Tamil Nadu belong to illiterate mothers while 42.9 per cent and 29.3 per cent underweight children belong to mothers with primary and secondary and higher levels of education respectively. Similarly, in Madhya Pradesh, 60.7 per cent underweight children belong to illiterate mothers and 56.7 per cent and 37.8 per cent underweight children belong to mothers having education up to primary and secondary and higher levels respectively. The association is statistically supported by chi-square showing that mothers with higher levels of education have fewer underweight children as compared with illiterate mothers in both the states.

An analysis between the standard of living and underweight children shows that underweight tends to be lower with the increase in the standard of living. Among the children belonging to households having low standard of living, 48.6 per cent and 61.3 per cent children are underweight in Tamil Nadu and Madhya Pradesh respectively as against 36.6 per cent and 58.0 per cent underweight children belonging to households having medium standard of living in Tamil Nadu and Madhya Pradesh respectively. Only 14.4 per cent underweight children in Tamil

Nadu and 34.5 per cent underweight children in Madhya Pradesh belong to households having high standard of living. The chi-square shows a strong association, which proves that malnutrition is more prevalent among households having low standard of living and less among the households having a higher standard of living.

Mother's work status and underweight shows negative association in Tamil Nadu and Madhya Pradesh. In both the states, working mothers have more underweight children than non-working mothers. In Tamil Nadu 44.6 per cent underweight children belongs to working mothers and 34.4 per cent underweight children belongs to non-working mothers. On the other hand, 61.9 per cent underweight children belong to working mothers as compared with 48.4 per cent underweight children belonging to non-working mothers in Madhya Pradesh.

The cross tabulation between underweight and birth order of the child shows that underweight children are more in the higher birth order. In Tamil Nadu, out of the total children in the birth order of one and two, 35.7 per cent are underweight as compared with 44.0 per cent underweight children in the birth order of three and above. In Madhya Pradesh, out of the total under three years of age children in the birth order of one and two, 51.6 per cent are underweight as compared with 58.2 per cent in the birth order of three and above. The chi-square show that with the increase in the birth order of the child, the child tends to become underweight.

BMI of mother plays an important role in determining the nutritional status of the children. It is evident from the data that mothers with low BMI have more malnourished children. In Tamil Nadu, mothers with low BMI have 51.0 per cent underweight children as compared with 31.8 per cent underweight children belonging to mothers having normal BMI. It is evident that in Madhya Pradesh, 60.8 per cent underweight children belong to mothers having low BMI and 51.4 per cent underweight children belong to mothers with normal BMI. The chi-

square shows a strong association, which is significant at less than one per cent level of significance.

Maternal care during pregnancy also plays an important role in determining the nutritional status of the children. Therefore, it is seen that when the mothers do not receive iron and folic acid tablets during pregnancy, the percentage of underweight children are more and this is true for both the states. In Tamil Nadu and Madhya Pradesh, 35.3 per cent and 57.9 per cent underweight children belong to mothers who did not receive iron and folic acid tablets during pregnancy respectively, in comparison to 37.7 per cent and 52.5 per cent underweight children of Tamil Nadu and Madhya Pradesh respectively whose mothers did not receive the same. However, the chi-square shows a strong association only in Madhya Pradesh and not in Tamil Nadu, as the number of cases is very few.

Mothers who did not receive tetanus injections during pregnancy have more underweight children. In Tamil Nadu and Madhya Pradesh, 45.5 per cent and 60.8 per cent children respectively are underweight whose mothers did not receive tetanus injections during pregnancy in comparison to 37.4 per cent and 53.0 per cent underweight children in Tamil Nadu and Madhya Pradesh whose mothers received tetanus injections during pregnancy. Chi-square shows a strong association among the variables only in Madhya Pradesh as the number of mothers who did not receive the same are very few in Tamil Nadu.

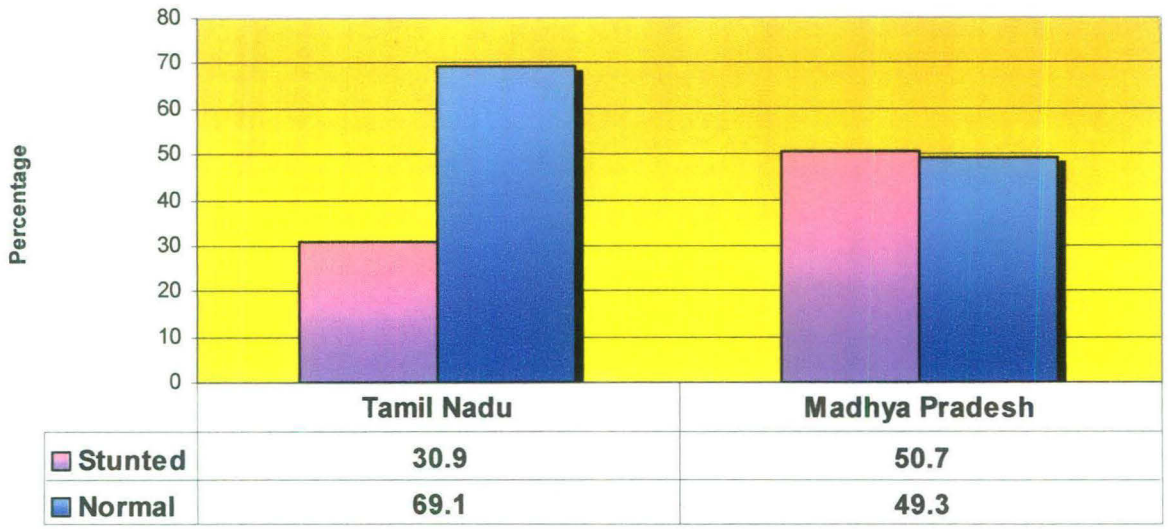
Exposure to mass media has a strong influence on the nutritional status. Both the states show the same trend i.e. with exposure to mass media the levels of child malnutrition decreases. In Tamil Nadu, 44.1 per cent and 34.1 per cent underweight children belong to parents who are not exposed and who are exposed to mass media respectively. Similarly, 61.6 per cent underweight children of Madhya Pradesh belong to parents who are not exposed to mass media and 46.3 per cent underweight children belong to parents who are

regularly exposed to mass media. The chi-square shows a strong association and thus proves the hypothesis.

4.2.b Association between stunting and the independent variables

The graph below (fig. 4.3) gives us a comparative view of the distribution of stunted children below three years of age in Tamil Nadu and Madhya Pradesh.

Fig. 4.3 Percentage of stunted and normal children in Tamil Nadu and Madhya Pradesh, NFHS-2, 1998-99



	Tamil Nadu	Madhya Pradesh
Stunted	30.9	50.7
Normal	69.1	49.3

In the height-for-age index (stunting), it is evident that the levels of stunted children are higher in Madhya Pradesh as compared with Tamil Nadu for all the studied independent variables. This is shown with the help of table 4.4. Stunting measures the linear growth retardation of children caused due to malnutrition and is an indicator of chronic malnutrition.

Age of the child shows a strong association (less than one per cent level of significance) with the children being stunted for both the states. The percentage of stunting is highest in the age group of 12-23 months as compared with the

Table 4.4 Percentage distribution of stunted children under three years of age in Tamil Nadu and Madhya Pradesh, NFHS-2, 1998-99

INDEPENDENT VARIABLE	CATEGORY	TAMIL NADU		MADHYA PRADESH	
		Percentage	Number	Percentage	Number
Age of the child	Less than 12 months	12.8	49	26.9	202
	12-23 months	40.3	160	63.8	442
	24-35 months	39.0	154	63.0	454
Pearson chi-square (sig.)		87.352 (.000)		261.084 (.000)	
Sex of the child	Male	32.0	199	49.1	546
	Female	29.6	164	52.4	552
Pearson chi-square (sig.)		.818 (.366)		2.253 (.133)	
Place of residence	Rural	30.6	200	54.0	894
	Urban	31.3	163	40.0	204
Pearson chi-square (sig.)		.068 (.795)		30.651 (.000)	
Religion	Hindu	30.9	310	51.4	1019
	Others	30.6	52	43.6	79
Pearson chi-square (sig.)		.007 (.934)		3.949 (.047)	
Caste	General	27.3	239	47.4	639
	SC/ST	41.4	123	56.1	458
Pearson chi-square (sig.)		20.865 (.000)		15.118 (.000)	
Mother's education	Illiterate	41.1	106	56.7	737
	Literate primary	33.9	108	50.4	206
	Literate secondary and higher	24.9	149	33.8	154
Pearson chi-square (sig.)		23.871 (.000)		70.660 (.000)	
Standard of living	Low	39.6	167	58.5	439
	Medium	28.2	157	51.6	538
	High	16.7	30*	32.1	117
Pearson chi-square (sig.)				69.502 (.000)	
Mother's work status	Non-working	28.6	232	45.1	489
	Working	36.1	131	56.3	609
Pearson chi-square (sig.)		6.639 (.010)		27.290 (.000)	
Birth order of the child	1-2	29.8	273	47.5	472
	3 and above	34.7	90	53.4	626
Pearson chi-square (sig.)		2.313 (.128)		7.436 (.006)	
BMI of mother	Low	33.0	116	52.3	441
	Normal	30.0	247	49.9	655
Pearson chi-square (sig.)		1.062 (.303)		1.150 (.284)	
Mother received iron and folic acid tablets during pregnancy	No	25.0	17*	55.7	586
	Yes	31.3	346	46.0	512
Pearson chi-square (sig.)				19.972 (.000)	
Mother received tetanus injections during pregnancy	No	45.5	10*	58.7	346
	Yes	30.6	353	47.7	752
Pearson chi-square (sig.)				20.862 (.000)	
Exposure to mass media	Not exposed	37.6	150	55.9	703
	Exposed	27.4	213	43.5	395
Pearson chi-square (sig.)		12.705 (.000)		32.559 (.000)	

Source: IIPS (2000)

Note:
Chi-square is not given for variables marked (*) as the number of cases is low.

other age groups for both the states. In Tamil Nadu and Madhya Pradesh, 40.3 per cent and 63.8 per cent of the children in the age group of 12-23 months are stunted respectively.

Sex of the child and stunting do not show any association. In Tamil Nadu, out of the total male children, 32.0 per cent are stunted whereas among the total female children 29.6 per cent are stunted. In Madhya Pradesh, out of the total male children, 49.1 per cent are stunted and among the total female children, 52.4 per cent are stunted.

Stunting according to the place of residence shows that rural children are more stunted than the urban children in Madhya Pradesh while the urban children of Tamil Nadu are more stunted than the rural children. Among the total rural children, 30.6 per cent and 54.0 per cent are stunted in Tamil Nadu and Madhya Pradesh respectively. Likewise, out of the total urban children, 31.3 per cent and 40.0 per cent are stunted in Tamil Nadu and Madhya Pradesh respectively. A strong association is seen between the place of residence and the children being stunted only for Madhya Pradesh.

Data show that stunting is more common among the Hindu children than among children belonging to other religious backgrounds. Out of the total Hindu children, 30.9 per cent and 51.4 per cent are stunted in Tamil Nadu and Madhya Pradesh respectively as compared with 30.6 per cent and 43.6 per cent stunted children belonging to other religions in Tamil Nadu and Madhya Pradesh respectively. The chi-square result has not been considered in this case as the number of cases for other religion is very few in both the states.

From the analysis, it is evident that malnutrition is more prevalent among the scheduled caste and scheduled tribe children than among the general caste children for both the states. Among the general caste children, 27.3 per cent and 47.4 per cent are stunted in Tamil Nadu and Madhya Pradesh respectively. In Tamil Nadu, out of the total scheduled caste and scheduled tribe children, 41.4

per cent are stunted whereas in Madhya Pradesh, 56.1 per cent of the scheduled caste and scheduled tribe children are stunted. The chi-square shows a strong association for both the states and supports the hypothesis that undernutrition is more among the children belonging to scheduled caste and scheduled tribe families.

From table 4.4 it is seen that mother's education influences the levels of nutrition. In Madhya Pradesh, among the illiterate mothers, 56.7 per cent children are stunted, whereas among the mothers having primary and secondary and higher levels of education, 50.4 per cent and 33.8 per cent children are stunted respectively. In Tamil Nadu, among the illiterate mothers, 41.1 per cent children are stunted, while among the mothers having primary and secondary and higher levels of education, 33.9 per cent and 24.9 per cent children are stunted respectively. The chi-square shows a strong positive association between mother's education and the children being stunted for both the states.

Considering the economic conditions, it is seen that the standard of living determines the level of malnutrition. For both the states it is observed that with increase in the standard of living, the levels of stunting decreases. In Tamil Nadu, among the households having low, medium and high standard of living, 39.6 per cent, 28.2 per cent and 16.7 per cent of the children are stunted respectively. Similarly, in Madhya Pradesh, out of the total households having low, medium and high standard of living, 58.5 per cent, 51.6 per cent and 32.1 per cent children are stunted respectively. The chi-square shows strong association between the variables, which is significant at less than one per cent level of significance for both Tamil Nadu and Madhya Pradesh,

Mother's work status and stunting shows negative association in Tamil Nadu and Madhya Pradesh i.e. stunting is more among children belonging to working mothers. In Tamil Nadu, it is observed that non-working mothers have 28.6 per cent and working mothers have 36.1 per cent stunted children while in Madhya

Pradesh non-working mothers have 45.1 per cent and working mothers have 56.3 per cent stunted children respectively.

The percentage of stunted children according to birth order, shows that stunting is common among children in higher birth order (three and above) for both the states. Among the children in the birth order of three and above, 34.7 per cent and 53.4 per cent are stunted in Tamil Nadu and Madhya Pradesh respectively. However, chi-square shows weak association between birth order and stunting only in Madhya Pradesh.

Maternal factors like BMI of the mother shows that mothers with normal BMI have less stunted children than mothers with low BMI. Among the mothers who have low and normal BMI in Tamil Nadu, 33.0 per cent and 30.0 per cent children are stunted respectively. In Madhya Pradesh, out of the total mothers having low and normal BMI, 52.3 per cent and 49.9 per cent children are stunted respectively.

From table 4.4 it is also evident that mothers who received iron and folic acid tablets and tetanus injections during pregnancy have less malnourished children than mothers who did not receive the same. In Tamil Nadu, out of the total mothers who did not receive and who received iron and folic acid tablets during pregnancy have 25.0 per cent and 31.3 per cent stunted children respectively. On the other hand in Madhya Pradesh, out of the total mothers who did not receive and who received iron and folic acid tablets during pregnancy have 55.7 per cent and 46.0 per cent stunted children respectively. The chi-square result has only been considered for Madhya Pradesh and not for Tamil Nadu as the number of mothers who did not receive antenatal care is very few. The analysis establishes a strong positive association.

Similarly, in Tamil Nadu, out of the total mothers who did not receive and who received tetanus injections during pregnancy have 45.5 per cent and 30.6 per cent stunted children respectively. In Madhya Pradesh, mothers who did not

receive tetanus injections during pregnancy have 58.7 per cent stunted children while those mothers who received tetanus injections during pregnancy have 47.7 per cent stunted children. The chi-square show a strong association in Madhya Pradesh but the chi-square result has not been considered in Tamil Nadu because of the above mentioned reason.

Table 4.4 shows that exposure to mass media has a strong influence on the nutritional status of the children for both the states. Parents who are exposed to mass media are more knowledgeable about their child's nutrition and hence have less malnourished children than parents who are not exposed to mass media. In Tamil Nadu, out of the total parents who are not exposed and those who are exposed to mass media, 37.6 per cent and 27.4 per cent have stunted children under three years of age respectively. Similarly, in Madhya Pradesh, out of the total parents who are not exposed and who are exposed to mass media, 55.9 per cent and 43.5 per cent have stunted children respectively. The chi-square shows a strong association between exposure to mass media and the child being stunted in both the states.

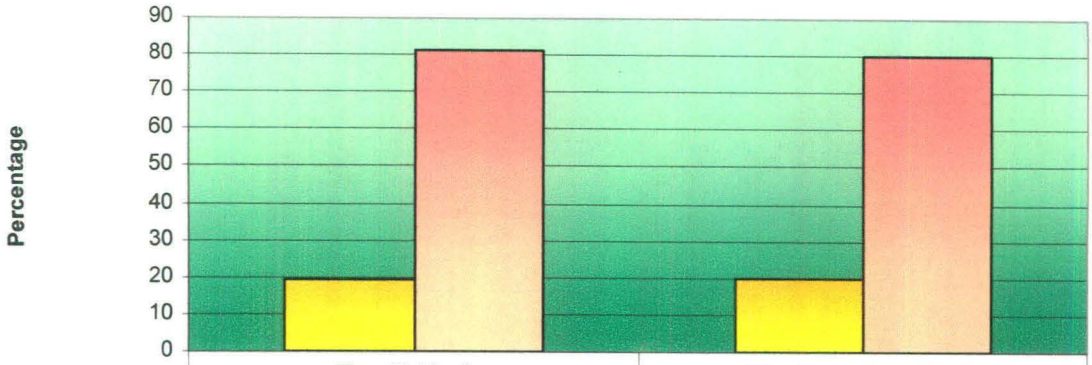
4.2.c Association between wasting and the independent variables

The graph (fig. 4.4) gives us a comparative view of the distribution of wasted children below three years of age in Tamil Nadu and Madhya Pradesh.

Comparing the three anthropometric measures for assessing child nutrition like, weight-for-age, height-for-age and weight-for-height, it is seen that the levels of wasting are less than that of underweight and stunting. This shows that acute malnutrition does not prevail in both the states. According to NFHS-2, 15.5 per cent of the Indian children below three years of age are wasted i.e. they are below -2SD in the weight-for-height index. Tamil Nadu has 19.1 per cent wasted

children and Madhya Pradesh has 19.9 per cent wasted children below three years of age.

Fig. 4.4 Percentage of wasted and normal children in Tamil Nadu and Madhya Pradesh, NFHS-2, 1998-99



	Tamil Nadu	Madhya Pradesh
Wasted	19.1	19.9
Normal	80.9	80.1

The analysis of wasted children in Tamil Nadu and Madhya Pradesh according to the percentage among the different categories of the respective independent variables and their association as presented in table 4.5 shows the following results.

On the basis of the age of the child, it is seen that wasting is the highest in the age group of 12-23 months for both the states. In Tamil Nadu, out of the total children in the age group of less than 12 months, 19.1 per cent are wasted, whereas among the children in the age group of 12-23 months and 24-35 months, 24.9 per cent and 13.4 per cent are wasted respectively. In Madhya Pradesh, out of the total children in the age group of less than 12 months, 12-23 months and 24-35 months, 16.0 per cent, 26.9 per cent and 17.2 per cent are wasted respectively. The chi-square shows a strong association between the age of the child and wasting.

Table 4.5 Percentage distribution of wasted children under three years of age in Tamil Nadu and Madhya Pradesh, NFHS-2, 1998-99

INDEPENDENT VARIABLE	CATEGORY	TAMIL NADU		MADHYA PRADESH	
		Percentage	Number	Percentage	Number
Age of the child	Less than12 months	19.1	73	16.0	120
	12-23 months	24.9	99	26.9	187
	24-35 months	13.4	53	17.2	124
Pearson chi-square (sig.)		16.973 (.000)		32.062 (.000)	
Sex of the child	Male	19.3	120	20.0	222
	Female	19.0	105	19.8	209
Pearson chi-square (sig.)		.026 (.872)		.015 (.903)	
Place of residence	Rural	19.6	128	21.0	348
	Urban	18.6	97	16.3	83
Pearson chi-square (sig.)		.170 (.680)		5.443 (.020)	
Religion	Hindu	19.4	195	20.3	403
	Others	17.1	29*	15.5	28*
Pearson chi-square (sig.)					
Caste	General	18.8	165	18.2	245
	SC/ST	20.2	60	22.7	186
Pearson chi-square (sig.)		.276 (.599)		6.462 (.011)	
Mother's education	Illiterate	22.1	57	23.0	300
	Literate primary	20.4	65	18.1	74
	Literate secondary and higher	17.2	103	12.5	57
Pearson chi-square (sig.)		3.186 (.203)		24.416 (.000)	
Standard of living	Low	21.3	90	21.5	162
	Medium	18.3	102	21.2	221
	High	17.2	31*	12.9	47*
Pearson chi-square (sig.)					
Mother's work status	Non-working	18.1	147	17.6	191
	Working	21.5	78	22.2	240
Pearson chi-square (sig.)		1.856 (.173)		7.066 (.008)	
Birth order of the child	1-2	18.3	168	19.6	195
	3 and above	22.0	57	20.1	236
Pearson chi-square (sig.)		1.754 (.185)		.068 (.795)	
BMI of mother	Low	23.4	82	22.1	187
	Normal	17.4	143	18.3	241
Pearson chi-square (sig.)		5.692 (.017)		4.683 (.030)	
Mother received iron and folic acid tablets during pregnancy	No	16.2	11*	21.2	125
	Yes	19.3	214	18.7	306
Pearson chi-square (sig.)				2.101 (.147)	
Mother received tetanus injections during pregnancy	No	9.1	2*	21.2	223
	Yes	19.3	223	19.4	208
Pearson chi-square (sig.)				.869 (.351)	
Exposure to mass media	Not exposed	20.1	80	22.6	285
	Exposed	18.7	145	16.1	146
Pearson chi-square (sig.)		.317 (.573)		14.170 (.000)	

Source: IIPS (2000)

Note:
Chi-square is not given for variables marked (*) as the number of cases is low.

Wasting according to the sex of the child shows that wasting is more common among the males than among the females for both the states. In Tamil Nadu, out of the total males, 19.3 per cent are wasted and out of the total females, 19.0 per cent are wasted. In Madhya Pradesh, out of the total males and females, 20.0 per cent and 19.8 per cent are wasted respectively. The chi-square does not support any association for any of the states.

The prevalence of wasting is more among the rural children than among the urban children for both the states. In Tamil Nadu, out of the total rural and urban children, 19.6 per cent and 18.6 per cent are wasted respectively. In Madhya Pradesh, out of the total rural and urban children, 21.0 per cent and 16.3 per cent are wasted respectively. The chi-square shows a weak association only in Madhya Pradesh.

The data show that wasting is more prevalent among the Hindu children but the chi-square does not support any association. In Tamil Nadu, the percentage of wasted children is 19.4 per cent among the Hindus and 17.1 per cent among other religions. In Madhya Pradesh, the percentage of wasting among the Hindu children is 20.3 per cent and that among children belonging to other religious backgrounds is 15.5 per cent.

Like, underweight and stunting, wasting is also more common among the scheduled caste and scheduled tribe children as compared with the general caste children for both the states. In Tamil Nadu, out of the total general caste children, 18.8 per cent are wasted whereas out of the total scheduled caste and scheduled tribe children 20.2 per cent are wasted. In Madhya Pradesh, out of the total under three years of age general caste and scheduled caste and scheduled tribe children, 18.2 per cent and 22.7 per cent are wasted respectively. The chi-square establishes the association only in Madhya Pradesh.

Mother's education shows a positive association with wasted children. It is seen that with increase in mother's education, the levels of wasting declines among

the children. In Tamil Nadu, out of the total illiterate mothers, 22.1 per cent have wasted children, whereas out of the total mothers having primary and secondary and higher levels of education, 20.4 per cent and 17.2 per cent have wasted children respectively. In Madhya Pradesh, illiterate mothers have 23.0 per cent wasted children and mothers with primary and secondary and higher levels of education have 18.1 per cent and 12.5 per cent wasted children respectively. The chi-square is significant only for Madhya Pradesh.

Considering the standard of living, it is seen that with increase in the standard of living the level of wasting declines. In Tamil Nadu, out of the total children living in households with low, medium and high standard of living, 21.3 per cent, 18.3 per cent and 17.2 per cent are wasted respectively. In Madhya Pradesh, out of the total children living in households with low, medium and high standard of living, 21.5 per cent, 21.2 per cent and 12.9 per cent children are wasted respectively. The chi-square shows association between the dependent and the independent variable. But only the result of Madhya Pradesh is taken into account as the number of cases in Tamil Nadu is low.

In Tamil Nadu, non-working mothers have 18.1 per cent wasted children and working mothers have 21.5 per cent wasted children. In Madhya Pradesh, non-working mothers have 17.6 per cent wasted children whereas working mothers have 22.2 per cent wasted children. Thus it is evident that in both the states working mothers have more wasted children as compared with non-working mothers. The chi-square shows a negative association only in Madhya Pradesh.

Table 4.5 shows, that the prevalence of wasting is more among the children in the higher birth order for both the states. In Tamil Nadu, out of the total under three years of age children in the birth order of one and two and three and above, 18.3 per cent and 22.0 per cent are wasted respectively. In Madhya Pradesh, out of the total under three years of age children in the birth order of one and two and three and above, 19.6 per cent and 20.1 per cent are wasted respectively. The

chi-square does not support the association that wasting is more common among the children in the higher birth order.

Maternal factors like BMI of the mother show that for both the states, mothers with low BMI have more wasted children in comparison with mothers having normal BMI. In Tamil Nadu, among the mothers having low BMI, 23.4 per cent have wasted children under three years of age and among those mothers having normal BMI, 17.4 per cent have wasted children under three years of age. Similarly, in Madhya Pradesh, among the mothers having low and normal BMI, 22.1 per cent and 18.3 per cent have wasted children respectively. The chi-square shows a strong positive association between the BMI of the mother and the children being wasted for both the states. It is significant at less than one per cent level of significance.

Antenatal care also affects the levels of wasting in children. It is observed from the analysis that when mothers receive iron and folic acid tablets and tetanus injections during pregnancy, the percentage of wasted children declines. In Tamil Nadu, out of the total mothers who received and who did not receive iron and folic acid tablets during pregnancy, 19.3 per cent and 16.2 per cent have wasted children respectively. In Madhya Pradesh, among the mothers who received and who did not receive iron and folic acid tablets during pregnancy, 18.7 per cent and 21.2 per cent have wasted children. The chi-square is not taken into consideration for Tamil Nadu as the number of cases is few. However, in Madhya Pradesh, chi-square shows a strong positive association.

In Tamil Nadu, among the mothers who did not receive tetanus injections, 9.1 per cent have wasted children and among those mothers who have received the same, 19.3 per cent have wasted children. In Madhya Pradesh, among the mothers who did not receive and who received tetanus injections, 21.2 per cent and 19.4 per cent have wasted children. The chi-square does not show any association between the two variables in Madhya Pradesh and it is not considered for Tamil Nadu as the number of cases is few.

Data show that exposure to mass media has a strong influence on wasting. In Tamil Nadu, out of the total parents who are not exposed to mass media, 20.1 per cent have wasted children and among those who are exposed to mass media, 18.7 per cent have wasted children who are under three years of age. In Madhya Pradesh, out of the total parents who are not exposed and who are exposed to mass media, 22.6 per cent and 16.1 per cent have wasted children respectively. However, chi-square results show a strong association only in Madhya Pradesh.

4.3 EFFECT OF THE DEMOGRAPHIC AND SOCIO-ECONOMIC VARIABLES ON CHILD NUTRITION

In the previous section, the characteristics and the association between the dependent and the independent variables are discussed. The association between the dependent and the independent variables as shown with the help of chi-square only show the gross effect, thus this relation does not control for the influence of other variables in the analysis and hence the net effects are ignored. Therefore, this section incorporates control for demographic and socio-economic background variables in analysing its net effect on child nutrition, namely on underweight, stunting and wasting. It is to be mentioned in this context that only those variables with significant result are to be discussed here.

4.3.a Effect of the demographic and socio-economic variables on underweight

Table 4.6 shows the unadjusted and adjusted effect of demographic and socio-economic variables on the likelihood of the children being underweight.

The age of the child shows positive effect on the unadjusted and adjusted odds of the children being underweight in both the states i.e. Tamil Nadu and Madhya Pradesh. In Tamil Nadu, when all other independent variables are controlled for,

Table 4.6 Unadjusted and adjusted effects of the different independent variables on underweight children under three years of age in Tamil Nadu and Madhya Pradesh, NFHS-2, 1998-99

INDEPENDENT VARIABLES	CATEGORY	TAMIL NADU				MADHYA PRADESH			
		Unadjusted		Adjusted		Unadjusted		Adjusted	
		Odds ratio	Sig.	Odds ratio	Sig.	Odds ratio	Sig.	Odds ratio	Sig.
Age of the child	Less than 12 months (r)								
	12-23 months	3.708	.000**	3.737	.000**	4.292	.000**	4.829	.000**
	24-35 months	3.213	.000**	3.321	.000**	4.296	.000**	4.833	.000**
Sex of the child	Male (r)								
	Female	1.125	.330	1.063	.641	1.231	.017*	1.203	.054⊥
Birth order of the child	1-2 (r)								
	3 and above	1.416	.015*	1.054	.748	1.308	.002**	.992	.941
Place of residence	Rural (r)								
	Urban	.882	.300	1.236	.149	.553	.000**	.835	.173
Religion	Hindu (r)								
	Others	.894	.519	1.121	.553	.716	.032*	.899	.561
Caste	General (r)								
	SC/ST	1.907	.000**	1.544	.005**	1.429	.000**	1.106	.347
Standard of living	Low (r)								
	Medium	--	--	--	--	.871	.157	.976	.826
	High	.480	.000**	.682	.014*	.332	.000**	.496	.000**
Mother's education	Illiterate (r)								
	Literate primary	.753	.091⊥	.880	.490	.847	.149	1.011	.935
	Literate secondary and higher	.414	.000**	.589	.004**	.393	.000**	.581	.000**
Mother's work status	Non-working(r)								
	Working	1.540	.001**	1.008	.956	1.729	.000**	1.172	.133
Exposure to mass media	Not exposed(r)								
	Exposed	.657	.001**	.842	.256	.537	.000**	.801	.066⊥
BMI of mother	Low (r)								
	Normal	.449	.000**	.471	.000**	.683	.000**	.672	.000**
Mother received iron and folic acid tablets during pregnancy	No (r)								
	Yes	--	--	--	--	.803	.011*	.988	.919
Mother received tetanus injections during pregnancy	No (r)								
	Yes	--	--	--	--	.729	.000**	1.080	.550

Source: IIPS (2000)

Note:
1. (r) is the reference category in the logistic regression.
2. ** is the coefficient which is significant at one per cent level of significance.
3. * is the coefficient which is significant at five per cent level of significance.
4. ⊥ is the coefficient which is significant at ten per cent level of significance.
5. – means few cases and not considered in logistic regression.

underweight among children in the age group of 12-23 months is 3.7 times more likely than in the first year of life. Similarly, in Madhya Pradesh, when all other independent variables are controlled for, children in the age group of 12-23 months are 4.8 times more likely to be underweight than children less than 12 months of age. This shows that with increase in age, the chances of the children being underweight also increase.

Standard of living has positive effect on the unadjusted and adjusted odds of underweight children in both the states. In Madhya Pradesh, when all other independent variables are controlled for, children in households with high standard of living are 50.4 per cent less likely to be underweight as compared with children belonging to households with low standard of living. In Tamil Nadu, the medium and high standard of living households are clubbed into high standard of living as the number of cases in high standard of living is low. In the state, when all other independent variables are controlled for, children belonging to high standard of living are 31.8 per cent less likely to be underweight than children belonging to low standard of living.

Mother's education shows high statistical significance on both the unadjusted and adjusted odds of underweight children in both the states. In Tamil Nadu when all other independent variables are controlled for, mothers with secondary and higher levels of education are 41.1 per cent less likely to be underweight than children belonging to illiterate mothers. In Madhya Pradesh, when all other independent variables are controlled for, children belonging to mothers having education up to secondary and higher levels are 41.9 per cent less likely to be underweight as compared with illiterate mothers.

BMI of mother shows positive effect on the unadjusted and adjusted odds of the children being underweight. In Tamil Nadu, when all other independent variables are controlled for, the chances of having underweight children are 52.9 per cent less to mothers having normal BMI as compared with mothers having low BMI. In Madhya Pradesh, when all other independent variables are controlled for, the

chances of having underweight children are 32.8 per cent less to mothers having normal BMI as compared with mothers having low BMI.

Caste of the child has a positive effect on the unadjusted and adjusted odds of underweight children in Tamil Nadu. The scheduled caste and scheduled tribe children in Tamil Nadu are 1.5 times more likely to be underweight than children belonging to the general caste. However, in Madhya Pradesh, caste has positive effect only on the unadjusted odds of the underweight children and is statistically significant, but when all other independent variables are controlled for, caste becomes an insignificant factor in determining the nutritional status. This shows that in less developed state where the economic condition of the people is relatively poor, other intervening factors rather than caste play an important role in determining the nutritional status of the children.

The sex of the child shows positive effect on the unadjusted and adjusted odds of the children being underweight in Madhya Pradesh. When all other independent variables are controlled for, female children are 1.2 times more likely to be underweight as compared with the male children and the odds ratio is significant at less than ten per cent level of significance. The effect of the sex of the child on the child being underweight is statistically insignificant in Tamil Nadu. This shows that in less developed state like Madhya Pradesh, sex preference – mostly in favour of male children – is more an important factor in the distribution of food which in terms determine the nutritional status of the children.

The effect of the birth order of the child shows positive effect only on the unadjusted odds of underweight children in both the states. In Tamil Nadu and Madhya Pradesh, children in the birth order of three and above are 1.4 times and 1.3 times more likely to be underweight than children in the birth order of one to two respectively. However, when all other variables are controlled for, the odds ratio of the children being underweight becomes insignificant.

Mother's work status shows negative effect only on the unadjusted odds of the children being underweight for both the states. In Tamil Nadu, children belonging to working mothers are 1.5 times more likely to be underweight than children belonging to non-working mothers. Similarly in Madhya Pradesh, children belonging to working mothers are 1.7 times more likely to be underweight than children belonging to non-working mothers. However, when all other variables are controlled for, the odds ratio becomes insignificant. The plausible cause for such negative effect is not known.

Exposure to mass media shows negative effect only on the unadjusted odds of the underweight children for both the states. On the other hand, place of residence, religion, mother received iron and folic acid tablets during pregnancy and mother received tetanus injections during pregnancy shows positive effect only on the unadjusted odds of the children being underweight, and only in Madhya Pradesh.

4.3.b Effects of the demographic and socio-economic variables on stunting

Table 4.9 shows the unadjusted and adjusted effects of demographic and socio-economic variables on the likelihood of the children being stunted.

The age of the child shows positive effect on both the unadjusted and adjusted odds of the stunted children. In Tamil Nadu and Madhya Pradesh, when all other independent variables are controlled for, children in the age group of 12-23 months are 4.7 times and 5.3 times more likely to be stunted respectively as compared with children in the age group of less than 12 months. This shows that with increase in age the chances of the children being stunted increase.

The household standard of living shows positive effect on the unadjusted and adjusted odds of the children being stunted in both the states. In Tamil Nadu, when all other independent variables are controlled for, children belonging to households with high standard of living are 34.1 per cent less likely to be stunted

Table 4.7 Unadjusted and adjusted effects of the different independent variables on stunting of children under three years of age in Tamil Nadu and Madhya Pradesh, NFHS-2, 1998-99

INDEPENDENT VARIABLES	CATEGORY	TAMIL NADU				MADHYA PRADESH			
		Unadjusted		Adjusted		Unadjusted		Adjusted	
		Odds ratio	Sig.	Odds ratio	Sig.	Odds ratio	Sig.	Odds ratio	Sig.
Age of the child	Less than 12 months (r)								
	12-23 months	4.602	.000**	4.746	.000**	4.786	.000**	5.327	.000**
	24-35 months	4.356	.000**	4.549	.000**	4.621	.000**	5.124	.000**
Sex of the child	Male (r)								
	Female	.892	.366	.834	.189	1.138	.133	1.095	.340
Birth order of the child	1-2 (r)								
	3 and above	1.254	.129	.879	.453	1.266	.006**	.952	.629
Place of residence	Rural (r)								
	Urban	1.034	.795	1.350	.051⊥	.567	.000**	.782	.064⊥
Religion	Hindu (r)								
	Others	.985	.934	1.122	.556	.733	.048*	.947	.764
Caste	General (r)								
	SC/ST	1.887	.000**	1.668	.001**	1.414	.000**	1.099	.373
Standard of living	Low (r)								
	Medium	--	--	--	--	.755	.004**	.792	.034*
	High	.519	.000**	.659	.010**	.334	.000**	.442	.000**
Mother's education	Illiterate (r)								
	Literate primary	.734	.074⊥	.867	.454	.774	.024*	.885	.353
	Literate secondary and higher	.476	.000**	.625	.015*	.390	.000**	.550	.000**
Mother's work status	Nonworking (r)								
	Working	1.412	.010**	1.020	.895	1.570	.000**	1.041	.702
Exposure to mass media	Not exposed(r)								
	Exposed	.628	.000**	.687	.017*	.607	.000**	1.051	.678
BMI of mother	Low (r)								
	Normal	.869	.303	1.017	.909	.910	.284	.948	.587
Mother received iron and folic acid tablets during pregnancy	No (r)								
	Yes	--	--	--	--	.680	.000**	.831	.099⊥
Mother received tetanus injections during pregnancy	No (r)								
	Yes	--	--	--	--	.641	.000**	.957	.728

Source: IIPS (2000)

Note:
1. (r) is the reference category in the logistic regression.
2. ** is the coefficient which is significant at one per cent level of significance.
3. * is the coefficient which is significant at five per cent level of significance.
4. ⊥ is the coefficient which is significant at ten per cent level of significance.
5. – means few cases and not considered in logistic regression.

than children belonging to households with low standard of living. Similarly, in Madhya Pradesh, when all other independent variables are controlled for, children belonging to households with high standard of living are 55.8 per cent less likely to be stunted as compared with children belonging to households with low standard of living.

Mother's education shows positive effect on both the unadjusted and adjusted odds of stunted children in Tamil Nadu and Madhya Pradesh. In Tamil Nadu and Madhya Pradesh, when all other independent variables are controlled for, mothers with secondary and higher levels of education are 37.5 per cent and 45.0 per cent less likely to have stunted children as compared with illiterate mothers.

Caste of the child shows strong positive effect on the unadjusted and adjusted odds of the stunted children in Tamil Nadu and only on the unadjusted odds of stunted children in Madhya Pradesh. In Tamil Nadu, when all other independent variables are controlled for, scheduled caste and scheduled tribe children are 1.6 times more likely to be stunted as compared with children belonging to the general caste. However, in Madhya Pradesh, children belonging to scheduled caste and scheduled tribe families are 1.4 times more likely to be stunted than children belonging to general caste. But when all other independent variables are controlled for, caste of the child becomes an insignificant factor in determining child nutrition.

Exposure to mass media shows positive effect with both the unadjusted and adjusted odds of the stunted children in Tamil Nadu, and only with the adjusted odds of stunted children in Madhya Pradesh. It is observed that in Tamil Nadu when all other independent variables are controlled for, parents who are exposed to mass media are 31.3 per cent less likely to have stunted children as compared with parents who are not exposed to mass media.

As already mentioned, the analysis for mother received iron and folic acid tablets during pregnancy is not undertaken for Tamil Nadu due to the reason already mentioned before. From table 4.9, it is evident that mothers receiving iron and folic acid tablets during pregnancy show weak effect on the odds of stunted children in Madhya Pradesh. In Madhya Pradesh when all other independent variables are controlled for, mothers receiving iron and folic acid tablets during pregnancy are 16.9 per cent less likely to have stunted children as compared with mothers who did not receive the same. The odds ratio is significant at less than ten per cent level of significance. However, the unadjusted odds show strong statistical significance.

The working status of the mothers shows strong negative effect only with the unadjusted odds of the stunted children in both the states. It shows that children belonging to working mothers are 1.4 times and 1.5 times more likely to be stunted than children belonging to non-working mothers in Tamil Nadu and Madhya Pradesh respectively. However, when all other independent variables are controlled for, the odds ratio becomes insignificant. The reason for negative effect is unknown.

The birth order of the child and mother received tetanus injections during pregnancy shows statistical significance only on the unadjusted odds of the children being stunted in Madhya Pradesh. However, when all other independent variables are controlled for, these factors become insignificant.

BMI of mother do not show any significance either with the unadjusted or adjusted odds of the stunted children in both the states and the reason for the same is unknown.

The sex of the child does not show any statistical significance with the unadjusted and adjusted odds of the children being stunted in both the states.

4.3.c Effects of the demographic and socio-economic variables on wasting

Table 4.12 shows the unadjusted and the adjusted effects of demographic and socio-economic variables on the likelihood of the children being wasted.

The age of the child shows positive effect on the unadjusted and adjusted odds of the wasted children in Tamil Nadu and Madhya Pradesh. It is also observed that in Tamil Nadu and Madhya Pradesh, children in the age group of 12-23 months are more likely to be wasted. In Tamil Nadu, when all other independent variables are controlled for, children in the age group of 12-23 months are 1.3 times more likely to be wasted in comparison to children in the age group of less than 12 months. In Madhya Pradesh, when all other independent variables are controlled for, children in the age group of 12-23 months are 1.9 times more likely to be wasted as compared with the children in the age group of less than 12 months.

BMI of mother has positive effect on both the unadjusted and adjusted odds of wasted children in Tamil Nadu as well as in Madhya Pradesh. In Tamil Nadu, when all other independent variables are controlled for, mothers with normal BMI are 29.7 per cent less likely to have wasted children as compared with mothers having low BMI. In Madhya Pradesh, when all other independent variables are controlled for, mothers with normal BMI are 18.0 per cent less likely to have wasted children than mothers with low BMI and the odds ratio is significant at less than ten per cent level of significance.

Mother's education shows positive effect on both the unadjusted and adjusted odds of the wasted children in Madhya Pradesh and only on the unadjusted odds of the wasted children in Tamil Nadu. Thus it is observed that when all other independent variables are controlled for, children belonging to mothers having secondary and higher levels of education in Madhya Pradesh are 43.6 per cent less likely to have wasted children as compared with illiterate mothers. In Tamil Nadu, the odds of having wasted children is significant at less than ten per cent

Table 4.8 Unadjusted and adjusted effects of the different independent variables on wasting of children under three years of age in Tamil Nadu and Madhya Pradesh, NFHS-2, 1998-99

INDEPENDENT VARIABLES	CATEGORY	TAMIL NADU				MADHYA PRADESH			
		Unadjusted		Adjusted		Unadjusted		Adjusted	
		Odds ratio	Sig.	Odds ratio	Sig.	Odds ratio	Sig.	Odds ratio	Sig.
Age of the child	Less than 12 months (r)								
	12-23 months	1.411	.048*	1.348	.092⊥	1.938	.000**	1.965	.000**
	24-35 months	.658	.033*	.615	.015*	1.094	.522	1.105	.488
Sex of the child	Male (r)								
	Female	.976	.872	.928	.625	.987	.903	.974	.809
Birth order of the child	1-2 (r)								
	3 and above	1.256	.186	1.212	.306	1.029	.795	.868	.227
Place of residence	Rural (r)								
	Urban	.940	.680	1.070	.691	.732	.020*	1.074	.656
Religion	Hindu (r)								
	Others	.852	465	.937	.778	.720	.122	.825	.405
Caste	General (r)								
	SC/ST	1.092	.600	.954	.794	1.320	.011*	1.065	.600
Standard of living	Low (r)								
	Medium	--	--	--	--	.978	.849	1.081	.528
	High	.812	.173	.919	.643	.539	.001**	.820	.364
Mother's education	Illiterate (r)								
	Literate primary	.902	.616	1.007	.973	.738	.035*	.807	.166
	Literate secondary and higher	.734	.094⊥	.898	.622	.479	.000**	.564	.003**
Mother's work status	Non-working(r)								
	Working	1.238	.174	1.133	.463	1.332	.008**	1.109	.395
Exposure to mass media	Not exposed(r)								
	Exposed	.916	.574	1.040	.822	.656	.000**	.811	.137
BMI of mother	Low (r)								
	Normal	.690	.017*	.703	.031*	.790	.031*	.820	.078⊥
Mother received iron and folic acid tablets during pregnancy	No (r)								
	Yes	--	--	--	--	.856	.147	.921	.520
Mother received tetanus injections during pregnancy	No (r)								
	Yes	--	--	--	--	.895	.352	1.145	.342

Source: IIPS (2000)

Note:
1. (r) is the reference category in the logistic regression.
2. ** is the coefficient which is significant at one per cent level of significance.
3. * is the coefficient which is significant at five per cent level of significance.
4. ⊥ is the coefficient which is significant at ten per cent level of significance.
5. – means few cases and not considered in logistic regression.

level of significance, which eventually becomes insignificant when all other independent variables are controlled.

Standard of living, exposure to mass media, place of residence and caste of the child shows positive effect only on the unadjusted odds and are statistically significant in Madhya Pradesh. However, they become insignificant when all other independent variables are controlled. Mother's work status shows negative effect only on the unadjusted odds of the children being wasted in Madhya Pradesh which also become insignificant when all other independent variables are controlled.

The sex of the child is statistically insignificant with the unadjusted and adjusted odds of the wasted children in Tamil Nadu and Madhya Pradesh.

4.4 SUMMARY OF THE FINDINGS

To summarise, in both the states – Tamil Nadu and Madhya Pradesh – underweight, stunting and wasting are more common among children in the age group of 12-23 months and though it slightly declines thereby, but it continues to hover almost near the same percentage. This is also statistically significant even after controlling other demographic and socio-economic factors. This shows that child malnutrition increases from 12 months onwards and it is of serious concern especially among children under three years of age. So the government should adopt appropriate policies because according to Gupta and Rhode (2004), malnutrition is virtually irreversible after the age of two. Standard of living, BMI of mother, mother's education and caste are the important factors that determines the nutritional status of children under three years of age in both the states and they are statistically significant too.

It is important to mention in this context that mother's working status shows negative effect on child nutritional status in both the states. It is observed from the analysis that working mothers have higher percentage of underweight,

stunted and wasted children as compared with non-working mothers. This could be due to the fact that low levels of literacy among the females accompanied by poverty have forced them to work and therefore they are quite unaware about the nutritional well-being of their children which has led to high percentage of malnourished children in the state.

The sex of the child is, however, statistically insignificant with underweight, stunting and wasting, which proves that there, exists no sex preference in determining the nutritional status of children in both the states.

CHAPTER 5

CONCLUSION

Considering the children to be the most important future human resource, the first 'World Summit for Children', organised by UNICEF and WHO, was held in 1990. A declaration was made to try and end child deaths and child malnutrition by the year AD 2000 and to provide basic protection for the normal physical and mental development of the world's children as part of United Nations Millennium Development Goals. The declaration aimed at child immunisation, oral rehydration therapy for continued feeding during and after diarrhoea as well as the use of oral rehydration salts (ORS) to prevent and treat dehydration, safe water supply, proper sanitation and providing basic education (UNICEF 1998). India is a signatory to the declaration of 'World Summit for Children' for the survival, protection and development of children and the plan of action for implementing it. The 'National Plan of Action: A Commitment to the Child' formulated by the Department of Women and Child Development, Government of India put forward the following nutrition related goals in their 'National Plan of Action'.

Reduction in severe and moderate malnutrition among under five years of age children by half of 1990 levels in the year 2000 by expanding nutritional intervention through Integrated Child Development Services (ICDS) and to bring in behavioural changes among the mothers through existing programmes such as ICDS, Safe Motherhood, Urban Basic Services (UBS), Development of Women and Children in Rural Areas (DWCRA) and programmes of Food and Nutrition Board. It also emphasised on women's employment and education particularly nutrition and health education. Our study also shows that women's education and employment are important factors in raising the levels of child nutrition in both Tamil Nadu and Madhya Pradesh.

The present study shows that according to anthropometric data, the prevalence of wasting is lower than stunting and underweight among children under three

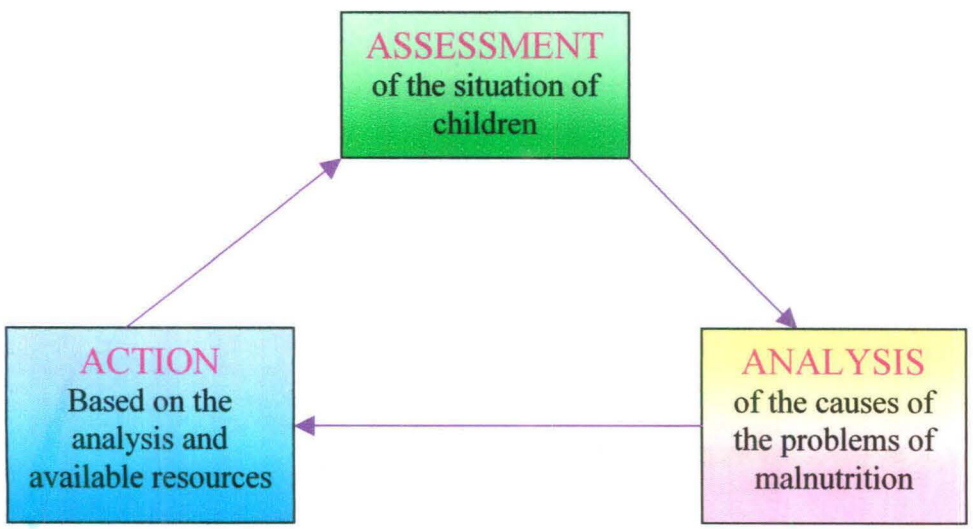
years of age which indicates that chronic malnutrition is more prevalent than acute malnutrition in both Tamil Nadu and Madhya Pradesh. Even in Tamil Nadu the percentage of wasted children is comparatively higher. Therefore, the prevalence of chronic and acute malnutrition in Tamil Nadu – one of the economically and socially developed states of India – arouses serious concern and needs further investigation. It is also observed that when all other variables are controlled for, the multivariate analysis of the different demographic and socio-economic variables like age of the child, mother's education, household standard of living and BMI of mother show a strong positive relationship with the nutritional status of children under three years of age. The age of the child shows that malnutrition increases with increase of age and becomes prominent in the second year of life than in the first year of life. The results also show that children of educated mothers, living in households with high standard of living and whose mothers are also well nourished and have normal BMI have better nutritional status as compared with children belonging to illiterate mothers, low standard of living and mothers with low BMI respectively. Contrary to this, it is evident that mother's work status has negative relationship with the child nutritional status in both Tamil Nadu and Madhya Pradesh. However, in contrast to the evidence of son preference in India, both the states do not show any gender discrimination in the parlance of child nutrition.

The study also show that in spite of the implementation of vigorous nutrition intervention programmes by the Ministry of Human Resource Development with the help of ICDS, which have been in place for almost a decade, still the overall child nutritional status in both Tamil Nadu and Madhya Pradesh remains low, although the situation in Tamil Nadu is better than in Madhya Pradesh. According to NFHS-2, the percentage of underweight children under three years of age is very high in India compared with stunted and wasted children under three years of age. Although the percentage of underweight children under three years of age has declined somewhat over time from 52 per cent in 1992-93 (NFHS-1) to 47 per cent in 1998-99 (NFHS-2), this reduction of about 0.8 per cent per year is similar to the percentage reduction observed in other developing

countries where the improvement is largely attributable to overall development rather than to the effect of nutrition intervention programmes. National nutrition programmes with successful nutrition interventions tend to record reductions in malnutrition more on the order of two to three per cent per year. The NFHS findings suggest that there is a critical need to strengthen the existing ICDS programme, which is aimed at reducing malnutrition in young children. It is particularly important for nutrition programmes to target children at a very early age, to avoid irreversible malnutrition disorders in later stages (Arnold et al., 2004) so that the children can become future human resource of the country.

The present study shows high levels of underweight children for both the states. Both chronic and acute malnutrition are prevalent among children under three years of age. Therefore it is necessary to improve the nutrition information system for enhancing the nutritional status of the children under three years of age. The nutrition information system should be designed in such a way that the information related to the level and degree of malnutrition as well as its determinants gets translated into action. This is possible by adopting the 'Triple A' cycle of assessment, analysis and action on the path of WHO model as shown in figure 5.1. The Triple A cycle assess the nutritional well-being of the children by growth monitoring and thereby analyses the causes of malnutrition. On the basis of the analysis, action is taken at all levels of society to improve the nutritional status of children.

Fig. 5.1 The 'Triple A' cycle for assessing malnutrition in children (UNICEF 1997)



From our study it is also evident that chronic malnutrition is more prevalent than acute malnutrition in every part of the country, whether it is a socially and economically developed state like Tamil Nadu or a backward state like Madhya Pradesh. Even in a developed state like Tamil Nadu, acute malnutrition in terms of wasting is quite high and is comparable with Madhya Pradesh (less developed state), which arouses serious concern for the problem. Therefore it is necessary to strengthen the monitoring and surveillance of nutrition across the country with the help of Triple A, as well as delivering the services through the multi sectoral ICDS programme for improving the nutritional status of the children. It should also be mentioned in this context that the National Plan of Action adopted by the government of India for improving the nutritional well-being of the children as a result of the World Summit for Children held in 1990 is now almost a decade old and ten years is a short time for getting the benefits of the adopted policies. Therefore we hope that in another decade's time the nutrition intervening programmes adopted by the government will show beneficial results by improving the nutritional well-being of the children and will lead to better human resources for the country.

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